The Shaping of United States Biodefense Posture

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by

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June 2015

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ISBN: 978-0-9914849-4-2

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About the Author

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Abstract

The First Gulf War highlighted significant shortcomings in the United States military's ability to detect and defend against biological weapons. A subsequent examination of U.S. capabilities reveals that, historically, defenses against biological weapons have never been regarded as adequate.

Despite seventy years of effort, the United States still struggles with the biological weapons threat. It is hypothesized that there is a bias inherent in the biological defense program that is hindering the development of more effective defensive measures.

This work conducts a historical analysis utilizing a congruency/process tracing test designed to determine the level of influence that behaviors associated with three distinct theories have had over the U.S. biological program. The history of the program is examined for evidence of behaviors associated with organizational frames, realism, and bureaucratic politics.

From the historical data, it is determined that while behaviors associated with each theory have exerted some influence, a chemical frame has exerted the greatest influence over the program. It is argued that this influence has blinded those within the program to the unique nature of biological weapons, and has subsequently hindered the development of effective countermeasures. Based upon this finding, the impact of organizational frames on the program is examined and possible solutions are explored.

CHAPTER 1

Introduction

> Many books also quoted General Schwarzkopf's statement about Iraq's potential for chemical-biological warfare attacks: "We just thank goodness that they didn't."
>
> No one was bothering to ask *why* the U.S. military, having the skills and resources of the Army Chemical Corps so readily available, was unprepared for an opponent using World War I and II chemical-biological agents in 1990.
>
> —Albert J. Mauroni, *Chemical-Biological Defense*[1]

In 1993, the United States General Accounting Office (GAO) investigated chemical and biological detection capabilities during the Gulf War and found that "at the outset of Operation Desert Storm, U.S. military forces had the capability to detect all known Iraqi chemical agents and to warn its forces of an attack. However, they had an extremely limited capability to detect biological threats."[2]

This realization caused concern for the United States, and led to increased emphasis on biological defense. Yet in 1996, the GAO found that "units designated for early deployment today continue to face the same problems experienced by U.S. forces during the Gulf War. Activities … are improving the readiness of U.S. Forces. … However … shortcomings persist and are likely to result in needless casualties."[3] Fourteen years later, in 2010, a witness testifying before Congress regarding biological terrorism succinctly stated, "let me be direct—America is not prepared."[4]

This work conducts a historical analysis of the United States biological weapons and biodefense program in an attempt to understand the disparity in the effectiveness of U.S. defenses against chemical weapons versus biological weapons. Why is the United States better able to defend itself against chemical weapons than biological weapons? Is it lack of effort? Does the United States not possess the technical capabilities? Has the United States. paid too little attention to biological weapons? Has the United States made explicit decisions to forego investment in biodefense? Or, have some other factors prevented the United States from developing effective biodefense?

U.S. Biodefense Capabilities—Not Ready For Prime Time

Researching the current state of U.S. biological defense capabilities reveals numerous areas of concern. In his article "Biological Terrorism: Understanding the Threat and America's Response," Gregory Koblentz assesses that biological detection systems "will remain imperfectly reliable, environmentally sensitive, slow, range-limited, and difficult to operate for the foreseeable future."[5] A 2006 report lists six major technical challenges and two critical challenges facing detection capabilities, all of which reference biological detection.[6] The GAO has found that there is "neither a comprehensive national strategy nor a focal point … to guide the efforts to develop a national biosurveillance capability."[7] The National Academy of Sciences reviewed the current BioWatch system and found that it needs better testing, and only offers an advantage over traditional public health systems under a limited set of circumstances.[8]

Many defensive measures combine the chemical and biological threats, making an assessment of the biological component difficult. Detection technology represents the best example of a dedicated biological program. An Air Force study of detector performance identified significant operational issues with the Portal Shield system, one of two currently deployed biological detection systems. The study found that one in five hundred samples were false positives for the top three biological agents of concern. The study also identified issues with readings generated by the particulate counter associated with the system.

Because of these concerns, simulations of trigger devices were performed, which showed significant operational issues. Simulations based on performance data from Met-1 equipped Portal Shield units predicted the system would trigger one hundred times per day if utilized to trigger portal shield, or nineteen triggers per day if operating in "smart mode."[9] Ultimately, the simulations predicted that false alarms could number up to one hundred per day depending on background aerosols.[10]

Such high incidence of false alarms greatly reduces the usefulness of these systems. Military commanders often turn off the systems because they are unwilling and unable to alert the base and put their units in protective equipment multiple times a day in response to false alarms. One must question why the military would produce and field a system so cumbersome and unreliable that commanders routinely disable it?

Compared to biological defense, the United States has consistently maintained a more robust chemical weapon defense capability. In 1999 for example, the United States had seventeen fieldable chemical detection systems, but only two fielded biological detection systems.[11] This trend continues today, not only in number of systems, but also in actual hardware. For example, in fiscal year 2009, the United States fielded 8,393 chemical detectors, 171 combined systems, and 453 biological detectors.[12] In fiscal year 2010, 25,454 chemical-specific detectors and 843 combined chemical/biological/ radiological systems were fielded, while only forty biological-specific detectors were fielded.[13]

While many official statements have expressed concern over the state of biological defense, there seems to be less concern regarding defenses against chemical agents. A simple search for "deficiencies in biological agent detection" in the GAO report database produces multiple results. Yet similar searches for chemical weapons produce far fewer results, and the reports focus almost exclusively on the state of chemical weapon destruction relative to the Chemical Warfare Convention. In fact, the only recent finding of significance in the GAO archives regarding chemical agent detection faults the Department of Defense (DoD) for not having a strategy to deal with low level (sub-clinical) chemical weapons exposure.[14]

Successful understanding of the mechanisms that produced the defensive gap is of great interest to military and national security agencies. Chemical agents and biological agents each represent unique and real threats to the military and to the country, and funding for acquisition and research programs to defend against biological weapons accounts for a substantial amount of money each year. Military and government agencies rely upon the hardware and doctrine produced by our defense organizations to provide the best possible defenses against an attack.

Yet the solutions developed to date have serious capability gaps, resulting in physical vulnerabilities and, arguably, a considerable waste of resources. Identification of a factor contributing to this gap could help defensive organizations refocus their efforts, resulting in improved defensive capability and more efficient use of resources.

Explaining the State of U.S. Biodefense Capabilities

From previous works, three theories have been identified which can influence the development of military doctrine, foreign policy, or national behavior, and could explain the disparity between chemical defense and biological defense. These theories are realism, bureaucratic politics, and organizational frames.

First, the rational actor paradigm, based on realism, suggests that the capabilities gap may in fact be intentional—the product of numerous explicit policy decisions over time. For example, Douglas Kinnard documents President Eisenhower's debate over how to allocate funds for force modernization, and his decision to expand nuclear weapons in order to save funds by reducing conventional forces.[15] On an international politics scale, Glenn Palmer shows that in alliances, smaller states will reduce the amount of funds they dedicate to defense, with the assumption that the larger states will contribute enough resources to adequately address the threat.[16] In the military's "balanced budget" model, the allocation of funds is optimized so that moving funds from one defense function to another yields no increase in benefit.[17] Similarly, a rational actor could argue that based on relative threat, the maximum benefit to the military would be achieved by allocating greater resources towards chemical defense.

Realism theory is associated with authors such as Kenneth Waltz and Hans Morgenthau. In his works, Waltz establishes the assumption that the international arena exists in an anarchic state.[18] As there is no higher authority, states must act in their own self-interest to preserve their existence. Under this model, power politics, perceived threats, and relative threats all factor into a state's security decisions. Also, Morgenthau cautions that prudence should trump both morality and politics when making decisions.[19]

Implicit in realism is the assumption that states are rational actors. State decisions are based on cost-benefit analysis, and when a state responds to a threat, it seeks to maximize its investment by establishing balance between the perceived threats, other threats, and available resources.[20] Since the international environment is fluid, external threats will change over time. As a result, programs under the influence of external threat will evolve to reflect the changing international environment.

There is reason to believe that external threats have influenced the U.S. biological program.[21] Since World War II, the United States has had reason to expect biological weapons posed some degree of external threat to the state. For almost thirty years, the United States had an active biological weapons program. In addition, the United States has had both allies and enemies with known or suspected chemical weapons and/or biological weapons. While the United States has always suspected it faced some level of threat from biological weapons, the full extent of enemy programs has not always been known. Realism would predict that firsthand knowledge of the agents, combined with external threats, would necessitate a defensive response by the state.

Realism also predicts that if the distinctions between chemical agents and biological agents are fully appreciated, the two weapons classes will be viewed as distinct threats. As such, it would be reasonable to expect that the two threats would receive different amounts of resources, and that the level of resources would change over time. Realism would also predict that biological weapons would be weighed against all other external threats. Therefore, if defense organizations were operating under the influence of realism, one would predict a positive correlation between the level of perceived threat and corresponding defensive postures.

Under this paradigm, the existence of the defensive capabilities gap is intentional—the United States may have decided that when threat and resources were considered, biological weapons represented less of a threat to the state than did chemical weapons. In this case, the discrepancy would be the result of a rational choice to maximize total security in the face of finite resources.

Of the possibilities, an intentional/rational actor explanation is the least troubling, as the solution is straightforward—though not necessarily easy. Under this model, the present inequality would be the result of incomplete intelligence, an incorrect calculation, or a threat evolving faster than the state is able to respond. In this case, rational assessment of the situation and reallocation of resources would reduce the discrepancy.

It is also possible that this inequality is unintentional. Biological defense is conducted by large organizations operating within a bureaucratic universe. As such, they are subject to inter- and intra-organizational influences and biases. The discrepancy may not be based on rational calculations, but rather the result of biases that blinded the organizations to the true nature of the threat and the corresponding defensive capabilities.

Another potential explanation commonly applied to understanding bureaucratic outcomes is the "Model II" theory popularized by Graham Allison and Philip Zelikow. Frank Smith uses the alternative term "bureaucratic politics" to capture the organizational behaviors described by Allison and other authors such as James Wilson and Morton Halperin. This theory impacts behavior at the organizational level, and shares some of the same characteristics Lynn Eden attributes to organizational frames theory (discussed below). However, imperialism is a behavior unique to Allison's theory, and results in organizations seeking to grow budgets, personnel, and territory. Imperialism is also seen in organizations seeking to "colonize" new profitable territories.[22]

Several authors have written slightly different descriptions of imperialistic behaviors driving organizational decisions. Matthew Holden writes that organizational power is obtained by creating a "favorable balance of constituencies."[23] Wilson takes a slightly different approach, arguing that organizations seek to maximize autonomy.[24] Halperin writes that organizations seek "influence in order to pursue their own objectives" and that "stands on issues are affected by the desire to maintain influence."[25] Regardless of the measure of power, the common theme is that with imperialism, the good of the organization is considered a major factor when making decisions.

There are several examples of imperialistic behaviors within the DoD. While federal law places some constraints on the roles and responsibilities of the organizations, there is always room to expand and conquer. Wilson cites Air Force/Army conflict over close air support, the scramble for nuclear weapons, and the battle over a unified Joint Chiefs of Staff as examples of DoD inter- and intra-service organizational struggles.[26]

Likewise, Kinnard describes competition between the services over modernization funds in the Eisenhower defense budget. For example, he notes that the Army developed the Jupiter missile, even though the Air Force had been designated to have operational responsibility for long-range nuclear missiles.[27]

Imperialistic behavior does not necessarily ignore the existence of external threats. However, a strong imperialistic influence can take a threat-based program and create an alternative biological defensive posture. It would not be surprising to see an imperialistic organization claim an external threat as justification for a new program. However, imperialism predicts that programs created by that organization would seek to maximize organizational health, rather than maximizing state security.

Imperialism is evidenced by organizations fighting for money and power in an attempt to remain relevant, rather than basing their decisions on the needs of the nation. Examples of imperialism would include power struggles, or the existence of multiple parallel programs and organizations.[28]

There is reason to believe that imperialism has influenced the U.S. biological program. New missions and new threats can easily be used by imperialistic organizations to justify additional responsibility, prestige, personnel, and resources. The biological threat rose to national attention in the late 1930s, representing a "new" threat available for colonization. Though the importance of the biological threat has waxed and waned over time, there have been several instances when it represented a significant source of resources, making it a tempting target for imperialistic organizations.

Imperialism predicts its own unique national biodefense posture. As with realism, chemical agents and biological agents are regarded as separate threats. But under imperialism, this separation would be driven by organizations seeking to create new mission areas for colonization, rather than optimizing national resources. Therefore, an imperialism-influenced posture would appear almost as a patchwork of different components, indicative of multiple parallel and competing organizations.

As already discussed, the chemical/biological discrepancy may have been a rational choice. However, if the source of the discrepancy was unintentional, its existence is more troubling, and the solutions more difficult. Evidence in support of an unintentional discrepancy would mean the defense program thought it was addressing the problem, but in actuality was not providing the best possible solutions. If this were in fact the case, fixing the discrepancy would not only require identifying the source of the bias, but also implementing programmatic and organizational changes to eliminate its influence.

Finally, a more recent explanation for bureaucratic behavior has emerged in organizational frames theory, as developed in the book *Whole World on Fire* by Lynn Eden.[29] In this book, she traces the history of U.S. nuclear damage assessment, concentrating on the fact that the United States did not account for thermal effects when developing models to predict the damage caused by nuclear weapons.[30] She proposes that organizations responsible for understanding bomb damage developed a blast "frame" in World War II that impacted the modeling of nuclear weapons.

During the war, the United States relied on precision daylight bombing with conventional bombs, and made a significant effort to understand how blast damage affected targets, which resulted in an organizational "blast frame."[31] As the United States developed nuclear capabilities, the same modelers (under the influence of the blast frame) were given the responsibility of predicting damage from nuclear weapons. Eden argues that they adequately modeled blast effects, but underestimated the thermal effects of nuclear weapons, as this type of damage was foreign to the blast frame. Ultimately, she theorizes that organizations which develop an organizational bias or "frame" in response to one problem tend to view subsequent problems in the same frame, resulting in less than optimal solutions to the new problem.

Other authors have made observations similar to Eden's "organizational frames." Paul Shrivastava and Susan Schneider propose that one of the dangers associated with organizational frames of reference is a limited viewpoint, which can create blind spots in organizations, and cause them to become sluggish, have greater inertia, and possibly fail to support creative solutions.[32] Authors such as Herbert Simon and Robert Entman have also published work on frames. As with Eden, they propose several potential biases that frames can introduce into an organization. In their model, frames create realities for an organization, as well as influencing how organizations define problems and select solutions.[33]

While any organization should strive to avoid these pitfalls, the more lethal the problem, the greater the peril associated with organizational failure.

There is reason to believe an organizational frame has impacted U.S. biological defense posture. Other authors have demonstrated incidents of organizational frames affecting perceptions of biological weapons. Smith argues that the military has historically approached biological weapons through a kinetic weapons frame.[34] Franz makes the argument that procedures modeled on a nuclear weapons frame will not work for control of material in biological laboratories.[35]

Observing the history of the U.S. biological program, one notes parallels between the biological program and the United States' efforts to predict nuclear weapon damage. Just as it relied on those familiar with blast damage to model nuclear weapons, the United States delegated the biological program to organizations established to address the chemical weapons threat.

The Chemical Weapons Service (CWS) was created in World War I to develop offensive and defensive chemical capabilities. After the war, the CWS was retained as an organization and given responsibly for the country's offensive and defensive chemical programs. In World War II, it was the CWS that was ultimately given the "new" mission to develop an offensive and defensive biological weapons program. By the time the CWS received the biological mission, it had been dealing exclusively with chemical weapons for almost twenty years—ample time for an organizational frame to take hold.

While the organizations responsible for chemical and biological defense have changed over time, program leadership for both has been drawn from historically chemical organizations. In 1946, the CWS was redesignated as the Chemical Corps and retained responsibility for the chemical and biological programs through the 1960s. After a realignment of mission, chemical officers continued to serve in leadership roles for both programs. When Congress established a Joint Service Chemical and Biological Defense Program, the Army was designated as the lead agency for acquisition of chemical and biological defensive equipment.

Given the culture, mission, and conditions present at its inception, is it reasonable to believe the organizations responsible for biological defense are operating under an "organizational frames" paradigm as described by Eden? Is it possible that the early Corps and its leadership developed a successful frame for chemical defense that influenced how it viewed and addressed biological agents? If so, has this frame existed long enough that it is now accepted by the DoD, and by national leadership, as the norm when dealing with biological weapons?

If such a frame exists, what are the implications for biological defense? If initial conditions set organizational frames, the military was conditioned on chemical weapons and may have attempted to address biological weapons defense using a chemical frame of reference. The development of similar detection equipment, protective equipment, and doctrine relating to the two types weapons, despite their dissimilarities, would suggest that biological defense is being addressed through a chemical weapons frame.[36]

Notes

1. Albert J. Mauroni, *Chemical-Biological Defense: U.S. Military Policies and Decisions in the Gulf War* (Westport, CT: Praeger, 1998).

2. United States General Accounting Office, *Chemical and Biological Defense: U.S. Forces are not Adequately Equipped to Detect all Threats* (Washington, DC: U.S. Government Printing Office, 1993).

3. United States General Accounting Office, *Chemical and Biological Defense: Emphasis Remains Insufficient to Resolve Continuing Problems, GAO/NSIAD-96-103* (Washington DC: U.S. Government Printing Office, 1996).

4. *Government Preparedness and Response to a Terrorist Attack Using Weapons of Mass Destruction: Hearing Before the Subcommittee on Terrorism, Technology and Homeland Security of the Committee on the Judiciary*, United States Senate, 111th Cong. (2010).

5 . Gregory Koblentz, "Biological Terrorism: Understanding the Threat and America's Response," in *Countering Terrorism: Dimensions of Preparedness*, eds. Arnold M. Howitt and Robyn L. Pangi (Cambridge: MIT Press, 2003), 97–137.

6. *Chemical and Biological Defense Program 2006 Annual Report to Congress,* (Washington, DC: Department of Defense, 2006).

7. United States Government Accountability Office, *Biosurveillance: Efforts to Develop a National Biosurveillance Capability need a National Strategy and a Designated Leader, GAO-10-645* (Washington DC: U.S. Government Printing Office, 2010).

8 . National Research Council, *BioWatch and Public Health Surveillance: Evaluating Systems for the Early Detection of Biological Threats* (Washington DC: The National Academies Press, 2011). The BioWatch system is a biological detection program/system administered by the Department of Homeland Security and deployed in several major U.S. cities. The program uses a filter to collect environmental samples that are periodically analyzed for the presence of select biological agents.

9. The Met-1 unit is a particle counter that can serve as a trigger device for a secondary biological detection device.

10. Jerry G. Jensen, *Effect of Atmospheric Background Aerosols on Biological Agent Detectors* (Washington, DC: U.S. Air Force, 2007).

11. See appendix A.

12. *Chemical and Biological Defense Program 2010 Annual Report to Congress* (Washington DC: Department of Defense, 2010).

13. Andrew Weber, *2011 Annual Report to Congress on Chemical and Biological Warfare Defense* (Washington, DC: Department of Defense, 2011).

14. United States General Accounting Office, *Chemical Weapons: DoD Does Not Have a Strategy to Address Low-Level Exposures* (Washington, DC: U.S. Government Printing Office, 1998).

15. Douglas Kinnard, "President Eisenhower and the Defense Budget," *The Journal of Politics* 39, no. 3 (1977): 596–623.

16. Glenn Palmer, "Alliance Politics and Issue Areas: Determinants of Defense Spending," *American Journal of Political Science* 31, no.1 (1990): 190–211.

17. Robert J. Massey, "Program Packages and the Program Budget in the Department of Defense," *Public Administration Review* 23, no. 1 (1963): 30–34.

18. Kenneth N. Waltz, *Theory of International Politics* (Boston: McGraw Hill, 1979).

19. Hans J. Morgenthau, "Politics Among Nations," in *Conflict and Cooperation*, ed. Marc A. Genest (Toronto: Wadsworth, 2004).

20. Graham Allison and Philip Zelikow, *The Essence of Decision, 2nd ed.* (New York: Longman, 1999).

21. Over part of the time period examined, the U.S. had both an offensive and defensive biological program. The U.S. renounced all use of biological weapons in 1969, ending the offensive component of program. While today the program is referred to as "bio-defense" or a "biological defense program" the term "defense" will not always be used in this book. This omission reflects historical programs, and in no way implies the existence of a current offensive program.

22. Allison and Zelikow, *Essence of Decision* (see ch. 1, n. 20).

23. Matthew Holden, Jr., "'Imperialism' in Bureaucracy," *The American Political Science Review* 60, no. 4 (1966): 943–951.

24. James Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 2000).

25. Morton Halperin, *Bureaucratic Politics & Foreign Policy* (Washington, DC: Brookings Institution, 1974).

26. Wilson, *Bureaucracy* (see ch. 1, n. 24).

27. Douglas Kinnard, "President Eisenhower and the Defense Budget" (see ch. 1, n. 15).

28. Frank Smith, "A Casualty of Kinetic Warfare: Military Neglect and the Rise of Civilian Biodefense" (doctoral dissertation, University of Chicago, 2009).

29. Lynn Eden, *Whole World on Fire* (Ithaca: Cornell University Press, 2004).

30. A nuclear blast can cause damage through blast and shock, radiation, light, and heat. The blast and shock damage are not different than a conventional weapon, except for the magnitude of the blast relative to the amount of material causing the explosion. Unlike conventional explosives, nuclear weapons also emit a large amount of radiation,

some of which is in wavelengths that can impart enough thermal energy to cause materials to combust.

31. This approach was contrary to the British strategy of nighttime bombing that relied in part on incendiary weapons, creating a different frame of reference for their bombing campaign.

32. Paul Shrivastava and Susan Schneider, "Organizational Frames of Reference," *Human Relations* 37, no. 10 (1984): 795–809.

33 . Herbert A. Simon, "Bounded Rationality and Organizational Learning," *Organization Science* 2, no. 1 (1991): 125–136; Robert M. Entman, "Framing: Toward Clarification of a Fractured Paradigm," *Journal of Communication* 43, no. 4 (1993).

34. Smith, "A Casualty of Kinetic Warfare" (see ch. 1, n. 28).

35. David R. Franz, Susan Ehrlich, Arturo Casadevall, Michael J. Imperiale, and Paul S. Keim, "The 'Nuclearization' of Biology is a Threat to Health and Security," *Biosecurity and Bioterrorism* 7, no. 3 (2009): 243–244.

36. The physical differences between chemical agents and biological agents will be discussed at length in Chapter Three.

CHAPTER 2

Explaining the Development of Biodefense Doctrine

> [Those] who have an excessive faith in their theories or in their ideas are not only poorly disposed to make discoveries, but they also make very poor observations.
>
> —Claude Bernard, French physiologist (1813–1878)

Biological weapons have been regarded as a threat for over seventy years, yet there are still gaps in U.S. defensive capabilities, despite dedicated government efforts to address the threat from biological agents. These gaps are even more pronounced when compared with chemical defensive capabilities. It would be wrong to assert that this discrepancy is the result of negligence, or a conscious decision to create inferior defenses against biological weapons. It is reasonable, however, to assume that it may be the result of other factors that have influenced the development of the biological program. This chapter will provide additional information on the three previously identified theories that could logically explain these gaps.

Organizational Frames

In the book *Whole World on Fire*, Lynn Eden explores the question of why U.S. military planners focused on blast damage and ignored thermal effects when they calculated the destructive capabilities of nuclear weapons. She proposes that some organizations operate as prescribed by a model she terms "organizational frames."

As described in Eden's book, organizational frames impact the way an organization operates in several ways. One key aspect of the theory is that the initial conditions and problems that exist when the organization is formed set the frame of reference for future action by that agency:

> As those in organizations engage in problem solving, they allocate organization attention and resources, develop and draw on expertise inside and outside the organization, and in general build organizational capacity to solve certain problems but not others. Ultimately, organizations are likely to create new knowledge and organizational routines that contain such knowledge. Once created, knowledge-laden routines enable actors in organizations to carry out new actions. At the same time, they constrain what those in organizations can do.[1]

As she examines the thermal damage puzzle, she identifies a frame and traces it back to the origins of the Army Air Corps in World War II. She argues that the predominant U.S. strategy of precision daylight bombing using conventional explosives necessitated a deep understanding of blast damage caused by conventional bombs. As the Air Force developed its nuclear capabilities, the same individuals that researched blast damage in World War II assumed lead roles in developing damage estimates for nuclear weapons. Lacking any clear guidance from key leaders as to what the estimates should contain, they continued within the established blast damage frame. Subsequently, they paid little attention to damage caused by thermal effects, which were outside of the blast damage frame developed during World War II. Eden argues that as a result of ignoring thermal effects, the United States vastly underestimated the damage that would be caused by a nuclear exchange.

While Eden claims the term "organizational frames," other authors have also discussed frames of reference relative to organizational behavior. As described by Entman, frame theories are "often defined casually, with much left to the assumed tacit understanding of reader and researcher." He proposes several characteristics that define the concept of frames. In his model, frames *select* a reality, provide *salience* to that particular reality, and then *define* the problems, which helps *diagnose causes* and make *judgments,* then *suggests remedies*.[2]

In their paper describing organizational frames, Shrivastava and Schneider also list several characteristics of organizational frames. In their model, organizational frames include *cognitive elements* (which influence basic assumptions), experimental biases and language, *cognitive operators* (which influence ordering of information, cognitive maps and analytical framework), and *reality tests* (which validate knowledge and express the connection between organization events and society). They also characterize the *domain* of the frames (how they influence the culture and definition of the organization) and *articulation* of the frames within organizational plans and policies. As a result of these frames, a filter is created "through which future events are screened and organized, creating a self-perpetuating system."[3]

James March and Herbert Simon also describe many aspects of organizations that could contribute to the development of frames. They propose that organizations can reinforce conditions through selective perception and rationalization, through in-group communication, and through selective exposure to environmental stimuli. They also propose that when faced with new problems, organizations will search for a solution within immediate internal knowledge and gradually expand the search outward, only creating a new solution or organization if no solution is available. Inherent in this process is the idea that an organization will stop the search once an acceptable solution is found, so rarely are "all-possible" solutions considered.[4]

Once established, it may be difficult for military organizations to break the frame. Julianne Mahler argues that for an organization to change, it must learn, and many cultural factors can influence that learning. She makes the point that learning is more likely when it is possible to see how outcomes impact the organization.[5] As military organizations have high turnover, and are relatively unaffected by poor program outputs, one would not expect them to quickly learn and change in the face of new problems.

The rapid turnover of military program management could also contribute to the establishment of frames within the organization. Several authors discuss organizational learning and memory in the problem solving process. Learning helps organizational knowledge survive turnovers, but can also ingrain certain routines.[6] The time constraints associated with high turnover, and the need to learn quickly and start producing could increase the instances of "selective perception" described by March.[7]

It is possible to imagine a scenario where an organizational frame established itself within the U.S. military's chemical and biological defensive programs. In World War I, the military was forced to establish new organizations, and to develop novel offensive and defensive solutions tailored to the new threat of chemical weapons. Once validated, the early chemical solutions would set the frame for the development of new equipment and doctrine as the chemical program evolved. This new chemical agency then had a period of approximately twenty years to focus exclusively on chemical weapons, allowing the frame to reinforce itself. Then, just before the United States entered World War II, the nation decided biological weapons posed a threat. After some civilian research into the nature of biological agents, the offensive and defensive biological missions were eventually handed to the CWS.

When faced with the challenges of defending against biological weapons, the CWS was put in a situation where effective technologies were not available. In this situation, Mahler proposes that "when program technologies are not well understood … the search for ways to adjust or redesign them must fall back on other kinds of knowledge, including organizational beliefs. … Thus culture plays a role in learning by filling in gaps in technological understanding."[8] If the leadership and culture of the CWS and Chemical Corps was operating under a chemical frame, they may have responded with familiar technical solutions based on the characteristics of chemical weapons, which were not necessarily well matched for biological weapons.

If the Chemical Corps did respond to the biological weapons defense problem utilizing a chemical weapons frame, it is possible to make predictions as to the outputs of the program.[9] It should be possible to observe similarities in how the military addressed the biological and chemical threats, despite the fact that biological and chemical weapons have many different physical characteristics that would suggest dissimilar strategies. Such similarities could be observed in the construction, operating parameters and employment of sensor hardware. Other hardware solutions, such as protective and decontamination equipment, would exhibit similar characteristics. Even nonphysical characteristics such as operational doctrine, officer education, and budgets should make sense when viewed from a chemical weapons perspective, while to an outside observer they wouldn't appear to be optimal for addressing the biological threat.

It is hypothesized that the organizations responsible for developing U.S. biological doctrine were "imprinted" with a chemical weapons frame established in World War I. This chemical frame subsequently influenced the DoD's efforts to develop effective biological defensive measures, resulting in less than optimal solutions. This hypothesis is based in part on an assumption that the differing natures of chemical and biological weapons should result in different approaches to defense.

This hypothesis predicts that DoD chemical and biological defensive solutions will be similar in approach. It also predicts that organizational behaviors and traits such as jargon, education, and symbolism will indicate a chemical weapons frame, and that there will be a greater linkage between the chemical and biological weapons programs than would be expected given the nature of the weapons.

For this and each subsequent theory, a series of predictive statements will be generated. The presence of predicted behaviors in the historical record will then be scored to determine whether the factors associated with the theory have exerted influence over the program.

Organizational Routines

The presence of a chemical frame can be "read" in organizational routines or products, when observed from outside the organization. This prediction is developed in part from the March and Simon idea that an organization will approach a new problem by utilizing solutions that have worked in the past. The organization will only look for a novel solution if the old solutions do not work, and will stop looking as soon as an adequate solution is found.[10] Similarly, Robert Montjoy describes how organizational performance can be steered by dominant coalitions within an organization operating with "a consistent set of preferences and beliefs about cause and effect relationships."[11]

For example, an organization operating in this manner would approach a new problem like biological detection by first looking at previously successful chemical detection solutions, or by referring to the dominant mode of thought within the organization. While there obviously could not be a direct correlation between sensor technologies, the underlying performance parameters (e.g., time to detect, limit of detection, employment strategies) that were successfully developed for a chemical problem may be retained to address the biological problem. Therefore it is possible to propose the following predictive statements:

1. *Chemical and biological defensive equipment will exhibit similar requirements, construction, and employment.* Chemical and biological defensive equipment is often developed by the same organization. For example, almost every office responsible for biological defense is also responsible for chemical defense. One significant example is the Chemical and Biological Defensive Program (CBDP), which is currently responsible for the entire joint DoD defensive program. If a frame were present, it would be realistic to expect the organization to view both weapons through the same frame, and to respond accordingly. Such behavior would be observed in the operating characteristics of the hardware and systems produced by the organizations. Similarities in operating behavior despite differences in the two weapons would be expected. A high degree of similarity in performance parameters such as time to alarm, level of detection, number of agents, standoff distance, level of decontamination, and employment (independent of weapons characteristics) would indicate the presence of a frame.

2. *DoD chemical and biological doctrine will be more similar than the differences in the weapons would predict.* As with hardware development, the individuals responsible for developing chemical, biological, radiological, and nuclear weapons doctrine are almost always within the same office. In this case, the product is not a piece of hardware, but rather written guidance on how to conduct military operations in an environment that has been impacted by one of these weapons. The presence of a dominant frame could influence the products of these offices, and be evidenced by doctrine that prescribes similar actions in response to an attack by disparate weapons, and by a tendency to refer to a "chemical or biological attack" or a "chemical/biological sensor."

3. *The DoD will utilize similar scenarios to conduct both chemical and biological training.* As with doctrine and hardware, defensive training for chemical weapons and biological weapons is often conducted by the

same organization. Individuals working in this field can be influenced by an organizational frame through the official doctrine they are responsible for teaching, and also through organizational culture, as they have been exposed to the frame throughout their own education and growth. The frame would manifest itself in similar training parameters (e.g., time periods, scenarios, operational impact) when conducting chemical and/or biological training.

Attention and Resources

As a result of using a chemical frame, biological agents will not receive the same level of attention or emphasis as chemical agents. This inequality is not the result of a response to external threat, or an overt decision to fund one to the detriment of the other. Instead, the chemical frame makes biological agents and chemical agents appear similar; therefore, programs are shaped by chemical requirements, with the assumption that the same or similar programs will also cover biological agents. The result is a situation where resources appear to be preferentially given to combat chemical agents.

1. *Overarching chemical defense issues will subsume biological defense in writings, discussions, and testimony.* Both chemical and biological weapons have been a threat to the military, and to the country, for many years. Military officials, government officials, and scholars have all made public statements, produced written works, and provided testimony regarding these weapons. The terminology and vocabulary used in these sources can indicate the presence of a frame. A chemical frame would predict that verbal or written products would tend to describe the threat in terms of chemical weapons. Such indicators could include consistent preference for one term over the other, attaching one term to a more general threat (e.g., a “chemical officer” who is responsible for both chemical and biological weapons), or using terms specific to one weapon to encompass both (e.g., using “vapor” to describe both weapons).

2. *WMD personnel will be described/qualified in terms of chemical qualifications.* Similar to the public statements referenced above, there are also internal communications within defensive organizations: job descriptions, job qualifications, and organizational identity are all subjective items produced for internal and external advertising. The

presence of an organizational frame could be indicated by a disproportionate use of chemical terminology or descriptors relating to jobs or personnel having responsibilities outside of the chemical threat.

3. *Resources (budgets) will be unequally distributed, with the inequality unrelated to external threat.* Realism, discussed in more detail later, predicts that resources allocated by the state to defend against external threats will be distributed relative to the severity of the threat. As the relative threats are not static, a doctrine based on external threat could and should produce an uneven distribution of resources between chemical and biological weapons.

However, a disparity in resource allocation could also be observed if frames theory was influencing behavior. Many of the authors referenced above refer to frame theories influencing both learning and decision-making. Individuals responsible for funding decisions would have developed within a frame culture, and their decision-making may be influenced by a chemical frame, which could result in an imbalance of funding in favor of the chemical threat. This imbalance would not be based on intelligence estimates, but rather on internal and organizational frame biases.

In this case, the historical distribution of funds would indicate which of the two theories was predominant. A consistent bias towards chemical could indicate an organizational frame, while a more erratic pattern correlating to threat level would indicate a program influenced by external threat.

4. *Military units will dedicate more time and resources to training for chemical attacks.* Military training requires the expenditure of resources in the form of time and money to conduct training. Therefore, training, and the resources allocated for training, can be expected to follow a pattern similar to that of the allocation of financial resources described above.

Organizational Knowledge and Learning

Authors writing on organizational theories emphasize the role of learning and culture within the organization as an important influence on the output of the organization. In particular, learning and culture play a key role in maintaining an organizational frame, as in Simon's description of successful learning within an organization: "If it works as predicted, it demonstrates an emergent property of an organization—a persistence of pattern that survives a complete replacement of the individuals who enact the pattern."[12] If a frame is influencing an organization, it should be possible to find evidence of the frame (e.g., chemical bias) in its day-to-day operations.

1. *Professional writings will demonstrate a chemical culture/bias*. All military personnel complete advanced military education programs as they progress through their careers, and are often required to write theses or research papers. Many career fields also publish professional journals featuring input from members. These written documents can be examined for evidence of a chemical bias. An example of an organizational frame would be a continued association of chemical and biological weapons, or a continued use of chemical-specific terms to describe a biological attack.

2. *Professional military education will demonstrate a chemical-centric teaching model.* As military officers and NCOs progress in rank, their professional education covers many topics, including biological weapons. Evidence of an organizational frame in professional education could be observed in the topics or amount of time dedicated to each weapon. Lessons using a combined threat or showing a bias towards chemical weapons could indicate the presence of a chemical frame. Separation of the two weapons classes would be predicted by both realism and bureaucratic politics theories.

Previous Success and Future Development

A consistent theme within the description of organizational frames theory is that organizations tend to rely on previously successful solutions when facing new problems. The DoD has developed and fielded adequate, though imperfect, chemical defensive measures. Therefore, if an organizational frame were the dominant influence, it would be expected that organizations would follow previously successful models when addressing new threats.

1. *Defensive organizations will respond to new/unique biological challenges by incorporating biological programs within the existing chemical infrastructure.* Of the two weapons classes, chemical weapons were the first to present a direct threat, and the DoD responded by creating a dedicated organization and research program. Frame theory predicts that

when a new weapon has similar characteristics to an older weapon (e.g., chemical and biological weapons are both essentially invisible weapons that have the most impact when inhaled), the mission to address the new threat will be assigned to the organizations created to deal with the original threat.

2. *Previously successful solutions (hardware and doctrine) will be used as models to address new problems*. It has already been argued that the similar view of chemical agents and biological agents can result in similar hardware and doctrine. However, it is possible to produce similar outputs when an organization assumes that what worked for one agent will work for another agent, despite distinct physical differences. An example of this behavior is the repeated attempts by states to use existing chemical dispersal techniques when initiating an offensive biological weapons program.

3. *A corollary to the influence of successful programs on future development is the impact of historical failures on future development.* Just as a successful approach will be utilized for new programs, frames theory predicts that previously unsuccessful approaches will not be considered for a new program. For example, medical pre-treatment has never been a significant contributor to chemical defense, and a similar relative lack of interest in medical treatment is also evident for biological defense, despite the significant potential that medical countermeasures have in combating the biological threat.

Bureaucratic Politics

Smith derives the bureaucratic politics theory from behaviors described as "Model II" by Allison and Zelikow, and from Halperin's book *Bureaucratic Politics & Foreign Policy*. In Allison's book *Essence of Decision,* Model II is an organizational-level theory examined as a possible explanation for the U.S. response to the Cuban Missile Crisis. This model proposes that the course of action taken in governments or large companies is a result of the interaction and competition between smaller organizations within the larger body. While an external event may initiate the need for organizational action, the event may simply serve as a justification for a sub-organization to expand its position. As a result, the final course of action may be of more benefit to the sub-organization than to the company or government as a whole.

In the Allison model, decisions must be reached by compromise or competition with other organizations. Solutions developed using this model may be more dependent on organizational power and makeup than on the appropriateness of the solution. Several of the traits Allison describes in this model, such as organizational culture, priorities, and routines, are the same traits used to describe organizational frames theory.

However, there is one specific (and relatively easily identifiable) trait listed by Allison that is distinct from the organizational frames theory: imperialism, which is when organizations "define the central goal of 'health' as synonymous with 'autonomy.' They therefore seek growth in their budget, personnel, and acquiring new territory. Thus issues that arise in areas where boundaries are ambiguous and changing, or issues that constitute profitable new territories are dominated by colonizing activity."[13]

Holden defines imperialism as "a matter of inter-agency conflict in which two or more agencies try to assert permanent control over the same jurisdiction, or in which one agency actually seeks to take over another agency." He further characterizes the tendencies for bureaucracies to expand, maintain, or retrench, with expansion most often exhibited in newer organizations.[14]

Halperin also identifies imperialistic behaviors in government decision-making processes in his book *Bureaucratic Politics & Foreign Policy*. In the organizational section, he makes similar observations about organizations, power, and decisions. Regarding conflict, he says that "organizations may bend over backwards to avoid giving reason to increase their bureaucratic competitor's share of the responsibility," and regarding autonomy, "organizations tend to agree on proposals which exclude any joint operations and which leave each free to go its own way." And regarding enhancing its "essence," an organization "will seek to protect these functions by taking on additional functions if it believes that foregoing these added functions may ultimately jeopardize its sole control."[15]

In the book *Bureaucracy,* Wilson describes possible imperialistic behaviors exhibited by organizations. While Allison takes issue with the definition of imperialism versus autonomy described by Wilson, the behaviors reflect the idea that organizations must compete, whether it is for resources or autonomy. Wilson advises that organizations looking to create a niche "seek out tasks not being performed by others … fight organizations which seek to perform your task … avoid tasks that differ significantly from those that are at the heart of the organization's mission … be wary of joint or cooperative ventures … avoid learned vulnerabilities."[16]

There is reason to believe that imperialism could be influencing the development of chemical and biological defensive equipment. The military has often been accused of creating or enhancing threats (e.g., China, ballistic missiles, biological weapons) in order to secure more funding or resources.[17] There is also a long history of inter-agency competition for resources, both within and between the branches of the armed forces, such as the race for all three services to have service-specific nuclear weapons, or the Navy having its own air power and ground elements that compete with the Air Force and the Army.

In the case of biological weapons, the realization of a new national threat and the commitment by the government to respond with an effective offensive and defensive program constituted an entirely unclaimed mission space. This new mission had the potential to provide a large amount of financial resources and national prestige to the organization responsible for the program. Therefore, it would be logical to expect evidence of competition between organizations seeking to claim the biological weapons mission space.

An organizational frame is not the only explanation for the biological gap. An alternative hypothesis is that the imperialistic behaviors predicted by bureaucratic politics have shaped the development of the United States' biological posture. It is realistic to envision a scenario where the biological weapons threat would be embraced by an organization wishing to use a new threat, or the existence of a failed response to the threat, as justification for more money and personnel. Such behavior could put this organization in competition with other organizations also looking for additional resources.

Organizations wishing to expand power would propose new programs and fight for the authority (and budget) to assume responsibility for biological defense. Inclusion of chemical agents within biological proposals would support the status quo (indicating a chemical frame) and would weaken the arguments made by newer "upstart" organizations. Once responsibility for the new mission was secured, these organizations would justify gains in personnel or budget based on the unique biological threat. Such organizations would not combine the threats, but would emphasize the unique nature of the biological threat and the special abilities their organization possesses to address it. To test for the influence of imperialism, a series of predictive behaviors are proposed.

Organizational Imperialism

Historically, biological weapons were a new threat when compared with chemical weapons. The bureaucratic politics theory predicts organizations would regard this new threat as a potential source of resources, missions, or prestige. Therefore, the behaviors associated with this theory will be indicative of organizations embracing the new threat and exhibiting an overt desire to take on the new mission area.

1. *Multiple organizations will attempt to assume responsibility (and corresponding resources) for new threats*.[18] A straightforward observation associated with imperialistic behavior would be intra-agency competition for a new mission. Example behaviors could include high-level involvement in the issue, multiple agencies with similar organizations, official testimony as to an agency's superiority in a mission area, lobbying of decision makers, and eager allocation of personnel and resources to the issue.

2. *Official testimony and statements from members of an organization will validate the unique threat and reflect the belief that their organization is best able to address the threat.* In order for a new area to be a target for expansion, the actual or potential resources allocated to it must be substantial to the organization. While the DoD and services have some ability to move money within their organizations, any significant change in resources must come from Congress. It would be reasonable for an organization desiring to take on a new threat, and receive the associated resources, to highlight and emphasize the severity of the new threat—in effect sowing the field it hopes to later claim. One would expect to find this behavior in Congressional testimony and in official agency reports or findings.

3. *Organizations will fight to retain what they have gained*. Bureaucratic and budgetary environments are not always conducive to organizational expansion. As already noted, Holden includes maintenance and retrenching behaviors in his work on imperialism. Observation of these behaviors in an organization may indicate past expansive behavior, or an attempt by an organization to retain the power and resources it already possesses. While such behavior is not unexpected or necessarily bad, when taken to the extreme, the organization may put its own self-interest ahead of the program as a whole.

4. *Imperialistic organizations will favor the offense.* Posen advances this idea as he argues that an offensive doctrine requires more resources than a defensive or retaliatory doctrine. Therefore, organizations looking to justify new weapons or additional manpower may advocate that the nation adopt an offensive-based doctrine.

Doctrine Through Imperialism is Rudderless

If successful, imperialistic behavior can result in several organizations claiming, or even performing, the same mission. Without an overarching authority, the resulting doctrine can become chaotic and disjointed.

1. *The national strategy will be disjointed and leaderless.* Bureaucratic politics predicts competition between organizations to claim mission space. Within a government department, there is a recognized chain of command, which can delineate mission requirements. However, interdepartmental (and unchecked intradepartmental) competition may lead to the creation of multiple parallel programs, which may result in the existence of several organizations claiming to speak for the nation with regard to biological defense.

2. *Acquisition programs will be developed which do not reflect mission requirements.* As organizations strive to colonize new mission space, they may take on new programs and hardware on their own, just to get their foot in the door, without necessarily identifying an operational need or end-user. As a result, organizations may be able to “sell” the new program to those responsible for allocation of resources without establishing a strong tie to an end-user or to a stated operational requirement.

3. *Imperialistic actions will result in a "patchwork" national posture.* The components of the national posture, such as research programs, hardware, and doctrine, will be produced by multiple competing organizations attempting to advance unique ideas. The stronger the imperialistic influence, the less likely there is to be an authority shepherding the development of a coordinated posture.

Realism

Behaviors associated with the realism theory of international politics could also be controlling the development of chemical defenses and biological defenses. As described by Waltz, realism examines international relationships between states. The theory starts with the assumption that the international system is in an anarchic state, where all states must first ensure their own survival. Waltz also proposes that states are rational actors, using cost-benefit analysis to make decisions.

Under realism theory, alliances, treaties, and other agreements can be made if they benefit the state. However, these agreements must always be viewed with caution, and can be broken if conditions shift and they threaten the wellbeing of the state. Ultimately, the state must take all actions necessary to ensure its own survival.[19]

While examining the Cuban Missile Crisis, Allison develops a decision-making model for states operating as predicted in realism. This model assumes a state is a unified actor, is rational, and seeks to maximize the return on investments based on relative threats. The state then assesses the threats, identifies the utility function, and makes the best choice to maximize objectives.[20]

The realism models described by Waltz and Allison differ from the other two theories already discussed in that realism focuses on how states react within the international arena. While not directly concerned with how decisions are made within the state, it assumes that the state will ultimately react in a manner that is in its own best interest relative to the threat at hand. Under this model, the state's perception of a potential threat has great bearing on predicting how the state should react.

There is reason to believe that factors associated with the realism model should influence the U.S. biological weapons program. Historically, the United States had developed both chemical and biological offensive weapons, and had a good understanding of their capabilities. The United States also knew that prior to the Biological Weapons Convention (BWC), many other states also had biological weapons programs. Even after the treaty was ratified, realism predicts the United States should have viewed other states with caution and not relied entirely upon the treaty to eliminate the threat. Morgenthau cautions that while political realism is aware of moral and political factors, prudence must remain the supreme value in politics.[21] Therefore, under the realist model, the United States should have viewed biological weapons as a valid threat to the state, and the state response would have been to maintain a capability to defend against the possible threat.

As with bureaucratic politics, realism predicts a recognized distinction between chemical agents and biological agents. In addition to the distinct physical threats posed by the two weapons classes, it is likely that potential adversaries will have a different mixture of chemical and biological capabilities. Treating the threats posed by chemical agents and biological agents in a monolithic manner is not consistent with the idea of maximizing functions associated with realism.

A final hypothesis explored in this work is that national response to external threat has shaped the development of the United States' biological posture. Realism would predict that chemical and biological programs operating under this model should behave according to the perceived threat facing the United States. Under the influence of external threat, output from the programs would be optimized to protect national interests, and would not necessarily show high correlation between the two weapons categories. Therefore, based on the physical differences between chemical and biological agents, combined with changing levels of relative threat, it would be logical to expect a distinct relationship between the two. It would be further expected that the programs would experience changes in priorities, budgets, and manpower based on changing intelligence estimates and real world events. As with the other two theories, a series of predictive statements will be used to test the historical influence of behaviors based on realism theory.

Relative Threat Drives a Proportional Response

Realism theory is perhaps the most straightforward of the three proposed theories. It lends itself to a series of statements based on a simple predictive model where threat drives response. The state makes a rational choice based on the perceived severity of the threat, and the availability of resources. As resources are finite, each threat/response must be weighed relative to all other threats facing the state. Behaviors predicted by realism reflect an evolving doctrine based on changing world events.

1. *How the United States views the threat from chemical agents and biological agents (in absolute and relative terms) is dynamic, and will change over time.* While not a direct statement of how the state will respond, this behavior sets an important condition: the international arena is not static, and threats to the state will change over time. As threats change, realism predicts state behavior will adapt in response. The change in threat can occur as the result of an external event, such as the discovery of the Iraqi program. The change in threat may also be internal, as the state reassesses its perception of the threat, as with the increase in concern over the biological threat under the Clinton administration.[22]

2. *Official policy and statements on threat level will change over time relative to new intelligence or world events.* This statement flows from the previous assumption that international threats, and specifically the threats of chemical or biological weapons, are not static. These threats also change relative to other threats, such as conventional forces or nuclear warheads. If realism holds true, official U.S. positions relative to all threats should change over time. Evidence of this change will be found in sources such as intelligence estimates, official testimony, or military doctrine.

3. *Budgets, force structure, and hardware will be built to reflect the current threat level.* Realism predicts that the state will respond to protect itself against perceived external threats. In the case of biological and chemical weapons, the relative threat these weapons pose to the United States has changed over time. If external threat is the dominant factor influencing U.S. policy, one would expect U.S. response, as measured in dollars, personnel, and hardware, to vary as threat perception varies.

4. *Military forces will train and exercise relative to the current threat level.* The U.S. military dedicates substantial resources to training its fighting forces. However, as training resources are not infinite, the

military must prioritize the threats and allocate resources as appropriate. Realism would then predict that military training would adapt, emphasizing the most likely threats facing the nation at a given moment in time. Realism would also predict that training would be tailored to meet the threats particular to each region and each branch of service.

Testing

This work will test the degree of support for each of the three theories by developing a series of expected behaviors, then examining the historical record for evidence of these behaviors. The strength of a particular factor's influence over the program will be scored by the prevalence of predicted behaviors in the historical record.

In addition to predictive behaviors, it is possible to construct a logical pathway that flows from each theory to a distinct biological posture. The presence of predicted behaviors, combined with the existence of a logical pathway, provides reinforcing evidence as to the influence of a particular theory. Many different behaviors may be evidenced in the historical record that do not ultimately impact U.S. biological doctrine, but the existence of a pathway demonstrating linkage between the predicted behaviors and the expected doctrine will provide greater confidence as to the influence of a particular theory.

As described by George and Bennett, in a congruency test the "investigator begins with a theory and then attempts to assess its ability to explain or predict the outcome of a particular case." After examining these data, "if the outcome of the case is consistent with the theory's prediction, the analyst can entertain the possibility that a causal relationship may exist." Scoring standards for a congruency test are based on the strength of similarities between "hypothesized causes and observed effects." The greater the expected variation in direction, magnitude, and dimension, the greater the degree of "congruity."

The strengths of the congruency test are that it allows flexibility in its design and does not require access to all data relating to a particular causal pathway. It can also be combined with other research methods to lend greater validity to the conclusions.

However, there are weaknesses in the test as well—researchers must guard against "unjustified" attribution of causality. One way to strengthen the causality claim is to include alternative theories in the analysis and determine which demonstrates superior congruency. Including multiple theories supports causality because by "invoking the superior standing of the theory employed or by resorting to process tracing, the investigator may be satisfied that the within-case approach suffices."

Therefore, a basic congruency method will serve as the foundation of this work. To address the method's weaknesses and add rigor to the conclusions, multiple theories are included in the analysis, and process tracing is employed as a supplemental method.

For this work, congruency scoring of each theory is based on the "more credible" measurement. The historical record will be examined for the predicted behaviors associated with each theory, and the greater the presence of these behaviors, the more credibility the parent theory's explanatory power will have. Observing which theory has the greatest historical evidence and eliminating the theories with lesser evidence will determine the "winning" theory.

The process tracing method adds support to the "best fit" scoring associated with the congruency method. Process tracing requires the creation of a logical pathway that explains the observed doctrine. The presence of data supporting a logical pathway will lend support to the parent theory. Evidence contradicting the pathway will mean the parent theory must be eliminated from that period of analysis, or at least modified to account for all available data.

Therefore, a general best-fit congruency approach, supported by process tracing where possible, will serve as the scoring standard for this research. Based on this scoring method, the three theories will be tested to determine if their predicted behaviors exerted significant influence over biodefense posture during each time period.

Notes

1. Lynn Eden, *Whole World on Fire* (Ithaca: Cornell University Press, 2004).

2. Robert M Entman, "Framing: Toward Clarification of a Fractured Paradigm," *Journal of Communication* 43, no. 4 (1993).

3. Paul Shrivastava and Susan Schneider, “Organizational Frames of Reference,” *Human Relations* 37, no. 10 (1984): 795–809.

4. James G. March and Herbert A. Simon, *Organizations* (Cambridge, MA: Blackwell Publishers, 1993).

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6. Herbert A. Simon, “Bounded Rationality and Organizational Learning,” *Organization Science* 2, no. 1 (1991): 125–136.

7. March and Simon, *Organizations* (see ch. 2, n. 4).

8. Mahler, “Influences of Organizational Culture” (see ch. 2, n. 5).

9. In general, references to the Chemical Corps are inclusive of earlier incarnations of the Corps, such as the Chemical Warfare Service.

10. March and Simon, *Organizations* (see ch. 2, n. 4).

11. Robert Montjoy and Laurence O’Toole, “Toward a Theory of Policy Implementation: An Organizational Perspective,” *Public Administration Review* 39, no. 5 (1979): 465–476.

12. Simon, “Bounded Rationality” (see ch. 2, n. 6).

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17. Francis J. Gavin, “Same as it Ever Was: Nuclear Alarmism, Proliferation and the Cold War,” *International Security* 34, no. 2 (2010): 7–37; Esther Pan, “The Scope of China’s Military Threat,” Council on Foreign Relations, 2 June 2006, http://

www.cfr.org/china/scope-chinas-military-threat/p10824; Maria Ryan, "The Rumsfeld Commission: Filling in the 'unknown unknowns'," Nth Position, July 2004, http://www.nthposition.com/fillingintheunknown.php; Jonathan B. Tucker and Amy Sands, "An Unlikely Threat," *Bulletin of the Atomic Scientists* 55 (1999): 46–52.

18. Even though there is an established mission structure within the DoD, it is still possible to have multiple agencies compete for a mission. For example, there are at least four agencies on Air Staff responsible for some part of chemical and biological defense.

19. Kenneth N. Waltz, *Theory of International Politics* (Boston: McGraw Hill, 1979); Kenneth N. Waltz, *Man, the State, and War: A Theoretical Analysis* (New York: Columbia University Press, 2001).

20. Allison and Zelikow, *Essence of Decision* (see ch. 2, n. 13).

21. Hans J. Morgenthau, "Politics Among Nations," in *Conflict and Cooperation*, ed. Marc A. Genest (Toronto: Wadsworth, 2004).

22. Susan Wright, "Terrorists and biological weapons: Forging the linkage in the Clinton Administration," *Politics and the Life Sciences* 25, no. 1–2 (2007): 57–115.

CHAPTER 3

Biological Agents, Chemical Agents and Current U.S. Defensive Capabilities

> Putting all three (WMD) weapons systems in one common view is much like comparing an M1 rifle, a 203mm mortar, and an 8-inch howitzer and deciding that the military should use the same defense against all three.
>
> —Albert J. Mauroni, *America's Struggle with Chemical-Biological Warfare*[1]

The physical differences between biological agents and chemical agents are of such significance that each should be considered a distinct weapons class in its own right, yet they are often regarded as one weapon type. This chapter provides background information to give insight into the basic nature of each type of weapon.[2]

Confusion in Terminology

A name can create strong associations that influence how a thing is perceived. Biological, chemical, nuclear, radiological, and even explosive weapons have historically been placed into a single category. These weapons have been identified by several acronyms, such as Nuclear, Chemical, Biological (NBC), Chemical, Biological, Radiological, Nuclear, Explosive (CBRNE), and Weapons of Mass Destruction (WMD). Seth Carus traces the development and significance of the term "WMD" and proposes that while it can be confusing, and often has different meanings, it has been accepted and will continue to be used in policy and public debate.[3] The use of these terms reflects a belief that somehow these weapons are all the same, while in actuality they are distinctly different.

Congressional testimony demonstrates the long history of this debate, and also the confusion when disparate threats are combined within a single term. Senate reports dating back to 1969 call for "the separation of the C-B 'twins.'"[4] Yet confusion over terminology is still present today, as testimony in 2010 relates: "Many leaders in this town … fail to understand the growing threat of bioterrorism. That was best demonstrated when the bipartisan leadership in Congress created the WMD Commission. The words biology, biological, and bioterrorism did not appear in the enabling language. It was as if the U.S. Congress thought WMD was an acronym for nuclear."[5]

The term Weapons of Mass *Destruction* gives a clue to the perception of these weapons, and may indicate a frame of reference that influences the organizations responsible for understanding and defending against these weapons. While nuclear weapons clearly cause physical destruction on a massive scale, biological agents and chemical weapons, while lethal, do not cause extensive physical destruction of the target area. Biological weapons are living organisms, while chemical weapons are small-molecule chemical poisons. Yet we consistently consider these weapons as being in the same category, which can be indicative of an organizational frame of reference that will ultimately influence how individuals view the solutions for each weapon.

Weapon Characteristics

Chemical agents and biological agents are distinctly different classes of weapons, and should not be considered in the same category when designing defenses. To understand the debate, and the issues caused by such an association, it is necessary to understand the nature, similarities, and differences between chemical and biological agents. The following section provides basic descriptions of characteristics, detection, and threat related to each type of agent.

Biological Agents

Biological weapons are based on living, microscopic organisms found in nature, which have the ability to infect and cause disease in a target population.[6] There are two main categories of biological weapons: bacteria and viruses. Some organisms naturally infect humans, while others only make effective weapons after specific steps are taken to weaponize the organism, exposing the target in a manner not normally encountered in nature.

While every organism is different, most biological agents share certain characteristics. The objective of a biological attack is to cause an outbreak of disease in a target population. Biological agents are capable of infecting the target through the respiratory system, digestive system, mucous membranes, and broken skin. Generally, respiratory-based attacks are the most effective, and require the agent to be delivered as an aerosol with particles of one to ten microns in size.[7] While an aerosol attack is the most effective, it is also possible to conduct biological attacks through other methods, such as contamination of food or water supplies.

As there is a wide range in the severity of natural disease, there is also a wide range of possible effects from a biological attack. Each biological agent is unique in how it interacts with its host, and every species has a limited number of hosts acceptable for growth. Agents that can infect humans have a broad array of effects. The causative agents for plague and anthrax often cause extensive damage, resulting in death of the host. Some agents may produce less damage, resulting in relatively mild disease, while others can produce severely incapacitating but non-lethal diseases.

Like any other disease, biological agents have an incubation period, meaning there is a delay between exposure to the agent and onset of symptoms. This delay can range from one or two days to over a week, depending on the agent. In terms of military tactics, this delay makes biological agents effective as strategic weapons, but gives limited tactical advantage.

As each species of agent is unique in how it infects a host, there is also a wide range in the number of infectious particles needed to cause an infection. For some agents, the inhalation of one to ten particles will result in an infection, while other agents may require a dose of thousands of particles. Infectious dose also depends on the target organism. Research has shown differences in infectious dose as high as two orders of magnitude between different host organisms exposed to the same agent.[8]

Each biological agent also has a particular set of environmental conditions in which it can remain viable. If a biological attack occurs under the appropriate environmental conditions, the agent may persist in the environment for a significant amount of time after the attack. Without appropriate environmental conditions, the agent will begin to die off, following a half-life decay model. Therefore, possible persistency of a biological agent after an attack varies greatly. Anthrax spores are probably the best known and most resilient biological agent, capable of surviving in certain environments for years, or even decades.[9] On the other hand, agents such as Tularemia are extremely fragile, with a half-life measured in minutes to hours.

Another type of persistency unique to biological agents is contagion. With some agents, infected individuals have the potential to cause secondary infections in individuals not initially exposed to the biological agent. Left untreated, a contagious agent could cause many rounds of infection and spread to a significant portion of the target population after an attack. Use of a contagious agent on the battlefield would pose significant logistical, operational, and medical challenges that could not be addressed effectively from a chemical weapons frame.

As bacteria and viruses are ubiquitous in our environment, the human immune system has evolved capabilities to fight infections and provides everyone with some basic level of protection against biological warfare. Biological weapons are most effective when they are delivered in massive infectious doses that overwhelm the immune system, or utilize organisms able to circumvent it entirely.

The immune system can be augmented by medical intervention, which is a legitimate component of defensive programs against biological warfare. Bacterial infections can often be treated with antibiotics, which can serve as an effective defense against a biological attack. However, in many cases antibiotic treatment must be administered within a relatively short amount of time post-infection in order to be effective.[10] A defensive strategy based on antibiotic countermeasures would rely on biological detection capabilities, stockpiles of the drug, and the ability to rapidly distribute mass quantities of the treatment to the target population.

It is also possible to precondition the immune system through vaccination. In this case, intentional exposure to the agent in a safe manner allows the immune system to develop antibodies, which help it "remember" the agent and more quickly and effectively fight off future challenges from the same organism.

While both drugs and vaccines can be strong components of a biological defense strategy, they do have weaknesses. Vaccines are often organism-specific, and organisms can develop resistance to drugs. Additionally, development of a medical countermeasure involves significant amounts of time, research, and resources. It can take five to ten years, and tens or even hundreds of millions of dollars to develop one new medical capability. Therefore, while it is possible to combat many biological agents with medical countermeasures, this strategy requires a significant amount of resources and several years of lead time if those countermeasures are to be available in the event of an attack.

While most biological agents share similar characteristics, there are some significant differences between bacteria and viruses. Bacteria are single-celled organisms possessing all the "machinery" necessary for independent energy production and independent reproduction, making them generally more resilient and more persistent in the environment, and thus more difficult to decontaminate than viral agents.[11]

Bacteria use resources found within the host to reproduce, which may cause some physical damage, though it is not the primary cause of injury to the host. Most physiological effects associated with a bacterial infection are the result of toxins or waste produced by the bacteria and then released into the host organism.

Viruses are the second major class of organisms most often considered likely agents for use as biological weapons. A virus is an infectious particle, much smaller and of simpler construction than a bacterium.[12] Unlike bacteria, a virus is not able to produce energy or reproduce on its own in the environment. The virus life cycle is dependent on infecting a host cell. After entering the host cell, the virus "hijacks" it, causing it to cease its normal function and to instead produce more viral particles. As a result, the host cell is often destroyed through viral reproduction, which can be a main cause of disease symptoms produced by viruses.

Compared to bacterial agents, viruses have some significantly different characteristics. Generally, viruses are more fragile than bacteria, and thus less persistent. While vaccines can be developed against viruses, antibiotics have no effect on a viral infection. Antiviral drugs are available, but are much less numerous than antibiotics, and while some antibiotics are "broad-spectrum," anti-viral drugs are generally effective only against a specific viral agent.[13]

In addition to bacterial and viral agents, there are also biological weapons known as toxins. In the context of biological weapons, the term "toxins" is generally associated with toxic chemicals produced by living organisms through metabolic processes. In contrast, chemical weapons are the product of a series of chemical reactions conducted in an industrial setting. Organisms such as bacteria, fungi, plankton, or reptiles can produce toxins, and they can be harvested, as with venoms, or produced through industrial bacterial fermentation.

Once removed from their biological origin, toxins are more similar to chemical weapons than to biological weapons. As molecules, toxins do not live or reproduce within the host. The effects associated with toxins are caused when the toxin alters a biological function of the host organism. Unlike bacteria or viruses, some toxins may be absorbed through the skin, similar to some chemical agents discussed below.

For these reasons, there has been debate as to how to categorize biological toxins—as biological weapons or as chemical weapons? For the purposes of this analysis, toxins are not included in either category; references to biological agents imply a bacterial or viral agent, while references to chemical agents imply a nerve, blister, or blood agent (discussed below).

Finally there are other types of biological agents that will be addressed only in passing. In theory, any living organism that can cause harm to the enemy could be a biological agent. The United States conducted extensive research into the ability to use fungi to infect Soviet wheat crops. A fungal attack is similar to a bacterial/viral attack against a human target in that if the fungal spore finds an appropriate host, it will begin to grow at the expense of the host plant, causing damage and possible death to the plant.

Examples of more exotic biological attack scenarios could include the introduction of an invasive insect species to destroy crops, bombarding the enemy with poisonous animals, or using dead animals to contaminate the enemy's water supply. This analysis will not include these types of attacks, instead focusing on the most common bacterial and viral anti-human weapons.

Chemical Agents

Whereas biological agents are living entities, chemical agents are chemical compounds manufactured through industrial chemical processes. They are not found in nature, and are designed to have specific physiological effects on a target organism. Being chemicals, these agents can exist in all three phases of matter.

Chemical weapons can act through the skin, mucous membranes, or through the oral/respiratory route. While some agents are employed as vapors to attack the lungs, they can also be employed as liquids, either to present a contact hazard, or to slowly off-gas and create a vapor hazard. Because of the multiple routes of entry, both respiratory and barrier protection are needed to effectively shield against a chemical attack.

Chemical weapons begin to show effects relatively quickly after exposure. Fast-acting nerve and blood agents cause effects within minutes, while some slower acting blister agents may take a few hours to a full day to show effects. Many chemical weapons are also dose-dependent, exhibiting a range of sub-lethal to lethal effects depending on total dose and time of exposure.

Chemical agents can be classified as persistent or non-persistent, a characteristic describing their ability to remain a hazard in the area where they are employed. Non-persistent agents are delivered as gasses (or as liquids that rapidly evaporate into gas), which quickly dissipate based on the prevailing weather conditions. Non-persistent chemical agents include nerve, blood, choking, and tear agents.

Persistent agents are often thick or oily liquids that remain on surfaces, where they are capable of causing casualties for hours or even days after employment and present a contact hazard to exposed personnel operating in the contaminated area. Persistent agents will slowly evaporate over time, also creating a potential respiratory danger for some time after their use.[14] The most common persistent agents fall within the nerve and blister agent categories.

The use of persistent versus non-persistent agents depends on the military mission. Non-persistent agents quickly cause casualties and dissipate, allowing attacking forces to move into the area without needing extensive protective equipment. Likewise, forces able to survive an attack through use of protective equipment can return to normal operations within a relatively short period of time.

Areas exposed to persistent agents, on the other hand, remain hazardous for many hours to several days. Personnel operating in a persistent chemical environment must remain in protective equipment for extended periods of time. The continued toxic hazard, combined with the physical effects of the protective equipment, greatly reduces the effectiveness of personnel in such an environment. Persistent agents would be used in situations such as contamination of terrain to slow movement of enemy troops, or contamination of seaports and airfields to slow operations.

Traditionally, chemical weapons have been categorized by their method of action. Categories include nerve, blister, choking, vomiting, blood, tear, and incapacitating. Of these categories, nerve and blister agents are of the most concern to modern military forces, as blood, choking, and vomit agents are generally regarded as obsolete, and tear agents are mainly used in riot control.[15]

The most common nerve agents are VX, Sarin (GB), Soman (GD), and Tabun (GA). As their name implies, nerve agents act by interfering with nerve function and causing seizures, paralysis, and death. Nerve agents can be employed as liquids or as gasses. They exhibit a wide range of persistency, with VX being a true persistent agent, while Sarin is non-persistent. The other agents exist between the two extremes and are regarded as semi-persistent. The persistent agents can penetrate many materials, thus full barrier and respiratory protection is required to ensure adequate defense against nerve agents.[16]

Nerve agents are absorbed through the lungs, mucous membranes, or the skin. Their effects are dose-dependent, but a lethal dose can cause symptoms in less than a minute, and death can occur within five minutes of the onset of symptoms. There is a short window of opportunity post-exposure where an antidote, atropine, can be administered. While there is generally no medical "vaccination" capability for chemical weapons, it is possible to provide some advanced protection against nerve agents by administering Pyridostigmine pre-exposure.[17]

The chemical agent "mustard" is the most common blister agent, and has a long history of use in warfare. Blister agents act upon the skin, mucous membranes, and lungs. The purpose of these agents is to cause chemical burns on exposed skin or tissue. These effects usually appear several hours post-exposure, with the blisters lasting for several days. There is no effective drug treatment pre- or post-exposure.

While blister agents are generally associated with the skin, they cause damage to any tissue they contact. Inhalation of a blister agent can cause pneumonia and can be fatal; exposure of the eye can result in blindness. These agents are generally deployed as liquids, and are persistent in the environment.[18] Mustard agent can penetrate many surfaces and causes damage to many militarily significant materials. Protection against blister agents is accomplished through filtration and barrier materials.

Blood agents are designed to inhibit the body's ability to utilize oxygen, and are primarily absorbed through the lungs or mucous membranes. Effects of these agents are evident within minutes of exposure. Drugs are available for post-exposure treatment, and the body is able to rapidly clear these toxins. Army guidance advises that anyone conscious and breathing five minutes after exposure will most likely recover spontaneously.[19] Respiratory protection is of the most concern for blood agents.

Similarities and Differences

There are significant differences between chemical agents and biological agents. One would not consult a microbiologist on an industrial chemical accident, or ask a chemical engineer to decontaminate an operating room—so why would the DoD attempt to develop a single solution to deal with both problems? Following is a discussion of several significant differences between these two weapons, and the implications for military action.

Physical Nature

There is a significant physical difference between chemical agents and biological agents. Chemical agents are relatively small chemical molecules composed of a known ratio of elements with a specific bonding pattern, and can exist in any state of matter—liquid, solid, or gas. They can seep into cracks, penetrate and sometimes even dissolve other materials, and move through extremely small openings.

The chemical agent's elemental composition, along with the bond structures and physical arrangement of the molecule, determines its characteristics, such as lethality, vapor pressure, and persistence. The chemical composition and shape of the agent allows it to interfere with a physiological process, resulting in damage to the target organism. It is also this specific combination of elements and bonds that is generally targeted by decontaminants and detectors.

Compared to chemical agents, biological agents are large, complex assemblies of multiple molecules that interact to perform the functions associated with a living organism. The relatively large size of biological agents means they behave as particulates, which is significantly different from the way gaseous or liquid chemical agents behave. Biological agents are subject to physical behaviors such as settling and filtration. They can settle in small openings, but lack the ability of chemical agents to dissolve surfaces, or to diffuse within other substances.

The infectivity and lethality of a biological agent is a function of its ability to find a suitable environment within a host. The damage caused by a biological agent is a result of the physical growth of the agent within the target organism. Whereas chemical weapons demonstrate a dose-dependent reaction, biological agents are more binary in their effects (i.e., you are either sick or well). A biological agent's DNA controls its behavior and serves as a signature targeted by some detection methods.

Operationally, there are two significant differences between chemical agents and biological agents: time to act and potency. As discussed earlier, incubation time is a factor with biological weapons. Compared to the rapid action of chemical weapons, biological weapons would offer minimal utility as a tactical battlefield weapon, as any military action would most likely be concluded before the effects became apparent. It is also important to note the relative potency of biological weapons compared to chemical weapons. The low infective doses of biological agents, combined with the small size of the agent, means that pound for pound biological weapons can cover vastly larger areas of territory than a similar volume of chemical agent.

Protection

The physical nature of the two agent classes generates different challenges when designing defensive capabilities. Physical protection is one area that has vastly different requirements depending on the nature of the threat agent. Chemical agents present unique challenges, such as their ability to penetrate and dissolve other substances, and their extremely small size. Effective barrier protection means using impermeable materials, or constantly replacing semi-permeable barrier material prior to breakthrough by the agent. Filtration of chemical agents requires exposing them to other chemicals that bind or sequester them. Many agents can penetrate human skin, so total body protection is required.

As already discussed, biological agents are particulates and cannot generally penetrate intact human skin, or most barrier materials. The most significant threat is in the form of an aerosol in the one- to ten-micron range. Alternative attacks such as contaminated food or water are possible, but would be more limited in their effects. Regardless of the challenge, the filtration of biological agents is possible through physical entrapment of the infectious particle.

Protection therefore represents two distinct physical challenges. For biological agents, respiratory and mucous membrane protection is required, and can be augmented with additional physical barriers that serve to prevent the spread of contamination by protecting non-intact skin. Respiratory protection is also required for chemical agents, but more substantial skin barrier protection is necessary, which usually imposes a significant thermal burden. Therefore, designing a system to protect against both threats imposes excessive protection and additional costs in the case of a biological attack.[20]

Detection

Most strategies employed for detecting chemical agents rely either on identifying the chemical properties of the agents, such as elemental composition or bond type and arrangement, or on chemical reactions with other substrates.[21] The chemical reaction method, which produces a visible color change in the presence of a chemical agent, is one of the simplest detection techniques, and is utilized in the form of chemical detection paper issued to soldiers facing a chemical threat.

Many automated chemical sensors have been developed and employed. These detectors utilize various technologies, but generally rely on spectroscopy or chromatography to identify signatures unique to a particular agent. Each chemical agent has a specific combination of mass, elements, and bonds which can be characterized and recorded as its unique signature. Detection systems then look for the presence of the same chemical signature in the field, and sound an alarm when it is detected.

These detection techniques are rapid and sensitive, allowing currently fielded sensors to detect militarily significant levels of agent within seconds of exposure. However, chemicals in the environment can cause false alarms, even with a generally "clean" background environment. More detailed identification or detection of lower levels of contamination generally requires more time and more sophisticated capabilities.

The requirement of being able to discriminate a biological agent of hostile origin from the vast background noise found in nature presents a significant challenge to biological detection. The environmental background is vastly different for biological agents than for chemical agents. While a molecule of a chemical agent would be relatively unique in nature, the natural environment is full of countless numbers and species of bacteria and viruses.[22] The existence of infectious organisms in nature also raises the issue that the detection of a biological agent may not necessarily indicate a hostile attack.

The biological background also presents the problem of "near neighbors" when attempting to develop detection strategies. Near neighbors are organisms native to an environment that may differ from a biological agent by only a few genes. Yet they do not cause disease, even though they may appear almost identical to a virulent biological agent. Because of their similarities, many biological detectors may interpret the presence of a near neighbor as a biological attack, and sound a false alarm.

Compounding this problem is the extremely low infectious dose of some agents. In extreme cases, providing effective protection requires a detector capable of identifying as few as ten infectious particles within the environmental background. While there are several technologies capable of meeting these parameters, they do not work rapidly, or in field environments. It is the need to quickly sift through all the biological material in nature, and reliably identify only agents of interest that adds significant challenges to biological detection.

In theory, the same chemical analysis detection techniques used to identify chemical agents could be used to detect and identify biological agents, as all living things are ultimately a collection of chemicals. The challenge to this approach is identifying a chemical unique to the particular bacteria or viral agent that is not present in any other naturally occurring bacteria or virus.

The most useful result of this approach to date has been to produce basic biological identification devices that analyze an air sample for "living" bacterial organisms versus "dead" particulates, such as pollen or environmental dust. At best, these systems can identify a rapid increase in the number of bacteria present in the air, which may or may not be indicative of a biological attack. Currently, they have no capability to identify the organism associated with the increasing numbers.

The most successful biological identification systems thus far have relied on DNA analysis or antibody-binding detection strategies. Antibodies are molecules produced by animal immune systems in response to an infection. These molecules recognize and bind to a specific component of an invading organism. Antibodies can be harvested and used to capture specific agents from an environmental sample as they would within the blood of an animal.

Once the antibodies sequester an agent, secondary reactions can be used to detect the presence of the captured agent. Antibody-based detectors are relatively fast (results within five to fifteen minutes), but are prone to cross-reactions with environmental contaminants, generating a significant number of false alarms. They also need a relatively large amount of target agent, often requiring air samples to be concentrated prior to testing, which can increase the testing time by fifteen minutes to one hour.

DNA is the molecule that contains the source code for the growth and function of all living things and is truly unique to each living species on earth. DNA analysis provides the most detailed identification of a biological agent. However, analysis takes hours to days, depending on the desired level of detail. While Polymerase Chain Reaction (PCR) identification provides an extremely reliable identification capability, it does not provide results in time to offer any protection from infection.[23]

With both chemical and biological agents, exposed personnel (and other living organisms) represent the final detector, although with different response times. In the event of a chemical attack, the effects are almost instantaneous, so even without detection equipment, adjacent personnel will be aware a chemical attack is underway. With biological agents, the effects are not evident for days, providing no immediate indication of the attack. Even when the evidence of a biological attack appears, the first indication may be individuals presenting with nondescript "flu-like" symptoms. Therefore, the medical community's ability to ascertain an unusual disease pattern is an important component of the detection process.

Decontamination

In a post-attack environment, there may be a need to decontaminate items, either by neutralizing the contaminating agent, or by diluting it to a level where it no longer presents a health hazard. Historically, the United States has pursued a strategy of developing fast acting, universal decontamination agents capable of neutralizing all chemical and biological threats. This program has had minimal success, and continues to present a significant technical challenge.[24] Decontamination also presents a logistical challenge, as the equipment and substrates must be transportable, require as little power as possible, and be able to operate over a wide temperature range.

Active decontamination of a chemical agent requires the molecular structure of the agent to be altered so it is no longer toxic to personnel. Most decontaminants contain a reactive molecule (e.g., chlorine or peroxide) that attacks molecular bonds, thus inactivating the agent. The stronger the bonds of the chemical agent, the more reactive the needed decontaminant. The difficulty with reactive molecules is that they may also react with the equipment being decontaminated, rendering it unsafe or unusable.

The ability of chemical agents to penetrate substrates presents a significant challenge to chemical decontamination. Chemical agents can penetrate many surfaces encountered on a military base, such as concrete, paint, and canvas. The ability of chemical agents to penetrate and remain sequestered in painted surfaces presents a substantial decontamination challenge, as all military equipment—from vehicles to aircraft—is painted.[25]

There are alternatives to reactive-based decontamination. Diffusion or dilution can lower the level of toxic agent below the point where it affects personnel. Weathering of equipment can allow for diffusion, while also allowing a low level of environmental chemical inactivation (hydrolysis) to take place. It is also possible to alter molecular structures through physical processes such as ultraviolet light, heat, or radiation. Another alternative is to sequester the agent (with absorbent paint, for example), then seal it in place or physically strip the contaminated material from the surface of the equipment. While these approaches work under certain conditions, the challenge is to employ the technology in a realistic field environment without damaging equipment.

Decontamination of a biological agent requires, at the most basic level, altering the agent so it is no longer able to reproduce within the host, and is therefore unable to cause disease. As biological agents are living organisms, they will eventually die without a suitable environment for growth and reproduction, giving each biological agent a measurable half-life relative to the type of environment where it is employed.[26] Therefore, weathering of biological agents has significant potential in reducing the hazard below an infectious level. As a general rule, biological agents are much more fragile and easy to decontaminate compared to chemical weapons.

There are several additional options available to alleviate a biological threat. As biological functions are based on the actions of proteins and DNA, any mechanism that can damage these molecules can render an agent safe. Such methods can include heat, desiccation, denaturing, reactive molecules, radiation, or sequestration/coating of receptor molecules. Several common household cleaners are effective at decontaminating many biological agents of concern.

As with protection, the United States has pursued a decontamination program based on a combined biological/chemical view of the threat. Many decontaminants have the potential to eliminate the hazard from chemical or biological agents—the challenge is to find one that can decontaminate all agents, while still meeting the additional requirements imposed by material effects, safety, and logistics.

The doctrine of addressing all of these issues with one decontaminant places almost insurmountable requirements on the program. Mark Mueller perfectly summarized the decontamination “problem” by observing that an auto detailing company may use dozens of products to clean the different materials found on a car, yet the military insists on a universal decontaminant capable of addressing all threats and all materials.[27] As a result, the United States has deliberately made the decontamination problem exceedingly difficult. A decontaminant may be ideal for eighty to ninety percent of the threats, yet is rejected because it cannot address one or two particular agents. As observed with protection, developing decontaminants to address the remaining ten to twenty percent of the problem results in over-engineering for most other agents. Many existing agent-specific decontamination products could be employed today (particularly for biological agents in hospitals) if the United States chose to adopt a system based on multiple decontaminants that could be tailored and deployed according to the expected threat.

The differences in responses to biological agents and chemical agents outlined above are some of the most obvious and significant; however, ignoring the physical differences between the two agents impacts all aspects of battlefield operations. Additional areas where preparation against one agent would result in less than optimal solutions for another agent include response measures, operational effects planning, maneuver, training, casualty assumptions, and logistics.

Any time two disparate problems are addressed with one solution, there is a compromise. As the military attempts to protect against both chemical and biological agents, the combined approach necessitates defensive measures that are over-engineered for all but the most challenging threat. The combined approach also imposes excessively difficult technical requirements that ultimately doom many programs to failure. While a combined defense does offer some advantages (e.g., logistics, training, communications) it is also associated with a cost that may not always be considered when developing a defensive program.

Current Defensive Systems

Each of the three theories of interest predicts a different relationship between chemical agents and biological agents. Part of this relationship is dependent on the physical aspects discussed in the previous section. However, to fully understand the nature of the defensive posture, it is important to have a basic understanding of current defensive capabilities.

Reports from the Chemical Biological Defense Program (CBDP) support the contention that the United States has a greater capability to defend itself against chemical agents than biological agents. The 2008 modernization plan rates current capabilities in both areas, with chemical capabilities rated yellow, compared to biological capabilities, which are yellow/red.[28] The report also projects that chemical defenses will reach a green status before biological defenses.[29] As it is not feasible to review every piece of defensive hardware, present detection capabilities will serve as a proxy for the current state of defensive capabilities.

Current Biological Detection Capabilities

The 2009 CBDP program report to Congress listed only two deployed automated biological sensors: Portal Shield, with 314 fielded, and the Joint Biological Point Detection System (JBPDS), with 517 fielded, both of which utilize antibody-based detection systems.[30] The Joint Biological Agent Identification and Diagnostic System (JBAIDS) is also employed by the military, and can function as an identification system. This system is a PCR detection system without sample collection, thus relying on collectors such as dry filter units, or other manually collected samples such as environmental swabs.[31] Currently, it is regarded as a medical asset rather than a biodefense asset.[32] As it relies on PCR technology, it is much more accurate and sensitive than the Portal Shield or JBPDS devices, but is slower (one to two hours to analyze a sample) and cannot provide an alarm in time to prevent exposure.

The DoD is now developing two programs in an attempt to address the weaknesses in our current biological detection capabilities. The Joint Biological Tactical Detection System (JBTDS) will be a "lightweight biological agent system that will detect, warn, and provide presumptive identification and samples for follow-on confirmatory analysis. … The JBTDS will be one-man-portable and capable of being battery operated. The JBTDS will be employed organically."[33] The proposed fully-fielded system will consist of 7,500 detector/samplers combined with 2,000 identifiers.[34] As of 2011, specific detection technology has been identified, and the status of this system is in "Technology Development" with an anticipated fielding date of 2018.[35]

The second system under development is a standoff detection system. Real-time standoff detection continues to be a technological challenge. The history shows a continued desire to produce such a device, starting in the 1950s, yet to date such programs have been unsuccessful. Congressional testimony from 2008 captures predictions of the impending fielding of a standoff biological detector.[36] However, technological challenges resulted in that particular device being relegated to service as a test bed device.[37] As of 2009, plans for the newest standoff detection device called for technical development starting in late 2010, with production starting no earlier than 2015.[38] In these plans, the developers stated several specific technical challenges with standoff detection, including detection and discrimination at a distance, false alarm rate, day/night capability, performance projection to live agents, and the ability to integrate the system into existing detection platforms.[39]

The DoD is not the only department developing detection capabilities. The Automated Pathogen Detection System is a PCR system with automated collection and detection capabilities integrated in the same device. The Department of Homeland Security (DHS) has evaluated it as a possible replacement for current BioWatch sensors.[40] This system addresses some of the issues with previous systems, utilizing dual collection (impinge/dry filter), and dual detection (multiplexed immunoassay/PCR) allowing up to one hundred tests per sample.[41] The use of dual technologies helps reduce the incidence of false detections and the multiplex addresses issues of throughput. The integration of collection and detection also reduces the need for separate analysis of filters, as is currently required by the BioWatch system. Co-location of the collection and detection hardware also reduces the time and cost of transporting samples for independent analysis, increasing the usefulness of the system. However, Emanuel identifies several limitations of such systems: detection is optimized for specific matrices, there is a tradeoff of sensitivity/selectivity in favor of speed, and the increasing number of samples may overwhelm the sites.[42]

The U.S. government's focus on real-time biological detection has yet to produce an effective detection capability, and has ignored numerous alternative detection strategies. One alternative system consists of dispersed constellations of smaller sensors, as opposed to the approach of large stationary devices situated at or near the target.

Fielding an array of small, networked sensors would allow greater coverage of the target, as well as provide information on the movement and scale of the attack cloud.[43] Such a system may be a hybrid network where alarm type sensors will detect deviations from the baseline and can function to alert identification systems, which would have greater ability to characterize the anomaly and identify biological threats.[44] The Defense Science Board also examined the detection problem and recommended affordable, widely dispersed sensors, a large signature database, and improved communication. A Congressional Research Service analysis of biological detection capabilities also advocated the use of layered sensor capabilities based on multiple small, cheap sensors deployed in a wide-ranging network.[45]

Chemical Detection Capabilities

While not perfect, current chemical detection capabilities are much more robust that current biological detection capabilities. While the 2009 CBDP report shows the DoD had two fielded biological detection systems, the same report lists twelve deployable chemical detection systems.[46] The reports show that the DoD has an extensive inventory of chemical point sensors, which are designed to be deployed on the front lines and alert forces to hazardous levels of chemical agent within seconds. There are also more sophisticated systems that can detect lower levels of chemical agents, although they take longer to alarm. These detectors are generally employed for conformation, de-masking, or forensics. What is missing is a standoff chemical agent detector. The Joint Standoff Lightweight Chemical Agent Detector is under development and has had issues meeting performance parameters. In spite of these issues, it still received an endorsement from the Army to proceed with development and acquisition.[47]

Perhaps the best indication of the health of chemical detection capability is the lack of Congressional concern. As already noted, searches of GAO reports regarding biological agent detection produce multiple results, while similar searches for chemical weapons produced far fewer results. In fact, the only recent finding of significance in the GAO reports relating to chemical agent detection faults the DoD for not having a strategy to deal with low level (subclinical) chemical weapons exposure.[48]

This finding is of particular note, as it serves to preview the issues associated with how chemical and biological weapons are viewed. In some aspects, low-level chemical agent exposure is more like biological weapons exposure (slow acting, no immediate impact on force strength, possible low level chronic physical problems) than an incapacitating chemical weapons exposure. Therefore, it is not surprising that the same issues plaguing biological detection are noted for this aspect of chemical detection.

Conclusions—Chapter Three

It is apparent that biological agents and chemical agents represent distinctly different weapons; therefore, the combined chemical/biological view prevalent in the biological defense program is not a logical solution. The physical differences between these two classes of threat agent are so distinct that separate defensive programs are warranted.

However, the United States, more often than not, has pursued a strategy based on a joint threat. While there may be financial and logistical advantages with combined hardware, there is also a significant cost in efficiency or effectiveness. Attempting to address both agents with one solution complicates the problem, over-engineers solutions, and excludes legitimate 80% solutions that fail to address one particular threat agent.

Notes

1. Albert J. Mauroni, *America's Struggle with Chemical-Biological Warfare* (Westport, CT: Praeger, 2000).

2. As with most aspects of science, almost every rule has several exceptions. The information in this section is accurate, but general in nature. Many exceptions to the general statements do exist, but do not alter the arguments presented in this chapter.

3. W. Seth Carus, *Defining "Weapons of Mass Destruction"* (Washington, DC: National Defense University Press, 2006).

4. Special Subcommittee on the National Science Foundation, *Chemical and Biological Weapons, Some Possible Approaches for Lessening the Threat and Danger* (Washington DC: U.S. Government Printing Office, 1969).

5. *Government Preparedness and Response to a Terrorist Attack Using Weapons of Mass Destruction: Hearing Before the Subcommittee on Terrorism, Technology and*

Homeland Security of the Committee on the Judiciary, United States Senate, 111th Cong. (2010).

6. Viruses can be considered alive in that they can be inactivated from an infectious to a non-infectious state. Also, while generally thought of as anti-human weapons, biological weapons can be used against animals and plants as well.

7. Particles of one to ten microns in size are optimal for transport deep into the human lung.

8. Heine et al., "Determination of Antibiotic Efficacy against Bacillus anthracis in a Mouse Aerosol Challenge Model," *Antimicrobial Agents and Chemotherapy* 51, no. 4 (2007): 1373–1379.

9. A bacterial spore is a "seed" in many ways, and as such is well suited to remain dormant in harsh environments for long periods of time, waiting for appropriate conditions to "germinate" and begin active growth and reproduction.

10. Generally, drug treatments are much less effective after the onset of overt symptoms. Thus, drug treatments need to work in tandem with a detection strategy to ensure treatment is started in time to be effective.

11. Rikettsia are a subclass of bacteria that live within the cells of a host. They are said to "straddle the line" between bacteria and viruses, as they may be unable to live or reproduce without help from the host cell.

12. A general virus construct consists of an outer capsule, composed of one or more proteins, that encloses a strand of genetic material. The virus particle does not contain the structures for energy production, metabolism, repair, or growth that would be found in a bacterial or eukaryotic cell.

13. A broad-spectrum antibiotic is capable of treating infections caused by many different bacterial agents.

14. The period of residual hazard from a chemical agent depends on conditions such as temperature, humidity, substrate, wind, precipitation, etc. Extensive data tables are available that attempt to predict the length of the residual threat. There is also disagreement between services as to which set of data to accept when determining residual chemical hazard.

15. P. A. D'Agostino and C. L. Chenier, *Analysis of Chemical Warfare Agents* (Medicine Hat, AB: Suffield Research Centre, Defence Research and Development Canada, 2006).

16. Respiratory protection may be adequate only in a purely vapor-hazard environment, leaving an individual susceptible to contact with any liquid agent, such as larger droplet precipitation or residual ground contamination.

17. Pre-treatment does not offer absolute protection, but works in conjunction with antidotes administered post-exposure to improve overall survival rates.

18. Pure mustard agent is a solid below 14° C and may be mixed with other agents if it is used at lower temperatures.

19. *The Medical NBC Battlebook* (Aberdeen Proving Ground, MD: U.S. Army Center for Health Promotion and Preventive Medicine, 2002).

20. While excessive protection may not seem like a bad thing, it comes at a cost. Protective equipment imposes an increased thermal burden, decreased visibility, decreased tactile capabilities, decreased mobility, and reduced communication capabilities. In some cases, these liabilities may prove to be more dangerous than the agent the equipment is meant to counter.

21. It is possible to construct chemical detectors based on biological principles, such as monitoring cellular activity for specific reactions associated with chemical agent exposure.

22. By some estimates, scientists have only characterized five percent of the bacteria present in the environment.

23. The PCR technology allows target DNA to be copied in an exponential manner. In theory, one strand of DNA can yield a million copies for analysis. This process takes thirty to sixty minutes, not including preparation time. The replication process is combined with DNA sequence analysis, allowing strain-specific identification of biological agents.

24. The need to preserve the equipment being decontaminated places a significant constraint on the decontaminant. There are many extremely reactive chemicals and harsh physical processes (such as fire) that would serve as universal decontaminants, but they would also destroy the equipment being decontaminated.

25. The military actually uses a Chemical Agent Resistant Coating (CARC) as paint for many types of equipment. However, after several months of use, the paint loses its resistant capability. Chemical agents are typically able to penetrate CARC within thirty to sixty minutes of deposition.

26. As already mentioned, biological agents show an extreme range in their ability to survive in the environment, with Anthrax spores remaining viable for years. In such extreme cases, weathering would not be an acceptable method of alleviating the hazard.

27. Mark T. Mueller, *Chemical and Biological Defense Program, Physical Science and Technology: "Rethinking" Decontamination* (Fort Belvoir, VA: Defense Threat Reduction Agency, 2007).

28. Rankings are presented as colors on a stoplight chart (green=good; red=bad). Both programs are predicted to be "green" by 2019.

29. Joint Requirements Office for Chemical, Biological, Radiological and Nuclear (CBRN) Defense—Force Structure, Resources, and Assessment Directorate, *2008 CBRN Defense Modernization Plan* (Washington, DC: Joint Requirements Office, 2008).

30. *Chemical and Biological Defense Program 2009 Annual Report to Congress.* (Washington, DC: Department of Defense, 2009).

31. Medical Identification and Treatment Systems, *Joint Concept of Operations for the Joint Biological Agent Identification and Diagnostic System* (Washington, DC: Joint Project Management Office, 2006).

32. Joint Program Executive Office for Chemical and Biological Defense home page, accessed 30 November 2010, http://www.jpeocbd.osd.mil.

33. Jess A. Scarbrough and Jean D. Reed, *2010 Portfolio: Department of Defense Chemical and Biological Defense Program* (Washington, DC: Department of Defense, 2010).

34. *Joint Biological Tactical Detection System (JBTDS) Advanced Planning Brief to Industry* (Washington, DC: Joint Program Executive Office, 2009).

35. "Joint Biological Tactical Detection Systems Inc 1," Joint Program Executive Office for Chemical and Biological Defense, accessed 31 January 2012, https://jacks.jpeocbd.army.mil/jacks/Public/FactSheetProvider.ashx?productId=362.

36. *Technologies to Combat Weapons of Mass Destruction: Hearing Before the Subcommittee on Emerging Threats and Capabilities of the Committee on Armed Services, United States Senate*, 110th Congress (2008).

37. Joint Program Executive Office (see ch. 3, n. 32).

38. As of Jan 2012, the status of this system was listed as "technology development," and the anticipated fielding date had slipped to 2020.

39. Joint Project Manager, Biological Defense, *Joint Biological Standoff Detection System (JBSDS) Advanced Planning Briefing to Industry* (Washington, DC: Joint Program Executive Office for Chemical and Biological Defense, 2009).

40. Department of Homeland Security, "FY 2009 Budget-in-Brief," http://www.dhs.gov/xlibrary/assets/budget_bib-fy2009.pdf.

41. Hindson et al., "APDS: The Autonomous Pathogen Detection System," *Biosensors & Bioelectronics* 20 (1925–31).

42. Emanuel et al., "Automated Screening for Biological Weapons in Homeland Defense," *Biosecurity and Bioterrorism* 3, no.1 (2005): 39–52.

43. *Technologies to Combat Weapons* (see ch. 3, n. 36).

44. Ivnitski et al., "Nucleic Acid Approaches for Detection and Identification of Biological Warfare and Infectious Disease Agents," *BioTechniques* 35, no. 4 (2003): 862–870.

45. Dana A. Shea and Sarah A. Lister, *The BioWatch Program: Detection of Bioterrorism* (Washington, DC: Congressional Research Service, 2003).

46. *Chemical and Biological Defense Program 2009 Annual Report to Congress.* (Washington, DC: Department of Defense, 2009); A complete listing is found in the Appendix.

47. *Chemical and Biological Defense Program 2008 Annual Report to Congress* (Washington, DC: Department of Defense, 2008).

48. United States General Accounting Office, *Chemical Weapons; DoD Does Not Have a Strategy to Address Low-Level Exposures* (Washington, DC: U.S. Government Printing Office, 1998).

CHAPTER 4

The World War Two Period (1939–1946)

> The solitary aircraft made three passes over the city, dropping a mixture of wheat and rice balls. … A week later, the first victim, an eleven-year-old girl, died of plague. By December, many Chang teh residents were dead of plague. Overall, as a conservative estimate, between 400 and 500 persons in Hunan Province perished from Ota's field tests.
>
> —Sheldon H. Harris, *Factories of Death*[1]

This period begins prior to serious U.S. interest in biological weapons and ends with the conclusion of World War II, by which time the United States had established a permanent offensive and defensive biological weapons program. In order to set the stage, and establish the case for a chemical frame, this chapter briefly reviews the use of chemical weapons in the First World War, and the creation of the Army service component dedicated to chemical warfare. The actual analysis of the biological program starts just prior to the United States becoming involved in the Second World War.

Historical Setting

While the United States had minimal interest in biological agents prior to World War II, it had a substantial interest in chemical weapons. As there was no formal biological program during the interwar period, it is not possible to conduct an analysis. However, the history of the CWS over this period shows some of the imperialistic and bureaucratic behaviors that will be formally investigated starting in 1939.

The First World War

World War I saw the first widespread use of chemical agents as weapons of war. Following the use of chlorine by the Germans at Ypres, all sides began to develop offensive and defensive chemical capabilities. By the end of the war, chemical warfare had taken on a considerable role in the conflict, and the United States had created a dedicated organization, the Chemical Warfare Service (CWS), to handle offensive and defensive chemical operations.

To investigate the chemical weapon/biological weapon relationship, it is important to understand how the CWS viewed itself, how it viewed chemical weapons, and how it behaved as an organization in the interwar period. An extensive history published by the Army details several important organizational decisions made during this time that influenced the culture of the CWS.[2]

In 1917, the original anti-gas mission was given to the Bureau of Mines because of their experience with mine gas accidents. Later that same year, the mission was transferred to the newly established Gas Service, which was part of the American Expeditionary Force. In 1918, the Gas Service was re-designated the Chemical Warfare Service.

The two original tasks given to the Gas Service were to obtain personnel and to procure a protective mask. As the Service grew, it took on two distinct missions during the war. Some members went to Europe and saw combat employing chemical weapons, while others remained in the United States and focused on offensive and defensive research. This dual mission created tension within the CWS that continued to fester as the organization defined itself and matured as a service.

After the end of the war, the CWS fought many of the organizational and bureaucratic challenges regarding chemical weapons that would be repeated with biological weapons after World War II. Originally slated to be disbanded six months after the end of hostilities, the CWS needed to convince military leadership and the U.S. government that it was still relevant and should be retained as a permanent organization.

This fight put the CWS in a retrenching posture. To survive, the organization highlighted the importance of the unique chemical missions that would be best performed if retained by the CWS. These missions included research and experimentation, maintaining chemical warfare specialists, and training of the army. While the CWS was fighting to remain an organization, it was also cementing its organizational identity.

In 1920, Congress made the CWS a permanent organization and added smoke and flame weapons to their mission. When fighting through military cuts in the 1920s, the CWS exhibited imperialistic behavior, emphasizing additional capabilities, such as exterminating boll weevils, while at the same time asserting itself over the Navy as the prime research organization for chemical issues. An Army historical review captures the bureaucratic fight waged by the CWS as it fought to remain relevant:

> Official publications about gas warfare formed another category. In the years immediately following WWI, the governmental agencies dealing with CW, being 'Johnny-come-latelies,' had to fight hard for continued support during the peacetime drives to cut back military establishments. These pressures led to public and intergovernmental publications in which sometimes extravagant claims for the munitions were made, apparently to publicize agencies or possibly influence appropriations.[3]

The CWS also faced challenges from within the Army. During this period, the service fought with the Ordnance Corps over missions such as design, fill, and delivery of chemical munitions, as well as the responsibility for incendiary munitions. The service also faced doctrinal challenges to its existence and mission, as the Army debated the merits of a centralized chemical organization, a doctrine based on chemical experts dispersed among combat units, and discussed the possibility of moving the CWS within the Corps of Engineers.[4]

The CWS often struggled with the Army to remain relevant, but when it was advantageous, the Army did embrace the ability of the CWS to address the chemical threat. In 1924, the War Department General Staff highlighted the chemical threat, arguing that "peacetime preparations in chemical warfare will be based on opposing effectively any enemy employing chemical weapons." Chemical weapons were also viewed as a source of power and retaliatory capability, much as nuclear weapons are today. The General Staff also stated that "in a broader sense, an implicit function of the CWS was to provide military support for a national policy that of dissuading others from resorting to the gas weapon."[5]

Similar arguments are reflected in the run-up to World War II, when the Chief of the Chemical Warfare Service made several statements regarding the weakness of U.S. chemical capabilities and the subsequent effect on national defense. In a memo to the Army Chief of Staff, he lamented the lack of resources and attention given to the CWS, saying, "we have no approved program embracing plans covering essential chemical items required by national defense to meet wartime needs."[6] Upon his retirement the following year, Brigham again cautioned that U.S. chemical capabilities were "seriously weak in this feature of national defense," whereupon he made several recommendations to improve manufacturing capabilities and to increase defensive equipment.[7]

Ultimately, the CWS became as much a research organization as a combat organization. However, this shift was not achieved without substantial internal debate, as captured in an article describing the history of the Chemical Corps insignia, which is composed of a benzene ring and a set of laboratory instruments known as retorts:

> But the crossed retorts and benzene ring were not popular with all who wore it. The scientific symbolism was lost to some of the CWS Soldiers serving overseas on the battlefields of Belgium and France, especially those whose primary role was to drop gas munitions on enemy positions. The Chief of the Overseas Gas Service Section, Lieutenant Colonel Amos Fries, voiced their dissent: "We in the field," he wrote, "emphasized the fighting value of chemical warfare...." However, in the United States, a large proportion of the officials in control were research and development, production, and chemical engineers. They looked upon the CWS as predominantly chemical and developed the insignia from that point of view.[8]

Also, a 1920 organizational plan defining the duties of the CWS stated that "now troops of the Chemical Warfare Service should be assigned within the Army as combat organizations, but that this service should carry on research and development. This is a supply service…" to which the Chief of the Chemical Warfare Service submitted "the most vigorous possible protest against this devitalizing of the Chemical Warfare Service."[9]

It is possible to observe the same type of parallel pattern with the CWS and chemical weapons that Eden observed with blast damage and thermal damage. Eden asserts that a critical component of her organizational frames model was the focus on understanding the effects of blast damage caused by aerial bombs during World War II, which subsequently influenced nuclear damage assessment. In a similar manner, the culture and biases that developed within the CWS over the interwar period would have a direct impact on how the United States viewed biological weapons.

For approximately twenty years, the chemical services focused on understanding the offensive and defensive aspects of chemical weapons. By the beginning of World War II, the CWS viewed itself as a research-focused organization. It had produced chemical respiratory protection, protective clothing, and detection capabilities. The military had incorporated chemical weapons into its doctrine and expected their use in the next conflict. Accordingly, chemical doctrine was well established, creating a frame of reference for non-kinetic, invisible, gas-like weapons. It was this organization and culture that was then handed responsibility for the new class of non-kinetic biological weapons as the United States entered World War II.

The Second World War

The period immediately prior to World War II saw a fundamental change in the way the U.S. government and military viewed biological weapons. The United States entered this period aware of, yet relatively unconcerned with biological weapons. However, by the end of the war it had embraced biological weapons, establishing a dedicated offensive and defensive weapons program. Over these few years, the country created civilian and military organizations responsible for the new biological weapons program, constructed dedicated biological weapons research laboratories, established production facilities, and acquired open-air test ranges. This period of time is important in that decisions, attitudes, and organizations in place at the beginning of the program could have long-term impacts on the subsequent behavior of the program.

Prior to World War II, the United States was greatly concerned with chemical weapons, yet while aware of the concept of biological warfare, showed no similar interest in biological weapons. While there had been discussion, and even international treaties, addressing biological agents in this time period, the United States had not created a government entity whose primary focus was biological warfare. The national sentiment is best captured in a seminal 1939 article by Army Major Fox (Medical Corps) regarding the use of bacteria as weapons of war. In this article, his conclusion was that "insurmountable technical difficulties prevent the use of biological agents as effective weapons of warfare."[10]

However, contrary to the position of the United States, other countries were serious about biological warfare. The Japanese had been conducting offensive biological weapons research as early as 1932, and the British had been concerned with biological warfare starting in the mid-1930s.[11] Although the United States did not have a dedicated weapons program at this point, it was aware of foreign programs, and the U.S. Army Surgeon General was becoming concerned with a potential biological threat.

This concern was manifested in July 1941 when the Surgeon General of the Army made a formal request of the National Research Council to evaluate the biological weapons threat. This request eventually resulted in Secretary of War Stimson requesting that the National Academy of Sciences (NAS) and the National Research Council form a committee, the War Bureau of Consultants (WBC), to examine the threat of biological weapons. The committee was formed in 1941, and issued a report in 1942 stating that "biological warfare is regarded as distinctly feasible. We are of the opinion that steps should be taken to formulate offensive and defensive measures."[12]

After this report was issued, a second civilian organization, the War Research Service (WRS), was formed to initiate and advance a U.S. biological weapons program, in coordination with the military services. As this organization and the biological weapons program matured, the WRS increasingly integrated its program with the CWS. The involvement of the CWS in the biological weapons program continued to increase until 1944, when the program was transferred entirely to the CWS.

By the end of the war, the United States had made considerable strides in biological weapons, considering its lack of interest only four years earlier; it had developed a one hundred pound anthrax bomb, and was in the process of constructing a full-scale production plant. The program had made such progress that in 1945 it was considered as an alternative attack method against Japan, should the nuclear program fail.[13]

Organizational Frames and Biodefense, 1939–1946

In the run-up to the Second World War, it would be expected that the CWS would have developed a chemical frame by default. It is important to remember the role of chemical weapons in military operations up to this point. In the period prior to World War II, nuclear weapons were nothing more than theoretical concepts in specialized laboratories. True biological weapons were yet to be developed, and the historical use of biological "weapons" consisted primarily of primitive attempts to induce disease in opposing armies.

Therefore, the main "unconventional" weapons of this period were chemical agents, which had been used extensively in World War I and were expected to be used in the next major war. To military leaders at the time, chemical weapons were just another weapon available for use. Military writings from the period objectively examine chemical usage and debate how best to employ chemical weapons in future battles. Thus the CWS fully expected chemical weapons to play an important role in any future conflict, and had paid little attention to the possible use of biological weapons.

As previously discussed, chemical weapons were regarded as a strategic, mass casualty weapon. Early air power advocates wrote of strategic bombing campaigns utilizing poison gases. This line of thinking made chemical weapons a threat to the civilian population as well. The civilian threat was taken as seriously at this point in history as nuclear weapons were at the height of the Cold War. For example, a 1941 two-week civilian defense course dedicated an entire week to chemical defense, with all other subjects (explosives, protection, air raids, incendiaries etc.) combined in the second week.[14]

As the nation and the CWS became interested in biological weapons, it would be reasonable to expect that the existing chemical culture would influence how these new weapons were viewed. For some, biological agents simply represented an extension of chemical weapons technology. Both weapons could be used to fulfill the same mission requirements—mass casualties, denial of terrain, and degradation of performance.[15]

Confusion over Characterization

Faced with this new type of weapon, there was some confusion over how to classify it. In 1941, the Adjutant General of the Army recommended that the CWS conduct studies on the "chemical phases" of bacterial toxins.[16] Early work of the WBC committee also indicates some confusion over what would be considered a biological weapon, citing concerns over how to classify plant growth inhibitors and bacterial and plant toxins. They noted that some agents may be neglected if not placed in a particular category, and concluded that "it is probable that there may be overlapping with certain chemical warfare agents."[17]

There is also evidence that chemical and biological agents were being thought of as a single strategic weapons category. A directive from the Secretary of War in 1944 stated that "in view of the similarity of application of BW with chemical warfare, responsibility for carrying out BW should be vested in the Chief of the Chemical Warfare Service, in coordination with the Surgeon General for the defensive aspects, all under the direction of the Commanding General of the Army's Service Forces."[18] In a 1945 DEF committee meeting, Dr. Mueller questioned the ability of the United States to respond in kind to a biological attack, and offered that a chemical retaliation might be more effective.[19] An undated memo (from 1944 or later) to the Secretary of War from Assistant Secretary Harvey Bundy reflected a similar thought process, requesting that the President approve "immediate use by the Theater Commanders of gas and B.W. when ready in retaliation for B.W. or C.W use by the enemy."[20]

Actions within the CWS may also indicate a tendency to subjugate biological weapon programs to existing chemical weapon programs. A 1944 historical CWS report discussed responsibilities for biological weapons, research, and production, but stated "general administration of the Special Projects Division over each of the camps rests with individuals who are not specially trained in this field."[21]

While there are some instances of including biological weapons in the chemical weapon category, there is also evidence that the unique nature of biological weapons was recognized, and they were not arbitrarily placed with chemical weapons, as the frame theory would predict. For example, the Secretary of War stated to the President that the matter of biological warfare "deals primarily with the Public Health and to some extent with matters ordinarily in charge of the Department of Agriculture."[22] Dr. Fred (Chairman of the WRS committee), who served in the CWS, did not recommend the CWS have responsibility for biological weapons, but rather suggested the formation of an independent Army organization reporting directly to the Chief of Staff.[23] Finally, after the CWS did receive full responsibility for the program, Secretary Stimson established a separate Biological Weapons Committee in October 1944 to oversee and coordinate the U.S. biological program.[24]

There were also instances when the difference in weapons required specialized information. In an ABC committee meeting discussing intelligence on enemy biological weapons, it was recognized that intelligence officers had no knowledge of biological weapons, and a recommendation was made that the Surgeon General place suitable officers to work with medical intelligence. Also of note is the recommendation that the intelligence collected was to flow from G-2 to Medical Intelligence, and finally to the WRS and CWS.[25] However, by 1944 this intelligence function was moved from the WRS to the CWS.[26]

Combined Weapons Design

Early dissemination studies reflect perhaps the greatest evidence of a chemical frame. Like many other nations, the United States attempted to use chemical dispersal methods for biological agents. A CWS report noted that the "CWS had developed bombs which would disperse liquids such as mustard, and these bombs offered possible application to BW suspensions."[27] The first bombs tested as biological weapons were chemical bombs utilizing explosive dissemination. The use of these bomb designs presented scientists with competing interests, in that greater coverage could be achieved with a greater explosion, but a greater explosion was harmful to bacterial agents.[28]

Miller's analysis of the early biological program also identifies a chemical bias in early biological testing. The report noted that tests focused on the amount of liquid disseminated, without attempting to determine if infectious particles were generated.[29] She also noted the reliance on explosive dissemination and damage to living organisms. Finally, she observed that almost all the weapons tested for biological use were originally developed and optimized for the dispersal of chemical agents.[30]

Conclusion—Frames

The most compelling evidence for the existence of a chemical frame in this time period is the combining of the chemical and biological threats. This combined approach is evident in the development of biological weapons, and in some written documents from military leadership. However, this view does not dominate the biological program, as will be evidenced in the postwar period.

While there is some evidence that the frame was influencing decision-making, there is also evidence that biological weapons were treated as a separate threat, and not automatically viewed as equivalent to chemical weapons. While it is true that the CWS did emerge from this time period responsible for the biological weapons program, there are stronger bureaucratic and external threat explanations as to how the program was created. Therefore, it does not seem that chemical frame behavior exerted significant influence during this time period.

Imperialism and Biodefense, 1939–1946

Overall, there is little evidence that imperialism played a significant role in the development of doctrine during this time. High-ranking government officials directed many of the organizational actions taken over this period. The direct involvement of national leadership in the development of the program inoculated it from competition among lower level organizations that would have been more likely to exhibit imperialistic behaviors.

Contrary to imperialistic behaviors, the War Department voluntarily sacrificed autonomy by requesting help from civilian researchers after deciding to begin investigating biological agents. Ultimately, the decision to give the biological mission to the Chemical Corps was made by President Roosevelt, avoiding potential organizational fights. At the same time, the nation was involved in World War II, which provided much more lucrative targets for turf battles (e.g. responsibilities for theaters of operation) than the relatively insignificant resources associated with biological weapons.

While there does not seem to be an overwhelming body of evidence indicating that a chemical frame exerted significant influence, there is evidence that some bureaucratic behaviors influenced the biological weapons program. However, it must be noted that while some of the evidence shows bureaucratic characteristics, it does not necessarily reflect the imperialistic behaviors that would be associated with the "empire building" nature of Allison's Model II.

The Civilian Bureaucracy

Of importance in this time period is that the major effort to research biological weapons was initiated within a series of civilian committees composed of prominent scientists. Correspondence from the committee members indicates that in some ways the eventual decision to assign the role of biological weapons to the Chemical Corps was somewhat arbitrary, and made by committee chairmen and military officers "above the pay grade" of the CWS.

Reports and meeting notes from the various committees involved in the biological weapons program reveal an initial civilian program with military liaisons. Military involvement slowly increased until 1943, when the military was given prime responsibility for the program. The early composition of the program is captured in a letter from Frank Jewett, president of the National Academy of Sciences, who acknowledged the wide range of potential players in the biological issue, but recommended that "the work of all these agencies will have to be coordinated in a single new agency. This might be a small commission of very distinguished men. I have underlined 'very' because it seems to me that to have coordination in the hands of any but the best is to court disaster."[31]

Civilian members of the NAS conducted the initial meetings concerning biological warfare, with military liaisons present. It was a meeting of the NAS on August 20, 1941 that set the initial conditions for the U.S. biological weapons program, which included the creation of civilian organizations with primary responsibilities for research, and the splitting of responsibility for offense and defense between the CWS and the Army Surgeon General (SG). Also resulting from these decisions was the relegation of the Navy to a status of being "informed of these plans and their collaboration invited."[32]

The subject of greater military involvement was present early in the biological program. In a 1942 letter to Vannevar Bush, director of the Office of Science Research and Development (who reported directly to the President), E.B. Fred of the WRS discussed his thoughts on the role of the military in relation to biological weapons. He identified the Army as the most likely service for prime responsibility, but felt that it should be limited to an advisory role in research. He also recommended the Army set up a distinct organization responsible for biological weapons, reporting directly to the Chief of Staff, and not under the CWS.[33] He also identified a potential biological threat to the civilian population, and recognized the Public Health Service as having an important role in civilian defense.[34]

After the decision was made to initiate the biological weapons program, the initial physical research was conducted by the WRS, a civilian organization under George Merck. As the WRS began to conduct research, it realized some issues were beyond its capabilities and began to request assistance from the CWS. The WRS actually went to the Chief of Staff of the Army Forces with a request for assistance from the CWS. As a result of this request, the CWS was given a verbal directive by the Chief of Staff in November 1942 to "maintain close liaisons with the WRS and to carry forward studies or other activities relating to biological warfare which might be recommended by the director of WRS."[35] Army Service Forces Headquarters then issued a formal directive on November 10, 1942, specifically directing that the military portion of the biological mission be placed within the Special Assignments Branch of the CWS.[36]

The WRS continued to turn to the CWS for assistance. In 1942, the WRS requested CWS support for "supplemental research and development" in the areas of dissemination of stimulants, dispersal of agents destructive to animals, and design of an anthrax bomb."[37] Subsequent requests for assistance with an anthrax bomb were made in 1943, specifically asking for help with large-scale production, developing a military application, and developing protective measures against anthrax.[38] In a 1944 memo, the WRS requested CWS assistance from Fort Detrick with Glanders and Melioidosis, citing the lack of adequate personnel within the WRS.[39]

At the same time that the CWS was becoming more involved in the biological program, there is some evidence there may have been empire building on the civilian side. In a letter to the NAS, Merck expressed concern over the increasing participation of the military in the biological weapons program, and the resulting change in the civilian/military balance. More significantly, he identified a "considerable" increase in future research associated with biological warfare, and stated his feeling that civilian scientists should investigate the new problems.[40]

Merck's recommendations do not appear to have been followed. As the WRS continued its research (with assistance from the CWS) it recognized that the issues associated with biological weapons were outgrowing its capabilities, and recommended to the War Department that responsibility for the program be transferred. The War Department concurred, writing a memo to the President:

> When the War Research Service was first established, the primary considerations were research and secrecy so far as military participation was concerned. Therefore, this activity was placed in a civilian agency for more perfect cover. The immediate urgency now is one of military development, planning and preparation. This leads up to the conclusion that the responsibilities for biological warfare should now be unified and centralized within the military establishment.[41]

President Roosevelt responded by endorsing Stimson's recommendations and transferring the biological mission to the War Department on June 8, 1944.[42]

Imperialism by the Military

While the civilian researchers recruited into the WRS were enthusiastic about their jobs, there is evidence that the military services were opposed to the biological mission. Such behavior is contrary to the empire-building strategy predicted by a bureaucratic politics model.

A 1941 report prepared by the CWS regarding biological warfare stated that "the Chemical Warfare Service and the Medical Corps, working jointly, are the proper organizations in the Army for carrying out this work, although it must be admitted that no one in our Army likes the idea of being connected with this problem."[43] This reluctance in the military went as high as the Secretary of War, who wrote to the President expressing his opinion that "some of the scientists consulted believe that this is a matter for the War Department but the General Staff is of the opinion that a civilian agency is preferable, provided proper Army and Navy representatives are associated with it."[44]

Additional correspondence indicates that the Army Surgeon General was not motivated by empire building in acquiring the biological mission. Just after requesting help with BW research, the Surgeon General's office stated, in a memo dated August 16, 1941, that it did not want to be involved in offensive research, but would work to protect lives and develop capabilities to prevent disease.[45]

The Surgeon General also turned down an empire building opportunity related to a perceived biological threat against Hawaii. A 1942 Surgeon General memo regarding a possible biological attack on Hawaii acknowledged the potential threat and recommended an officer be appointed to be responsible for biological weapons defense. However, the Surgeon General did not take the opportunity to expand his organization's influence, instead recommending his officer be placed under the Department Chemical Warfare Officer [46]

Personnel assignments by the services also do not indicate an empire building strategy. An organization interested in expanding might attempt to influence the trajectory of a program by filling all positions with the best personnel available. Committee meeting minutes capture civilian leaders complaining of receiving officers without scientific abilities.[47] There were also complaints by the CWS and WRS that the Surgeon General was not providing adequate personnel for biological-related projects.[48]

Was there any evidence that military organizations did want the biological mission? One measure of how much importance an organization places upon an issue is attendance at meetings, and also the rank of those attending. The table below shows attendance at biological weapons related meetings from 1941 to 1945.

Military Attendance at WBC, ABC, and DEF Committee Meetings*

Meeting Date	USA SG	USA CWS	USN SG	War Dept	Public Health	Agriculture
21 Oct 41 (WBC)		**3** (6/5/2)	**1** (6)			
18 Nov 41 (WBC)	**1** (6)	**3** (5/5/2)	**1** (6)	**1** (5)		
28 Dec 41 (WBC)	**2** (6 /6)	**3** (5/5/3)	**1** (6)	**1** (5)		**1**
16 Oct 42 (ABC)	**1** (6)	**2** (7/6)	**1** (6)		**1**	**1**
1–2 Jun 43 (WBC)	**4** (7/6/4/3)	**6** (6/5/4/4/3/3)	**2** (6/5)	**1** (5)	**1**	**2**
18 Nov 43 (ABC)	**2** (7/7)	**1** (6)	**1** (6)		**1**	**1**
7 June 44 (ABC)	**3** (7/6/5)	**1** (Dr)	**1** (6)			**1**
12 Oct 44 (DEF)	**4** (7/6/5/Dr)	**2** (Dr/5)	**1** (6)			
12 Oct 44 (DEF)	**4** (7/6/5/Dr)	**2** (Dr/5)	**1** (6)			
12 Oct 44 (DEF)	**3** (7/6/Dr)	**1** (7)				

* The first number in each column is the total number representing each organization. The numbers in parentheses indicate the ranks of those attending in military designation: 7 = Brigadier General; 6 = Colonel; 5 = Lt. Colonel; 4 = Major, 3 = Captain; 2 = 1st Lieutenant; Dr = high-ranking civilian member w/PhD such as deputy director/chief scientist.

Given attendance rosters from meetings in this time period, it appears as though the Surgeon General actually had greater interest in the biological weapons problem than did the CWS. The table shows a gradual escalation of attendance in both number and rank, possibly indicating that the Medical Corps and CWS were concerned with their ability to influence the meeting, as the Medical Corps shows a slightly higher representation in rank. However, as already discussed, the Surgeon General's stated position was to not be involved in offensive biological warfare. Meeting attendance would also indicate that the Navy was at best there to monitor developments, and possibly only out of obligation, as their number and rank representation did not change over three years of meetings.

While the overall impression is that the military did not view biological weapons as a prime area for colonization, there is at least one example of imperialistic behavior. In 1941, the chief of the CWS technical services raised the possibility of disseminating bacteria by airplane. He also suggested that the CWS and the Medical Corps should be charged with the biological mission (joint, or with the CWS on offense and the Medical Corps on defense). Interestingly, he also recommended a separate medical division be established within his technical services branch.[49]

Conclusions—Imperialism

From the available evidence, it is possible to observe many bureaucratic actions and concerns, but not necessarily the imperialist behavior associated with bureaucratic politics. Looking at the history surrounding the development of biological weapons, the program was created under the control of civilian organizations, with Army and Navy advisors present. Over time this pattern shifted, and the military began to exert more influence over the program.

However, there is little evidence that this increase in military influence was accomplished through overt imperialistic behavior. The Army Surgeon General took an early position that his office would not be involved in the offensive aspects of biological warfare, leaving the CWS as the primary military organization assisting the biological weapons program. While the Navy did contribute personnel to Fort Detrick, there is little evidence that it was interested in leading any aspect of the program.

President Roosevelt handed prime responsibility for the program to the CWS when it outgrew the capacities of the WRS.

While some of the activities cited above are most certainly bureaucratic in nature, and show a complex interaction between military services and civilian organizations, they do not evidence the empire building behaviors predicted by the bureaucratic politics model. Contrary to that theory's predictions, the military repeatedly stated they were not interested in the biological mission.

In many ways, the weak evidence for empire building is not unexpected given that this program was developed during wartime. All branches of the military had plenty of other higher-priority missions, and the relatively small amount of additional resources to be gained by acquiring the biological weapons mission was not compelling. Therefore, many of the incentives associated with empire building (e.g., prestige, manpower, financial resources) would have been insignificant relative to other bureaucratic battles of the time period, such as the Army/Navy struggle to be the prime service in the Pacific.

Realism and Biodefense, 1939–1946

While the evidence in support of organizational frames or imperialism does not appear conclusive, data from the World War II time period strongly supports the realist argument that the external threat had a substantial impact on the development of the U.S. biological weapons policies and programs. As already discussed, in the interwar period there was a low-level awareness of bacteria and their potential impact on the battlefield, but there is little evidence that the government or the military had given biological weapons a high priority. However, facing the specter of a world war, combined with the belief that the Japanese had a significant biological program, the nation quickly took steps to respond to the emerging threat.

The Evolving Threat

The previously referenced paper by Fox is cited by many authors as capturing the prevailing attitude of the U.S. government just prior to entering World War II. Fox acknowledged the impact disease could have on a battlefield, but dismissed the ability of an enemy to produce or employ a bacteriological weapon with any efficiency.[50]

While this attitude was prevalent, it was not the only viewpoint. At the same time, other authors, as well as government and military officials, were becoming more concerned with biological weapons. In 1939, the CWS determined that it was possible to disseminate bacteria by aircraft, but cautioned that the lack of control over the weapons diminished their military value.[51] A 1941 memo to the Secretary of War serves as a literature review of sources expressing concern over biological warfare. In addition to the 1939 CWS study, the memo included a 1940 opinion from the Chief of the CWS warning not to dismiss the biological threat without further consideration, a 1940 letter from the Surgeon General of the opinion that the chief biological danger was "nuisance actions," a 1941 memo from G-2 (intelligence) citing reports of Japanese biological use and training, and a 1941 letter from the Adjutant General reporting possible German development of Botulinum toxin for deployment by airplane.[52]

These concerns were set against the backdrop of German and Japanese aggression, and fears of imminent U.S. involvement in those wars. Of particular concern to the United States were reports of biological weapons use by the Japanese in China, and incidents of Japanese scientists attempting to obtain pathogens from U.S. laboratories. On July 15, 1941, the Surgeon General of the War Department sent a memo to the National Research Council requesting "a committee of civilian experts be formed for the purpose of advising the Surgeon General on the problem of biological warfare."[53]

In response to this memo, and other concerns, Secretary of War Stimson established the War Bureau of Consultants (WBC), a civilian committee to investigate the threat of biological weapons. The committee was formed on October 1, 1941, with its enabling language specifically referencing external threat, stating that "because of the dangers that might confront this country from potential enemies employing what may be broadly described as biological warfare, it seems advisable that investigations be initiated to survey the present situation and future possibilities."[54]

The committee was formed with the general objective "to be prepared for biological warfare from the enemy and for retaliatory measures if necessary."[55] The committee's report in 1942 stated that "biological warfare is regarded as distinctly feasible. We are of the opinion that steps should be taken to formulate offensive and defensive measures."[56]

As previously discussed, the actions of the civilian committees created as a result of this finding do not seem to exhibit behaviors associated with a chemical frame, or with imperialism. However, when the actions of these committees are viewed in light of the external threat, it is possible to find a preponderance of behaviors predicted by realism.

External threat influenced the direction of the program for the entire World War II period, as officials cited both fear of attack, and a need to retaliate. Having suffered the surprise attack by the Japanese, the United States was particularly sensitive to further attacks against Hawaii and the homeland. In 1942, the surgeon general assessed concerns of a biological attack against Hawaii as "real and not theoretical," and recommended the Commanding General of the Hawaiian Department appoint a counter-BW officer.[57] In 1943, the Office of the Provost Martial cited "reliably reported" German and Japanese biological threats to the homeland when issuing policy letters for protection of public water supplies, blood plasma, drugs, and biological products.[58]

Additional correspondence to the Secretary of War cited 1943 intelligence reports indicating possible German use of anthrax in their cross-channel weapons. The same memo ended with a request that the President authorize use of biological weapons (when ready) in retaliation to enemy chemical or biological attacks.[59] The added focus on German biological threats in the 1943 time period is also significant, as the United States was preparing for the D-Day invasion to take place the following year.[60] Clearly the United States felt it was facing the real danger of a biological attack, and this fear was the overriding factor driving the development of the biological program.

Protection

While later chapters will explore the influence of a chemical frame on biological defensive and detection equipment, defensive work in this period appears dominated by the external threat, and cognizant of the differences between chemical agents and biological agents. For example, new protective masks were developed, as it was discovered a biological mask needed to be one million times more efficient that the standard chemical mask.[61] Likewise, while recognizing intact skin provided effective biological protection, clothing was tested for filtration and bactericidal properties, in contrast to later protective equipment, which focused on barrier protection.[62]

It could be argued that use of chemical clothing for protection represents a chemical frame; however, for this time period these steps fall under realism, and not a frames model. Based on demonstrated protective capabilities, facing a perceived imminent threat, and lacking any other available solutions, the decision was made to use chemical protective equipment as biological equipment as well. The key behaviors in this case are the steps taken to research the bactericidal and filtration properties of existing chemical gear. The decision was based on physical properties of the equipment that countered the new biological threat (as predicted by realism), and not simply a decision that "similar weapons = similar protective equipment" (which would indicate an organizational frame). A more detailed examination of protective equipment from the 1940s to present is included in Chapter Seven.

Medical Countermeasures

This area is particularly important in that the chemical frame predicts that medical countermeasures will not receive a high priority, nor be regarded as an effective form of defense. Hoyt relates that World War II produced many medical advances and saw significant vaccine production. External threat appears to have been the driving factor behind the program at this time. Part of this emphasis was due to the biological weapons threat, and part was due to the relatively new capabilities of vaccination to prevent common disease among tightly quartered military recruits.

There is also a bureaucratic component to the success of the program, as there were sixteen federal institutions involved in vaccine research, in addition to all of the major pharmaceutical companies. Hoyt specifically cites the flow of information between military and industry as a key factor in the development and testing of new vaccines. She also proposes that this close relationship is the reason the United States was able to develop so many vaccines in the 1950s.[63]

Conclusions—External Threat

When looking at the behavior of the U.S. biological program over this period, it is easy to construct a logical pathway where external threat leads directly to a state response, as predicted by realism. In this historical period of total world war, the United States was fighting for its existence and could not ignore what it thought was a real threat to its military power. The only possible response was to verify and understand the threat, and then develop its own capability.

Evidence that the external threat was significantly impacting U.S. action is found in the repeated references to German and Japanese advances in biological warfare found in decisions ranging from theater combat operations to homeland defense. The Japanese threat was also specifically cited in many of the early decisions that led to the creation of the civilian committees and military organizations established to assess and then produce biological weapons. These types of actions are expected and easily explained by realism.

Conclusions—The World War II Period

As the United States was involved in a world war, it is of little surprise that the external threat exhibited a powerful influence over the biological program at this time. The United States had suffered a surprise attack at Pearl Harbor, the Japanese had beaten the United States back to Midway, and the Germans were preparing to invade the United Kingdom. In this type of war, any significant advance in weaponry could result in a substantial power shift that would influence the outcome of the war. Such concerns are repeatedly observed in the original justification for the program, and in subsequent decisions to expand the program. As predicted from a rational actor standpoint, the nation responded in the only manner it could—after studying the weapons and finding they might be effective, it subsequently developed both a defensive and an offensive program in order to preserve power relative to the Axis forces.

While external threat played a dominant role in the program, there is little evidence of the empire building behavior predicted by the bureaucratic politics model. While there were definitely bureaucratic actions that created organizations and moved missions, they do not support this particular theory. None of the military services made any attempt to grab power or resources by trying to take ownership of the biological problem. On the contrary, there are several examples of military organizations specifically stating their desire not to be involved with biological weapons, clearly contrary to an empire building strategy.

Also of significance, the United States did not simply hand the biological problem to the CWS based on perceived similarities in weapons, as would be predicted by organizational frames theory. While the CWS was involved in the biological problem from the start, and ultimately ended up with the mission, the main players in the initial biological program were a series of civilian experts judged best able to assess and respond to this new and unique threat. Here, the country was recognizing a new threat and responding by allocating resources as realism would predict.

Therefore, for this particular time period, of the three theories being considered, the observed behaviors are most consistent with those predicted by realism. At the end of World War II, the nature of the external threats facing the United States were set to change drastically in the years that followed. Realism would predict a corresponding change in the U.S. biological program. It would also be possible for the new bureaucratic environment to result in a different influence dominating U.S. posture in the following years.

Notes

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3. Operations Research Office, Tactics Division, "Attitudes and Policies on Chemical Warfare," March 1959, accessed 1 July 2011 from Federation of American

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12. T. Turner, “The WBC Committee: An Account of its Initiation and Early Activities,” 15 May 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

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15. Kirby, “The Evolving Role” (see ch. 4, n. 13).

16. Jacobs to Harvey Bundy, memorandum, 14 August 1941, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

17. “The Fifth Meeting of the WBC Committee,” 1942, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

18. “Historical Report of War Research Service,” 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

19. DEF Committee, meeting minutes, 13 June 1945, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC. In addition to the WRS, two advisory committees were formed: the ABC committee (1943–1944) and the DEF committee (1944–1948). The acronyms for these committees were arbitrary, due to the secret nature of their work.

20. Harvey Bundy to the Secretary, memorandum, n.d., Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

21. I. L. Baldwin, “Responsibilities, Activities and Plans of the Chemical Warfare Service in the Biological Warfare Program,” 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

22. “Historical Report” (see ch. 4, n. 18).

23. E. B. Fred to Dr. Vannevar Bush, 2 February 1942, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington DC.

24. *U.S. Army Activity in the U.S. Biological Warfare Programs* (Washington, DC: Department of the Army, 1977).

25. ABC Committee, meeting, 19 November 1943, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC. G-2 is Army shorthand for the intelligence section.

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28. John Moon, "U.S. Biological Warfare Planning and Preparedness: The Dilemmas of Policy," in *Biological and Toxin Weapons: Research and Use from the Middle Ages to 1945*, eds. Erhard Geissler and John Moon (Oxford: Oxford University Press, 1999), 215–246.

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30. Dorothy L. Miller, *History of Air Force Participation in Biological Warfare Program 1944–1951* (Wright-Patterson AFB: Air Materiel Command, 1952).

31. Frank Jewett to Henry Stimson, 27 February 1942, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

32. "Historical Report" (see ch. 4, n. 18).

33. Of interest here is that Fred served in the CWS during World War I, but does not seem to have internalized a chemical frame.

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38. George Merck to Chemical Warfare Service, 31 March 1943, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

39. George Merck to Chief, Chemical Warfare Service, 10 April 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

40. George Merck to Dr. Frank Jewett, 21 April 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

41. Henry Stimson to the President, 12 May 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

42. Franklin Roosevelt to Henry Stimson, 8 June 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

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48. Conference on Personnel Matters, meeting minutes, 21 August 1943, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

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50. Fox, "The Use of Biological Agents" (see ch. 4, n. 10).

51. Barker, "Progress Report" (see ch. 4, n 43).

52. Jacobs to Harvey Bundy, memorandum, 14 August 1941, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

53. Office of the Surgeon General, “Biological Warfare,” 15 July 1941, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

54. Henry Stimson to Dr. Frank Jewett, 1 October 1941, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

55. WBC Committee, “Fifth Meeting” (see ch. 4, n. 17).

56. Turner, “The WBC Committee” (see ch. 4, n. 12).

57. McAfee, memorandum (see ch. 4, n. 46).

58. War Department, memorandum, “Facilities Processing Dried Human Blood Plasma, Biological Products, Drugs and Sterile Sources,” 23 July 1943, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC; War Department, memorandum, “Continuing Protection of Water Supply,” 12 June 1943, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

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60. John Moon, “U.S. Biological Warfare” (see ch. 4, n. 28).

61. Ibid.

62. G. Gantz, memorandum, “A discussion of Protective Clothing of Use Against BW Agents,” 31 July 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

63. Kendall Hoyt, *Long Shot: Vaccines for National Defense* (Cambridge, MA: Harvard University Press, 2012).

CHAPTER 5

The Rise and End of the U.S. Offensive Program (1946–1970)

> In view of the worsening world conditions, the biological weapon may soon be destined to assume a place in military strategy.
>
> —Dorothy L. Miller, *History of Air Force Participation in Biological Warfare Program 1944–1951*[1]

> The United States will similarly renounce the use of all other methods of bacteriological/biological warfare. The United States bacteriological/biological programs will be confined to research and development for defense.
>
> —President Richard M. Nixon, *NSDM 35, 1969*

Historical Setting

The period immediately following the Second World War through 1970 saw highs and lows for the United States' biological weapons program. The previous section found that for the World War II period, external threat was the primary influence driving U.S. biological posture. However, as hostilities ended and the external threat changed, it is possible that other factors exerted greater influence over the post-war program.

Unfortunately, the United States did not enjoy a completely peaceful postwar environment. The nation was soon faced with a new enemy: the Soviet Union. The emergence of the communist threat and the game-changing introduction of nuclear weapons made for an entirely new strategic environment. In the early years of the Cold War, the United States found itself with a small number of nuclear weapons and feared it would be the underdog in a potential war with the Soviet Union. For at least the first few years after the war, biological weapons were viewed as potential equalizers in the nuclear weapons gap.[2]

As the United States acquired more nuclear weapons, biological weapons lost some of their prestige and alternative missions were explored. Advocates for biological weapons proposed a concept of "large area coverage," where the military would seek to maximize the amount of terrain denied to the enemy, relative to the size of the munitions. For this mission, biological weapons were particularly suited in that they do not cause widespread damage to infrastructure, something of concern to military planners experienced with reconstructing German and Japanese infrastructure after the war.[3] Incapacitation was a second mission area that emerged, with the idea that a more "humane" battle could be fought and objectives obtained with minimal casualties.

Both of these new missions had financial impacts on the biological program. Responding to negative assessments of its biological weapons capabilities, the DoD countered that greater capabilities could be obtained with better agents that, incidentally, could be developed with a significant increase in funds. Likewise, the need for incapacitating agents, in conjunction with changes in U.S. doctrine, was cited many times as reason for needing new funding.[4]

The Korean War did not have a drastic impact on the biological program, although the United States was accused of using biological weapons in the conflict. The Chemical Corps did see action in the war, primarily in smoke and flame support roles. The Army noted that the war accelerated established biological programs, and was the source of additional funding for the program.

The early 1960s saw the implementation of project 112, so named because it was the 112th program in an encompassing review of national defense implemented by Secretary McNamara. In conjunction with changing U.S. policies on the use of biological weapons, this project contributed to a large increase in funding for research and development for both chemical and biological weapons, as well as increased testing. By the end of the 1960s, the United States had conducted a series of live agent tests in the Pacific Ocean. At the conclusion of these tests, biological weapons were considered an operational reality, as aerial tests with live agent demonstrated the ability to cause casualties over a one hundred square mile area.

Just as biological weapons were gaining prestige and funding, President Nixon issued orders to abandon any use of biological weapons, as well as any offensive research, while retaining a defensive program. The details of this decision are discussed in greater depth below, but ironically it was a series of chemical weapons incidents that played an important role in the U.S. decision to abandon the biological program.

In 1968, several hundred sheep died near Dugway Proving Ground in Utah following a series of open-air chemical weapons tests. While the actual cause of death has never been absolutely proven, reports of the sheep kill, combined with revelations that the United States was dumping old chemical weapons in the ocean, caused enough public outcry that an official review of the U.S. chemical/biological program was initiated.

While the review was underway, there was an accidental leak of chemical agent in Okinawa that poisoned several service members. Even more significant was the fact that the presence of chemical weapons on Okinawa was kept secret from both the U.S. and Japanese governments. At the same time, it was revealed that the United States had stockpiled chemical weapons in Germany, while being less than forthright with the German government about the presence of the weapons.

Ultimately, after an extensive interagency review and bureaucratic bargaining process, the DoD faced losing both its chemical and biological weapons programs. At this point the DoD was involved in the Vietnam War, relying heavily on riot control agents and herbicides, which were also being considered as part of the chemical weapons cuts. While the DoD argued to keep everything, it only managed to keep its riot control, herbicides, and retaliatory chemical capabilities, while losing the biological program and the offensive chemical program. This decision was made official U.S. policy by President Nixon in November 1969.

Just as the strategic view of chemical weapons changed over this period, the organizations responsible for the biological program saw a series of substantial changes. In 1944, the CWS (re-designated the Chemical Corps in 1946) was given primary responsibility for the biological program, but still operated under the Research and Development Board. This arrangement continued until 1950, when the Chemical Corps assumed prime responsibly for executing committee recommendations, and was forced to take a more active role in the biological program after attempts to use contractors failed.[5]

An important organizational change took place in response to a 1951 DoD instruction to increase Chemical, Biological, and Radiological (CBR) readiness: the Army identified a need to separate the chemical and biological elements of the program. In 1953, the Army created an Assistant Chief Chemical Officer for BW, which was subsequently abolished in 1954. In 1962, the Army instituted a major reorganization that abolished the chiefs of the technical services. As a result, Chemical Corps technical operations were assigned to Munitions Command under Army Materiel Command, staff functions were assigned to the Deputy Chief of Staff for Operations, and biological testing was assigned to Test and Evaluation Command.

This period also saw several changes in U.S. policy regarding the use of biological weapons.[6] President Roosevelt established the first U.S. policy on the use of biological weapons during World War II when he stated the United States would not be the first to use chemical or biological weapons, but reserved the right to respond in kind if attacked. By the 1950s, the DoD began to lobby for greater leeway in the use of biological and chemical weapons. In 1953, the Secretary of Defense stated each service should be prepared to employ CBR weapons if directed to do so, and in 1956, President Eisenhower changed U.S. policy to make first use an option if authorized by the President.

This policy was never announced publicly, but was continued by the Kennedy administration. In 1966, the Joint Chiefs of Staff proposed an even more offensive-oriented program based on incapacitating agents. While the President never approved this policy, the DoD had begun to assume it would be the new policy, until President Nixon made his announcement regarding chemical weapons and biological weapons.

From this brief historical overview, it is possible to predict that any of the factors of interest could find fertile ground in which to exert influence. The rise of the Soviet Union and the Cold War established a serious external threat to the nation. The bureaucratic battles over usage strategy, new mission areas, and potential cuts all provided conditions conducive to imperialism. While some of these behaviors were observed, almost all of these changes in strategy and debates over national policy were conducted in reference to the U.S. "chemical/biological" program, perhaps indicating that the combined weapons view predicted by the frames model was playing a significant role in the status of the U.S. biological posture over this time period.

Organizational Frames and Biodefense, 1946–1970

While external threat appears to have dominated the World War II period, there are some indications that a chemical frame was also present. The various committees and councils responsible for the chemical, biological, and radiological programs during this time exhibited an abundance of behaviors predicted by the organizational frames model. There are numerous examples of chemical weapons receiving higher priority than biological weapons, and of extensive combining of chemical and biological weapons in statements and doctrine. Also, given the differences between biological and chemical weapons, the development and procurement of hardware for the two weapons types during this period is more similar than would be expected.

Frames in Oversight

This time period captures the maturation of the biological program under the military's influence, as the biological mission was given to the Army towards the end of the Second World War. While the Chemical Corps was responsible for executing the biological mission, several committees had oversight over the program. Data from these sources reveals many behaviors associated with a chemical frame. Evidence of a frame in oversight committees would serve to reinforce the frame within the executing organizations.

The Chemical Corps Board was an early high-level advisory board. It existed as "a reviewing and policy-making staff organization, operating directly under the Chief of the Chemical Corps," but it had no operational responsibilities.[7] Given its position relative to the leadership of the Corps, recommendations from the board would carry heavy weight in program development.

The board's organizational chart and mission statements reveal that a chemical bias was already in place at this early stage of the program. The mission statements of each of the board's divisions reveals references to chemical weapons, yet none to biological weapons. For example, the Protection Division was responsible for all protective items, yet its mission statement, while specifically referencing chemical agents, includes no mention of biological agents. Only the Agents Division, which was responsible for the testing of all foreign agents, does mention biological weapons. The composition of the Chemical Corps Board also demonstrated a chemical bias, as the educational distribution of experts on the board consisted of two mechanical engineers, four chemical engineers, one chemical warfare agent technologist, one biochemist, and one physical chemist.[8]

Another early indicator of a chemical frame is observed in the relative number of chemical programs and biological programs. The early periods are of particular interest, as frames theory predicts the early actions of the organization will set the frame for later action. From the data below, it appears that based upon numbers, chemical programs were preferred over biological programs.

Chemical Corps Research Program Totals*

Year	Chemical	Biological
1948	44	0
1950	94	84
1954	110	60
1956	41	25

*Research Council of the Chemical Corps 1948; Chemical Corps 1950; Chemical Corps Technical Committee 1954; Chemical Corps 1956.

Not only the number of programs, but also the priority given to the research projects shows the bias of the chemical frame. While every organization must have a number one priority, the important point is that of all the priority statements found, none designated a biological weapons program as top priority. For example, in 1950 the committee stated the "design of a G agent manufacturing and munitions loading plant has no parallel within the Chemical Corps."[9] In 1954, the committee gave the Muscle Shoals chemical weapon production facility the "highest priority within the Chemical Corps."[10] And in 1955, the committee stated "the major emphasis [is] … Operational Requirement CW-03401, supporting the Chemical Corps in the design and development of projectiles, bombs and rockets as suitable CW munitions."[11]

Another indicator of the chemical frame repeatedly observed is the behavior of addressing chemical agents and biological agents as a single threat. The presence of this behavior from the outset of the program again indicates a chemical frame existed early within the leadership structure. In 1947, the Advisory Board recommended that "work on BW be correlated and coordinated with other parts of the Chemical Corps program with a view to effecting economies in each." Reflecting on limited budgets, they stated that "any increase in the proportion devoted to BW at the expense of other parts of the program connected with items and devices of proven utility would be most unwise. It is strongly felt that economies can be affected by merging related parts of the program in the Chemical Corps. In addition to economies, this coordination would probably tend toward greater efficiency in the program."[12]

There are many additional examples of the councils combining chemical and biological weapons, as predicted by the chemical frames model. For example, they recommended looking at chemical, biological, and radiological agents as "one general picture," and considering "RW, BW and CW jointly and severally in protection, decontamination, dissemination and detection."[13] Specific recommendations to treat the agents the same are reflected in a decontamination procedure that adapted a smoke generator to "accelerate hydrolysis of CW agents, kill BW agents and assist in the decontamination of RW agents."[14] Even the names of the committees reflected the combined view, as with the Research and Development Coordinating Committee on Biological and Chemical Warfare.

The military also sought input from experts outside the DoD. In 1947, the American Chemical Society formed an advisory board consisting of a committee of civilian scientists assembled to assist the Chemical Corps. Early research council meeting notes are similar to the opinions of other agencies. They felt biological weapons were not yet ready for strategic or tactical warfare, but did represent a potentially potent weapon for sabotage or destruction of crops. In some ways this recognition, and the separation of biological capabilities and chemical weapons, shows that a frames model was not in total control. However, in discussing future work, the committee reverted to the model by recommending a "research project for studying the effects of explosion on dispersion of chemical and BW weapons."[15] But, indicative of the frame, the three subsequent paragraphs that describe this research objective make reference only to chemical munitions.[16]

However, there is evidence that the Research Council was not operating entirely under a chemical frame. In 1948, members of the council raised concern over their ability to advise the Chemical Corps on biological issues due to lack of reports and information. Yet the military representative to the council revealed the chemical frame by responding that chemical and biological "viewpoints must be tied together" and pointing out the "great advantage in cross membership of the committees."[17]

In addition to the advisory committees, it is possible to observe behaviors consistent with a chemical frame in the organizational actions within the Chemical Corps. A 1951 DoD directive to evaluate chemical and biological efforts resulted in recommendations that were presented to and accepted by a panel of Army generals. The report recommended the Chemical Corps vertically split chemical and biological agents within the organization. As a result of this split, the short-lived position of "Chief Chemical Officer for BW" (a title which in itself reflects a chemical frame) was appointed in 1953.

This position was then abolished in 1954, when a new command structure was implemented. The following year, the Chemical Corps had an external committee review its mission and structure. The committee made several organizational recommendations, but none suggested any delineation between work on chemical agents and biological agents.[18] One of the recommendations from the committee was to move some of the training responsibility from the Chemical Corps to the Army. While previously the Corps had made no effort to retain the biological position, it exerted significant effort to retain its training responsibilities.[19] At the same time, the Army was making an effort to contract out a substantial portion of the biological program.[20] This deal fell through, but as a result the morale within biological research laboratories plummeted.[21]

These actions reflect behaviors expected of a chemical frame in that the Corps quickly reverted to a previous organizational model, rejecting the split of biological and chemical weapons. The organization also attempted to relegate the biological program to the status of contractor subunit. While supporting the chemical frame, these actions are contrary to those expected from imperialism. The bureaucratic model predicts the Chemical Corps would use the proposed split in the chemical and biological weapons programs to its advantage. In this case, an external power had actually directed the organization to grow itself and create a new division, yet the Corps reverted to a previous organization, abandoning potential new requirements and resources associated with the division.

Frames in Training

If a frame existed within the Chemical Corps, and the Corps had prime responsibility for both the biological program and the chemical program, it is logical that the Corps would have spread the frame through training. The available training materials reveal that chemical weapon training was a common occurrence in the forces, yet biological training was much less frequent. As early as 1947, the War Department restricted biological training chiefly to the Chemical Corps.[22]

Several training manuals from the period reflect this bias. One example is an Army training guide for members being assigned overseas. This manual covers all CBR threats within the same document, using phrases such as "CBR warfare conditions," or "CBR tactics." While it does have discrete weapons sections, they reflect a chemical bias. The chemical section has thirty distinct paragraphs or sub-paragraphs, and the radiological section has fourteen paragraphs, yet the biological section has only ten.[23] Similarly, in a 1961 Army CBR training course, descriptions of the employment or use of weapons always utilized the term "chemical and biological weapons" when referencing the weapons in the syllabus.[24]

The chemical agent emphasis is also observed in an Army manual outlining the training requirements for a Decontamination Specialist. The training prescribed in the lesson outlines included fifty hours dedicated to combined chemical, biological, and radiological training. Training for individual weapons classes included thirty hours for radiological, thirty for chemical, ten for biological, and nine for combined chemical/biological.[25]

The field manual for Army unit "CBR" training shows a similar bias, supporting the "principles of chemical and biological operations and nuclear warfare." Topics covered by the manual include gas chamber, mustard training, nerve agent training, exercises with toxic chemical agents, and exercises in nuclear and radiological defense. There is no section dedicated to biological weapons. The individual training tasks are also informative, as five tasks are of general "CBR" nature, four are chemical-specific, and only one is biological-specific (an instruction to clean your food after a biological attack).[26]

In some cases there was not even a training manual. Early attempts by other services to train personnel found that no specific biological training existed. In the early 1950s, the Air Force realized it faced a considerable shortage of officers who understood biological weapons. In an attempt to train one hundred new biological officers in three years, they developed a training program in conjunction with the Chemical Corps. Reflecting the general lack of biological emphasis, the program was abandoned after only two years due in part to low morale, lack of support, and a poor evaluation of the training program.[27] Other examples of biological training being overshadowed by chemical training include exercises that incorporated chemical weapons attacks but not biological, and CBR Weapons Orientating Courses where "CBR field demonstrations" consisted solely of chemical artillery.[28]

There was awareness of the training gap, yet little action seems to have been taken to address it. A 1954 Chemical Corps Technical Committee (CCTC) training review described the state of biological training as "limited to conferences at our service schools and an occasional discussion of its potential in troop training programs."[29] Interestingly, in the same report the committee stated that "training seems to be well underway to give us a reasonable defensive-offensive capability in CBR except in one single factor; the dosimeters. … If our forces were attacked by atomic weapons, they would operate under a great handicap for some time." This statement was made despite the fact that they had already identified a critical lack in biological weapons training, and that there were no operational biological detectors at this time.

The imbalance between chemical training and biological training was also evident to personnel in the field. In his military college thesis, Neil Burnett summarized his experience with this disparity of training: "What officer has not seen or otherwise been exposed to mustard, nerve agents, flame, smoke and tear gas in the chemical family of weapons? But how many officers have ever seen, or otherwise been exposed to an offensive biological weapons system?”[30]

Burnett’s paper raises two examples of how a realism-based assessment of biological weapons influenced the perception of the weapons among military officers. He asserts that because the decision to use biological weapons resided with the President, the average military planner would not normally be concerned with their use or employment. He also theorizes that at the tactical level, the slow action of the weapons, coupled with no visible effect of their employment, made them impractical for immediate battlefield use.

This slow action, combined with the fact that decisions related to biological agents were made above the level of most officers, created a situation where the average officer planning a battle did not give a thought to biological weapons. These two viewpoints can help explain how the operational military member would not spend time thinking about (or creating a frame of reference for) a weapon they would never plan to use in a battle. In this situation, if the officer were challenged with a biological weapon, they would most likely draw upon knowledge obtained from the chemical experiences described by Burnett.

While Burnett’s arguments are grounded in realism, the point he makes underscores the presence of a chemical frame: his training with chemical weapons seemed to anticipate their use in combat, yet similar biological training was absent. However, until 1969, there was no difference in national policy regarding use of chemical weapons or biological weapons. In both cases, use of the weapons required Presidential approval, yet the military routinely trained its personnel with live chemical agents. This is another manifestation of the chemical frame: weapons that do not conform to the established frame are relegated to lesser status, or not considered at all in the solution.

Frames in Other Agencies

A testament to the strength of the chemical frame is how far it propagated. As has been established, the frame existed within the Chemical Corps—was that frame propagated as the Corps interacted with other governmental agencies? The Air Force showed evidence of adopting the chemical frame by imitating the Army in placing responsibility for biological weapons under the Air Chemical Officer.[31]

The chemical frame was also evident outside the military. For example, the CIA was given a task to explore how the government should address its new biological and nuclear weapons (in addition to its existing chemical weapons) when making public statements. The wording of the task given to the CIA was "to establish a procedure for the development and promulgation of policy guidance for the content of governmental statements with respect to the existence, development and contemplated use of weapons using atomic power for propulsion or explosion, guided missiles and biological radiological and chemical weapons."[32]

The above statement brings forth several points. First, biological, radiological, and chemical weapons are defined as one weapons class, again demonstrating an artificial linkage. Also, this quote is from a CIA document, indicating the linkage was evident outside the DoD. Finally, this document goes on to recommend that the DoD be responsible for developing such policy. The significance of this recommendation is that if a frame existed within the DoD, that frame would be reinforced and shown to the public as the DoD developed the public "face" of these weapons.

The strength of the frame is demonstrated by significant examples of combined chemical/biological agent terminology at the highest levels of the government and the DoD. Observing a combined threat at this level indicates substantial support for organizational frames and appears to diminish arguments that the country was responding proportionally to individual threats, as would be predicted by realism.

The chemical frame existed at the top levels of the DoD only a few years after the Army assumed responsibility for the program. When assessing an appropriate U.S. policy on these weapons, the Chairman of the Joint Chiefs of Staff (JCS) simply restated the World War II "gas" policy, adding biological weapons with one sentence.[33] A 1951 DoD directive made ten references to a combined chemical/biological weapon threat, but only once referred to a distinct biological weapon or chemical weapon threat.[34]

Evidence of the frame is also found in national level documents from this period. *House Report 815* combined chemical agents, biological agents, and radiological agents as one class, stating "if CBR is to be considered a deterrent force in the U.S. arsenal of weapons, the program of research and advocacy here will have to be accompanied by an adequate program of manufacture and deployment of CBR munitions."[35] A 1960 National Security Council (NSC) study on limited warfare broke out nuclear warfare from the CBR class, but consistently combined chemical and biological weapons as one operational concept.[36] A 1962 Joint Chiefs of Staff memo reinforced the combined threat, referencing a chemical/biological offensive doctrine, defensive doctrine, and research program.[37] At the same time, the Army was requesting other services assist in creating a Joint manual for CBR doctrine and operations.[38]

There is even a chemical frame in capability reports, as estimated casualties and weapons characteristics were described in terms of "CB weapons systems."[39] Congressional testimony by the Deputy Secretary of Defense in 1967 also showed a chemical frame, starting with multiple references to "CB" warfare. When questioned on the Soviet rationale for biological warfare in Europe, he responded that they expected the Soviets to attack port facilities with lethal chemicals. Also, when questioned on Soviet "CBW" doctrine, he talked about chemical weapons, ignored biological weapons, and went on to talk about tactical nuclear weapons.[40]

There is evidence that some officials were concerned with the WMD terminology, although not for the implied artificial linkage of disparate weapons. A memo to the Secretary of Defense raised concerns with the term "weapons of mass destruction," but at issue was how the term impacted the U.S. view of the morality of these weapons, rather than any concern with the differences between the weapon classes.[41]

The examples above are only a small sampling of a vast number of combined strategies, statements, and studies. The abundance of this behavior is perhaps the most compelling evidence for the chemical frame, both in the sheer number of examples, and the fact that even though imperialism and external threat were the impetus for many of the projects, they were ultimately implemented through a chemical frame.

With the almost ubiquitous combining of chemical, biological, and even radiological weapons within the same category, contrarian views serve to highlight the differences between the two weapons. The fact that individuals or committees, especially those somewhat removed from the programs, identified the combining of the weapons as an issue lends support to the idea that those close to the programs were operating under the influence of a frame.

A prime example of such an evaluation is the 1950 Ad Hoc committee assembled at the request of the Secretary of Defense. This committee was composed of educators, corporate executives, and senior government civilians. One of their findings relating to the perception of chemical and biological weapons was that “chemical, biological, and radiological warfare have been mistakenly assumed to have enough significant characteristics in common to warrant their being grouped together as CEBAR for administrative and operational purposes.” The committee recognized that there might be administrative advantages with a combined weapons threat, but again cautioned that “many of the problems connected with these three weapons require totally different treatment.”[42]

In another statement, the committee seemed to foreshadow the pitfalls associated with the creation of a chemical frame:

> The Committee questions any approach to the weapons which would produce in either the public or military thinking a feeling that there was an inseparable association between chemical, biological, and radiological warfare. While psychological and public information aspects are quite similar for the three weapons, there are fundamental differences in the situation with respect to each of them which call for different handling in research, development, and production programs.[43]

This sentiment was not unique, and is observable at other points in this period. A similar sentiment was expressed in a 1961 meeting of the Defense Science Board (DSB):

> Dr. Horsfall suggests separation of biological and chemical warfare areas and revision of the name from warfare to defense. This would mean separate mentors (by two DSB members-at-large) as well as office reorientation.[44]

Likewise, in a National Security Council meeting, the President's Advisor for Science and Technology stated that "a sharp distinction should be made between chemical warfare and biological warfare."[45]

Frames in Hardware

One of the predictive statements for organizational frames is that past success will influence future development. During World War II, the CWS successfully developed many pieces of chemical hardware. Some of their successes included the M4 Vapor Detector Kit, the M5 liquid detector paint, the M6 liquid detector paper, the M7 detector crayon, and the M9 Chemical Agent Detector Kit.[46]

Moving into the post war period, the Chemical Corps was given prime responsibility for chemical and biological hardware. The organizational frames model predicts that research into biological hardware would be based on previous chemical successes. Such behavior is captured in an Army history, which states that "in the early years the research and development essentially paralleled the experience gained in the development of CW munitions during WWII," and "research on protective masks, particulate filters, protective clothing and shelters was closely integrated with the chemical defense program."[47]

This attitude is also reflected in meeting minutes early in the biological program's development. An advisory committee to the Chemical Corps questioned whether "in the preliminary studies, should there be any differentiation between chemical and biological agents which are dispersed as aerosols?" The same committee also felt that "major defense must fall back on chemical measures to neutralize agents as they are used, materials and methods for destroying the chemicals and agents to destroy the life of the virus or the bacteria, and the development of some method of detection of particular biological agents."[48]

Eventually, the biological and chemical programs were administratively separated. However, by then the chemical frame was strong enough that it continued to exert influence through the combined reference. The chemical and radiological research plan contained specific goals relating to chemical, radiological, and biological weapons, including "improved CBR collective protecting," "improved CBR respiratory and body protection," and "improved agents, equipment and techniques for CBR warfare."[49]

It is also possible that the bureaucratic acquisition system that made the Chemical Corps the lead for the biological program may have helped entrench the chemical frame in other services as well. Dorothy Miller notes that Air Force knowledge of biological weapons was not complete, and that the Air Force could at best describe "requirements in the form of statements of military characteristics" that "did not describe a definite item," and served "chiefly as a guide to the developing agency." It is logical to assume that given enough leeway, the Chemical Corps would implement these requests through a chemical frame.[50]

In fact, during this time period there were many dedicated chemical detectors, or combined chemical/biological detectors, but few if any dedicated biological detectors Some examples of combined chemical and biological program descriptions include Air Force projects 5064 and 5066, which were "BW-CW" warheads for the B-62 and B-64 missiles, respectively. While the program documentation did have distinct chemical and biological requirements sections, the text for the biological warhead requirements was identical to the text for the chemical warhead paragraph, only with the word "biological" substituted for "chemical." [51] A subsequent report highlighted the practice of assuming that chemical delivery systems would work for biological weapons. The committee noted that while the delivery technique "will be primarily applicable to delivery of CW munitions, consideration will be given to possible application to biological warfare."[52]

Many other Air Force program requests exhibited similar behavior. Though eventually identified as impossible and split to a mainly chemical agent detector, an early Air Force detection device request was for an "airborne instrument capable of rapid detection and identification of an airborne toxic (CW and BW) agent,"[53] A 1960 program required the development of drones for "CBR Warfare." In this program request, the desired capabilities were identical and actually referenced chemical and biological agents within the same requirements statements.[54] Another Air Force request for a "CB Detection and Warning" system was actually a request for a chemical-only detector, and a request for "CB protective equipment" simply referenced a "CB attack" requiring "CB protection"[55]

These incidents were not isolated, as later requirements continued to reflect the combined chemical/biological view. In 1960, NORAD established a requirement for "a system to detect and report enemy employment of biological and/or chemical agents. … This system must be capable of providing positive and timely detection of the agent, or agents employed, and the instantaneous reporting of such employment to the NORAD Combat Operations Center."[56]

The trend to combine weapons classes continued in the 1960–1965 technical directives established by the CCTC. For example, the areas of rapid identification, prophylaxis, therapeutics, anti-material agents, and anti-food agents all used a combined chemical/biological reference in their descriptions. One program for development of an incapacitating agent does not describe either a chemical or biological solution, only referencing an "agent."[57]

Within this directive, there were two sections with separate references to each type of agent. Offensive agents and defensive measures, specifically the detection requirements, were written with a separate chemical and biological subsection. It may have been the difference in available technology driving this separation. For example, chemical detection requirements called for "research *and* development to obtain a warning and detection system," while biological detection requirements called for "research *leading to* the development of detection and warning systems" (emphasis added).

In addition to combined program requirements, there is evidence that the agents themselves were seen as similar with regard to production, stockpiling, and weaponization. As noted in the previous section, nations developing biological weapons seem to base their first attempts on chemical weapon design. In her postwar assessment, Miller identifies the issue of a chemical frame influencing munitions design, noting that until 1950, biological weapons had utilized explosives for dissemination; while explosive dissemination is adequate for chemical weapons, it severely reduces the effectiveness of biological weapons.[58] She expands further on the chemical frame stating that "the term 'CEBAR' implies the development of a single weapon—and that is not the case. The three do not represent a combined munition. … Any attempt to treat them as a unit in evaluating their military worth is not realistic."[59] Yet throughout this period, weapons systems were routinely developed as a combined chemical/biological system.

Regarding biological agents, in 1950 the Chemical Corps was of the opinion that "storage of munitions filled with such agents will be comparable to storage of chemical munitions."[60] A 1959 Chemical Corps report showed this was not actually the case, as captured in a debate over the cost of production and long term storage of biological weapons for future use. This is possible for chemical weapons, but ignores the physical reality that biological agents (particularly vegetative bacteria) lose viability over time.[61] The Army found that the capability to deliver biological weapons within seventy-two hours of notification required continuous growth and weaponization of the agent to replenish older stocks, resulting in high costs. When faced with the $5.5 million cost to maintain the seventy-two hour delivery standard, the Army instead opted for a ninety-day plus seventy-two hour delivery standard, saving $2 million.[62]

Not all programs were combined—there were distinct biological programs as well. However, many of these programs also reflected a chemical frame, as biological programs were often derived from chemical-centric requirements. The operational requirements from the defensive chemical programs under development at the time give a feel for the characteristics of the hardware being developed by the military. Generally, chemical detectors had to be small, automated, and provide instantaneous detection of an agent. Using the chemical requirements as a baseline, requirements for biological systems were extremely similar, and in instances where distinct detectors were proposed, future modifications called for the system to be combined.[63] For example, requirements for a standoff G-Agent detector specifically included future plans to modify it to identify biological agents using identical performance parameters.[64] Subsequent evaluation of the detector in 1956 identified major issues of limited range (three hundred yards), no BW capability, excess weight, and high power consumption.

As in other areas, contrarian views highlight the existence of the frame. In the case of weapons, there are reports from civilian research organizations that do a good job of addressing the differences between biological and chemical weapons. A study on warhead design, although having a combined chemical/biological title, did break out chemical agents from biological agents. It highlighted critical differences such as the diameter of the aerosol, the fragile nature of biological agents, and the need for temperature control.[65] Likewise, a RAND report on anti-personnel BW/CW warfare also highlighted the differences in delivery systems, defense, and military applications.[66] The Air Force, while making requests for combined CB equipment, did at least recognize that the Army approach of small, light detectors was not optimal for large, static air bases.[67]

Frames in Doctrine

In addition to hardware, another output of the weapons programs is doctrine directing how forces should fight and train. The organizational frames model predicts that a chemical frame will result in development of similar doctrine for chemical and biological weapons. This similarity will also be greater than would be warranted by the distinct nature of the two weapons classes.

The military manuals of the time that were written solely in reference to biological weapons generally avoid a chemical bias. They address many of the differences discussed in Chapter Three, such as loss of viability, optimal aerosol size, delayed effects, and medical treatments. For example when addressing the delay in effects and battlefield use, one manual advised that "biological attacks must be timed sufficiently in advance of the planned coordinated exploitation to allow for the incubation period."[68]

However, it is possible to find some minor chemical frames within these documents. One manual advised that response to a biological attack is similar to a chemical attack response, and emphasized the use of masks for protection, but only after stating that the United States possessed no capability to detect a biological attack.[69] Another manual reflected the combined decontamination approach, noting that "the materials available for biological decontamination consist of those which are used for decontaminant of toxic chemicals, plus a few items necessary for special use."[70]

While the biological-specific documents generally avoid a chemical frame, some of the combined-use documents show a strong chemical frame. The 1964 Armed Forces *Doctrine for Chemical and Biological Weapons Employment and Defense* uses the term "CB" in every section.

Within this document, weapons characteristics, planning, defense, and combat support are all described relative to a generic CB weapon. In addition to providing inadequate information for both weapons, it highlights how a combined view can result in inaccurate statements. For example, mentioning developing immunity to a "CB" weapon, or saying that "detection and warning of and countermeasures against these weapons delivery systems normally are in operation regardless of the degree of threat" despite the United States having no biological detection capability.[71]

The 1968 version of *FM 100-5: Operations of Army Forces in the Field* is another combined document showing a chemical frame. This manual was the capstone document guiding operational doctrine for the Army at the time. It makes extensive use of the NBC acronym, but at one point does break nuclear weapons from chemical and biological weapons, referring to "nuclear weapons (often referred to as mass-destruction weapons) and biological or chemical agents," which are subsequently referred to as "mass-casualty" weapons.[72]

When chemical agents or biological agents are discussed separately from nuclear weapons, this manual makes almost exclusive use of a combined chemical/biological weapon class or threat, reflected in section titles such as "Biological and Chemical Operations" or "Biological and Chemical Munitions." The manual does make some references to independent use of chemical weapons, but never references a unique biological attack or defensive event.

The only independent reference to biological weapons in the manual is a brief description of biological agents, highlighting their relatively long action and noting their lack of applicability to tactical operations. Interestingly, the manual then includes biological weapons in a tactical situation, recommending the use of chemical or biological weapons as appropriate for securing a structure (e.g. a bridge) without causing physical damage.

When compared to manuals written in the 1970s and 1980s, those from this period do the best job of describing biological weapons as a distinct category of weapon—possibly due to the existence of the offensive program, which required the military to plan for the use of biological agents on the battlefield, and also provided a larger base of individuals with firsthand knowledge of biological weapons. This influence would become less pronounced after President Nixon's 1969 decision.

Medical Countermeasures

The last significant area that shows a predominant chemical frame is medical defense. While the medical/vaccine program appeared driven by external threat during the war, there was a declining emphasis on medical countermeasures as a major contributor to the nation's defensive posture. The general consensus seemed to be that preventative medicine was the best defense against biological weapons.

Kendall Hoyt relates that the 1950s and 1960s were the heyday of U.S. vaccine production. She cites the military/civilian relationships developed in World War II, along with a general sense of duty to country by pharmaceutical companies, as driving development at this time. She identifies eighteen "new" vaccines developed during this period, a number unmatched in any subsequent period of analysis.[73]

However, there was a general attitude from the DoD that vaccinations would not serve as adequate protection. In its 1947 annual report, the Army Medical Research and Development Board showed little interest in vaccine development, and had no programs dedicated to biological warfare issues.[74] The vaccines being developed in 1950 focused on diseases such as mumps, more of a concern in crowded barracks than on the battlefield.[75]

Available evidence also indicates that countermeasures were not regarded as a significant component of the biodefense strategy. An assessment of warfare in the Far East noted that "it is believed that immunization against all of the diseases which the Communists could possibly employ in the Far East presents a difficult and impractical technical and administrative problem."[76] A RAND report pointed out that vaccination is not applicable for all agents.[77] Miller also notes that the enemy could utilize an agent with no known vaccine, and points out the extensive timeline associated with developing new vaccines.[78] The Chief of the Chemical Corps also identified the fear that a massive attack could overwhelm vaccinations, and noted the difficulty in predicting which agents would be used.[79]

There was also a concern that antibiotics might not be effective due to the lack of detection capability and the need to administer the drugs prior to the onset of symptoms, as well as their lack of effectiveness against viral agents.[80] However, one report did argue that in the case of a large-scale biological attack, there would be sufficient unexploded ordnance available that, for some organisms, identification could be made in time for antibiotics to be effective.[81]

There are also indications of a general lack of urgency to develop medical countermeasures, as a medical committee noted concerns over lack of communication between the Surgeon General and the Chemical Corps.[82] The same report also noted a bias against vaccines, recommending therapeutics be utilized to protect laboratory workers instead of vaccinations. A different report noted that budgetary constraints had prevented the services from acquiring the amounts of countermeasures prescribed by mobilization estimates.[83]

Clearly there was substantial work by military and civilian laboratories to produce medical countermeasures to biological weapons over this time period; however, medical countermeasures were not widely embraced as a defense against biological attack. It is entirely possible that this is a manifestation of a chemical frame, as the idea of prevention (vaccination) or treatment (antibiotics) of an attack is foreign to chemical warfare and does not appear to be a significant component of biological defense planning at the time.[84]

Conclusions—Frames

From the evidence presented, there is a substantial argument to be made that a strong chemical frame existed during this period. While it appears the chemical frame was overshadowed by external threat during World War II, it reemerged in the following years. The distinction between chemical agents and biological agents became blurred over this period and the two weapons were more often than not regarded as a single threat, or as one class of weapon requiring one solution. This combined approach is observed in hardware, doctrine, policy, and training. The chemical frame is also apparent in organizations outside the military—evidence that it had become ingrained in the national lexicon.

The fact that a chemical frame was able to establish itself so early and so strongly within the program indicates that the frame was probably already in existence when the Chemical Corps took over responsibility for the biological program. The establishment of the frame at this point in history created a condition where, for the following forty years, biological defense would be approached through a chemical defense model, setting the stage for some of the issues highlighted by the First Gulf War.

While there is substantial evidence of a chemical frame, there are other significant events, such as the debate over Large Area Coverage, Project 112, and the decision to end the program, which would provide opportunities for other factors to influence the program as well. The next of these theories to be considered is imperialism.

Bureaucratic Politics and Biodefense, 1946–1970

It is evident that factors beyond external threat emerged to exert greater influence in the postwar period. While substantial evidence of the emergence of a chemical frame has been presented, it is also logical to propose that the evolving nature of the threat, changing national policies, and organizational changes could create environments conducive to imperialistic behavior.

The same historical sources also show examples of imperialistic behavior, such as attempts to justify budget increases by embracing new or vague threat data, selling new capabilities, programmatic confusion, and turf battles between newly established organizations. These turf battles may have been enhanced by the historical realties of the time, such as the assignment of the biological mission to the Chemical Corps, the downsizing of the military, and the creation of the Air Force.

However, while there are examples of imperialism over this period, the amount of supporting evidence for this factor is not as great as that for the chemical frame, perhaps due in part to the fact that within the military, missions and responsibilities are usually prescribed by regulation. Therefore, while there can be some external challenge and conflict, it will often be resolved when the disagreement reaches an appropriate decision authority. Alternatively, it may simply be that a chemical frame or external threat exerted a greater influence over this time period.

Expansion of Mission and Resources

The desire to obtain additional funds is an imperialistic behavior predicted by the bureaucratic politics model. For this time period, there are instances of organizations using the chemical, chemical/biological or CBR threat to justify needing additional resources. There is no doubt the Chemical Corps used such strategies to acquire resources, as captured in a description of the Corps arguing for the construction of a chemical production plant:

> But one can theorize that immediately following World War II military spending started to recede significantly. Previously, relatively unessential projects often had little difficulty in getting funded. But in the late 1940's this was no longer true. To get "big money" the purse holders had to be convinced that a program was absolutely essential to the preservation of democracy. The Chemical Corps convinced the War Department that (1) we had no adequate lethal CW capability, (2) we had to produce more agents quickly and in quantity, especially in view of the fact that the G-agent capability developed by Germany had been taken over by the Russians, (3) that mass casualty weapons such as CW agents were essential for our defense, and (4) that we had the technical know-how to produce G-Agents. … But no one told, or at least convinced, the proper authorities that the U.S. did not have the technical experience and pilot plant data to support [this claim].[85]

In addition to chemical agents, there is evidence the Chemical Corps viewed the radiological threat as a potential source of new resources. In the case of radiological weapons, in 1947 the Research Council reaffirmed the position that the Chemical Corps should have "full responsibility" for the development of radiological bombs, and also put forward the recommendation that other government agencies refer to the Chemical Corps for "all aspects of atomic energy, production and use of fissionable materials and fission products and related subjects."[86]

Ten years later, the Corps was still fighting for the mission and the associated resources. In a 1957 memo, the Chief of the Corps restated the policy assigning radiological warfare to the Chemical Corps, then stated his views of the "diversification" of Army effort in the area, and requested augmentation to assist with the Chemical Corps executing its assigned duties.[87]

There are examples of the Chemical Corps advocating for biological weapons as well. In a 1950 presentation for the Secretary of Defense, the Chemical Corps gave a sales pitch for biological weapons, stating that "it is the considered opinion of the Chemical Corps that attacks with anti-personnel BW agents will be effective." To fulfill this claim, the Corps stated it was "essential" that it be provided with sufficient funds, personnel, and facilities to conduct the appropriate research. The presentation also reflected a chemical frame when saying of off-the-shelf munitions that "no unusual difficulties are predicted in the production of BW munitions and their transportation and delivery on the target."[88]

In a 1960 report to Congress, the Army addressed the CBR threat, highlighted the need for better intelligence and understanding of the threat, then made the following recommendation in regards to research funding:

> The best immediate guarantee the United States can possess to insure that CBR is not used anywhere against the free world is to have a strong capability in this field too. … At the present time, CBR research is supported at a level equivalent to one one-thousandth of our total defense budget. In light of its potentialities, this committee recommends that serious consideration be given to the request of Defense officials that this support be at least trebled. Only an increase of such size is likely to speed research to a level of attainment compatible with the efforts of the Communist nations.[89]

This quote demonstrates the interaction of all three theories. First, there is clearly a combining of the chemical, biological, and radiological weapons, as associated with a chemical frame. Second, there is a definite realist argument that other unfriendly states possess these weapons and the United States must respond in some manner. However, it also demonstrates how an imperialistic organization can utilize a realist argument to support a request for more funding. A 1963 Chemical Center report made another subtle attempt to sell the biological program, highlighting the advantages of a biological attack, as opposed to a nuclear attack, when the target has a small industrial base and a large rural population base (such as China).[90]

Imperialism can also result in organizations developing programs simply to maintain their relevance. Programs developed with no clear user, or exhibiting no clear linkage to user requirements, may be evidence of an organization setting its own agenda without regard to the actual threat, or to the needs of their constituents. There are examples of such behavior in the Chemical Corps throughout this time period. In 1949, the research council recommended that "in spite of the lack of requirements, it is believed that continuation of the development of an integral mechanized flame thrower and request for funds should be vigorously pursued."[91]

There is evidence of similar behavior with regards to biological weapons. For example, in the early 1960s (after the biological program had been in place for several years), the Chemical Corps conducted projects Wasp and Scorpion. These programs consisted of meetings with the Air Force and Navy, respectively, to establish user needs and requirements for biological weapons.[92] The debate over incapacitating agents is also reflected in the statement that "general concepts for the use of incapacitating agents have been developed from time to time by the Chemical Corps; however, never has any potential user stated a concept. Thus those presented herein can only be assumed as possible applications."[93]

Large Coverage Area

Incapacitating agents are also related to the military's attempt to develop a Large Area Coverage (LAC) weapon. Part of the genesis of the program was an alternative use for biological and chemical weapons in light of increased U.S. nuclear capability. The program was also partly in response to the military attitude adopted by the United States, as reflected in Curtis LeMay's question: "Why don't you guys make a bomb to blow up all of Russia?"[94] While the LAC story shows imperialistic origins, the project ultimately failed due to a chemical frame.

Over this period in history, nuclear weapons were being developed, as was associated nuclear doctrine. Reid Kirby relates that early in the Cold

War, the United States was concerned that its supply of nuclear bombs was inadequate for a war with the Soviet Union, and for a brief time biological weapons were placed at the same organizational level as nuclear weapons.[95] While this may seem a realist-based response, the fact that a combined chemical/biological organization was established highlights how an external threat was addressed through a chemical frame.

As the United States accumulated greater nuclear capability, the interest in the biological program waned, but a doctrinal debate emerged as to the role of weapons that affect large areas. This new Large Area Coverage mission served as a potential new mission area for biological (and chemical) weapons. Regarding nuclear weapons, the Chemical Corps held a belief that atomic bombs would be best used against populated areas, but chemical or biological weapons could be more effective against ground forces dispersed in the field.[96]

For several years, there was confusion over how to conduct the program. A former member of the biological weapons program noted that in the early stages "research and development suffered because using agencies did not develop doctrine and target requirements for our agents."[97] In 1950, the Director of the Biological Department made a similar statement, saying "the service had been given no firm guidance as to the place that BW was to take in overall war plans."[98] Miller makes an additional observation that even after the Air Force had been given a retaliatory mission, there was still confusion at the JCS level over the program, and "still a selling job to be done to the people who make the decisions as to whether we step up production."

Eventually, the DoD did issue guidance directing the Air Force to deploy an operational biological weapon. As a result, the Air Force and Chemical Corps found themselves talking past each other, as neither really understood what was needed, or what was technically capable. The Corps found it had oversold its ability to quickly produce and weaponize a biological agent, and the Air Force established many arbitrary requirements and deadlines, with no understanding of the science involved. [99] Eventually, the program did produce a biological weapon utilizing the agent *Brucella suis,* which presented the service with several unique issues.[100]

One of the issues with this weapon was the realization that unlike chemical weapons, which remained potent for years, this biological agent had a shelf life measured in weeks. As a result, the Chemical Corps was required to repeatedly produce and refrigerate new batches of agent to ensure the weapons were available if needed. Even then, if the weapons were to be deployed, the bombs had to be filled and then flown into the theater under environmentally controlled conditions. Subsequent evaluation of the weapon by the Weapons System Evaluation Group (WSEG) found that it was inefficient, especially when compared to atomic weapons.[101]

However, in true imperialistic fashion, the military spun this negative report into a bureaucratic win when the Research and Development Board argued that the evaluation was based on the currently fielded weapon and did not consider more effective alternative agents, nor did it address the fact that biological weapons could spare the physical target.[102] In a subsequent letter, Whitman suggested the Secretary of Defense allocate another $10 million to develop new and better agents, and made requests for additional facilities and greater participation by the Navy and Air Force.[103]

Further evidence that the Corps had oversold the program was presented a few years later when the President's Scientific Advisory Committee (PSAC) noted that "in the past BW and CW have suffered from the overzealous efforts of their protagonists who have attempted to demonstrate these types of warfare are more devastating than nuclear warfare. This thesis could never be substantiated." The report also noted an issue with how the Corps sold the program, stating that "the justification of offensive programs on the basis of providing information for the defense is an old one and can be overdone."[104]

The execution of the LAC mission provides evidence for both frames and bureaucratic politics theories. It shows an attempt by the organization to identify a new mission area, and an attempt to use Chemical Corps capabilities to fill the new gap. Miller relates that when faced with nuclear weapons, and a need for diverse weapons to address the Soviet threat, "the Chemical Corps ... suggested that this requirement might be met by the development of toxicological warfare weapons. No other field appeared so promising."[105] The result of the Corps' sales pitch was a strong push by the Air Force for an incapacitating biological weapon. This push helped keep the Chemical Corps in business, but resulted in a bureaucratic plan executed through a chemical frame.

There is reason to believe that some of the problems associated with the program arose from attempting to execute it through a chemical frame. Evidence has already been presented as to how biological weapons and chemical weapons were prescribed in the same terms. It has also been noted that Creasy's early testimony describing the benefits of the biological program demonstrated a chemical frame. The presence of a frame was also reflected in the PSAC report, which identified issues with "BW and CW" weapons. The combined weapons view also negated the full advantage of biological weapons over chemical weapons for area coverage.[106] Finally, a chemical frame is observed in the testing of the concept, as the massive thousand-mile coverage claims were based on tests utilizing inert particles.[107]

In addition to issues with the weapons themselves, the PSAC identified behaviors within the Chemical Corps that are similar to behaviors associated with the chemical frame. The committee noted it "found that the Chemical Corps, particularly at the higher echelons has lacked imagination."[108] The President's Security Advisor noted a similar tone, identifying a "lack of creativity and ingenuity" with the Corps' applied research of agents and development of defensive items.[109]

While the Chemical Corps seems to execute its imperialistic behavior through a chemical frame, there is at least one example of a civilian agency utilizing the biological threat to justify a program that had no attached chemical program. In 1960, the Interdepartmental Committee on Internal Security came to the "unequivocal conclusion that the absence of defense against clandestine BW attack is a serious threat to internal security." To solve this issue, they requested $8 million to develop rapid identification and detection capabilities.[110]

This request resulted in a series of memos ultimately recommending that the request be disapproved, in part due to similar work underway by defense and public health agencies. Of particular interest is that while the request showed a possible imperialistic behavior, some of the questions posed by the National Security Council brief clearly indicated the presence of a chemical frame (or at least a general lack of knowledge of biological agents). For example, questions were asked as to why the request was limited to biological weapons versus "clandestine attack by other than BW weapons," or questions as to the technical differences between detecting and identifying biological agents.[111]

Conflict

Conflict is another behavior associated with imperialism. This conflict can be external, such as competing with other organizations for new missions, or internal, such as leaders within an organization struggling with each other for power.

From the beginning of this period, the CWS found itself in organizational conflicts as it was forced to defend its existence. In the postwar period, serious consideration was given to combining the CWS with the Ordnance Department. In an attempt to secure its future, the CWS put forward a multi-point argument, including biological weapons as justification for its existence. They asserted that a dedicated agency was needed to conduct chemical and biological research, that this research was "new" and (ironically) should not be subject to "shackles of existing weapons and channels of thought," that the Ordnance Department was concerned with commercial research and had no experience with biological weapons, and finally that a propagandistic approach was needed for effective research programs.[112] However, as noted previously, although the Corps was willing to push biological weapons as a justification for its existence, it reverted to a chemical frame while executing the subsequent program.

The Air Force became a separate service in 1947, and as a new organization it may have been tempted to acquire as many missions as possible, putting it in conflict with the Chemical Corps. An Air Force memorandum in 1953 reflected imperialistic behavior by the Air Force regarding chemical and biological weapons. In the memo, the Army objected to Air Force plans to evaluate previous Army reports and programs, and the (Air Force) author asserted that "wherein the Air Force does not concur with these studies, every effort should be made to resolve the differences between the Army and the RDB in the Air Force's favor."[113] Miller also relates that although there was a process to resolve conflict between the Chemical Corps and other services, "the fact that many of the technical advisors had some association with the Chemical Corps led them to believe that the Chemical Corps interests received prior consideration."[114]

Additional evidence of inter-service friction is found in 1947 meetings of the research council. In this meeting, one member disparages Navy research, characterizing it as research for the sake of research, with the "pious hope" that some of it may help the Navy. The council expressed the opinion that this type of research was not an Army function and should be for the National Science Foundation.[115] While the initial criticism of the Navy could have led to an imperialistic move, the recommendation to defer to the National Science Foundation shows a lack of imperialism on the part of the Army.

Correspondence between the Chemical Corps and NORAD reflects conflict between these two organizations. In 1960, the Joint Chiefs of Staff summary of communication from NORAD to the Chemical Corps stated NORAD's responsibility for North America and its requirement to detect chemical and biological weapons. The commander then requested that the Chemical Corps meet with NORAD to discuss detection requirements. The exchange seems to indicate that input from the Joint Chiefs of Staff was required to settle the matter, and that there was pressure for both organizations to have input into future systems development.[116] Also of interest in this exchange is that while it demonstrates possible tension between the organizations, the initial request by NORAD shows the linkage of weapons indicative of a chemical frame in requesting a system to detect enemy employment of chemical and/or biological weapons.

Perhaps the largest conflict the Chemical Corps faced was in 1962 when the Army abolished the heads of the technical service. Interestingly, at the same time, the Chemical Officer advanced a plan to create a DoD-wide Armed Forces Special Weapons Agency that would be responsible for all chemical and biological agent development, which at the time was the responsibility of the Chemical Corps.

While this proposal appears at first to make no sense, it is understandable given that at the time the Chemical Corps was facing an impending loss of autonomy with the chemical and biological program. By proposing a DoD-level agency, it could preserve the integrity of its core functions, as well as create a high level DoD organization for which it would be the logical lead. Also, the proposed plan highlighted how the new agency would be able to address requirements from the newly established Project 112, which is discussed in more detail below.[117]

Ultimately this plan was not adopted. The Army abolished the Chief Chemical Officer position, and Army Materiel Command assumed the chemical and biological mission. While the Chemical Corps still existed, it no longer had exclusive responsibility for chemical and biological weapons.[118]

While there is evidence of interagency competition, there are also many examples indicating that imperialism did not dominate every decision. There were numerous instances where the organizations fell in line with established command relationships rather than attempting to make a play for greater authority. There are even examples of organizations willingly offering up mission areas to other organizations.

In 1947, when the Chemical Corps was facing budgetary reductions, the Advisory board proposed giving some biological weapons research (specifically, anti-crop agents) to the U.S. Department of Agriculture.[119] A 1954 Air Force request for development of a cluster bomb specifically stated that the Chemical Corps would furnish technical personnel, equipment and facilities to accomplish the project.[120] In the Air Force requests for chemical and biological sensors cited above, the Air Force conceded that it had no responsibility to develop chemical sensors, and that the Chemical Corps would be the agency responsible for sensor development.[121] Similar behavior is reflected in the majority of program documents examined from this period.

While such behavior is not indicative of imperialistic behavior, it could have inadvertently served to reinforce the chemical frame of reference. As the other services went through the Chemical Corps, or relied on the Corps' expertise to execute their programs, they perpetuated the Chemical Corps' dominance in the field. Their lack of involvement also removed a possible source of fresh outside perspective on the biological weapons program.

Finally, there is one telling anecdotal example of biological weapons almost falling through the organizational cracks of the Chemical Corps, which would not be expected if biological weapons represented a rich target for imperialistic behavior. It is captured in a historical interview conducted by Chemical Corps Historian Sigmund Eckhaus. When asked about his experiences as a division chief within the chemical weapons program he responded, referencing a reorganization, "and when I looked at my job description I found it included BW."[122]

Imperialism and First Use

A final area of historical importance relative to imperialism and external threat is how the United States intended to use its biological and chemical weapons**.** Posen hypothesizes that organizational theories (imperialism) would almost always favor offensive doctrine, as offense is better able to justify greater expenditures in materials and research, and argues that retaliation-based strategies are associated with balance of power (realist) theory.

President Roosevelt established the initial U.S. policy regarding the use of chemical and biological weapons during the Second World War. He stated that the United States would not be the first to use either weapon, but would respond in kind if attacked. This policy stood until 1954, when President Eisenhower decided that chemical or biological weapons could be used first in a conflict, but only upon Presidential approval.

While the Eisenhower decision was never publically acknowledged, President Kennedy continued the Eisenhower policy as part of his flexible response doctrine. In 1966, the Joint Chiefs of Staff advanced a National Security Action Memorandum (NSAM) arguing for even fewer restrictions on the use of these weapons, stating it was "in the national interest of the United States to be prepared to employ chemical and biological (CB) weapon to maintain offensive and defensive capability because it could deter their use by an enemy"[123] This proposal was never adopted, as debate over it was subsumed within President Nixon's 1969 policy on chemical and biological weapons, which will be discussed in greater detail later.

Looking at the debates behind these decisions, it is possible to find many imperialistic statements from the DoD that advocated a greater role for both chemical and biological weapons. The 1950 Ad Hoc committee report specifically called out the U.S. policy of retaliation as detrimental to national security.[124] The Technical Committee raised the concern again in 1954 when it cautioned that although chemical weapons had previously been used only in retaliation, that fact must "not deter achievement of realistic preparedness in chemical or biological warfare." The same report also contained guidance from the Secretary of Defense, directing the services to maintain "offensive and defensive CW-BW" training.[125] Department of Defense policy in 1956 reflected similar concerns, stating that forces "must be prepared to use chemical and biological weapons" and that these weapons would be used to "enhance the effectiveness of the armed forces."[126]

As Posen proposes, offense is attributed with more resources, so some of these statements may be the result of imperialistic organizations chasing funds. For example, Goldman contends that the 1956 decision by Eisenhower was partly influenced by the perception that the "military services were not adequately funding fundamental R&D in the field because they were uninterested in purely retaliatory weapons."[127] This thought is echoed in an Air Force history, which notes the "retaliation only" policy had placed a low priority on the biological program, hindering research and development.[128]

Goldman's contention may be true, because just a couple of years after President Eisenhower's decision, the perception of biological weapons had changed. In 1959, "the Chemical Corps mission reached a height of emphasis unprecedented since WWII. The military services were submitting requirements for BW munitions, which included dissemination means for artillery, missiles, drones and other lesser weapon systems."[129] There is also evidence that President Eisenhower's change in policy created momentum to further alter funding and doctrine. National Security Council meeting notes from 1960 reflect concern from the budget director who stated "we were spending too much money on chemical and biological weapons if we did not intend to use them and too little money if we did." The notes then identify future work in developing incapacitating chemical and biological agents as important to the nation.[130]

While these behaviors indicate imperialistic behavior, it is important to note that when these policies and programs were debated, they were always addressed as a combined chemical/biological program, indicative of a chemical frame. As stated by Miller, "biological warfare was associated so closely with chemical warfare that the policy for both was assumed to be the same."[131] It was not until the decision by President Nixon that the United States differentiated between the use of biological weapons and chemical weapons. So while imperialistic behaviors may have exerted some influence over these decisions, they were consistently executed through the lens of a chemical frame.

Conclusions

Like organizational frames, bureaucratic politics was overshadowed by realism in the World War II period. As the overt external threat from World War II faded, and the country faced the new external threat of the Cold War, it could be expected that imperialism would emerge as a dominant influence.

It is clear that the Chemical Corps exhibited imperialistic behaviors. Some of the programs, organizational conflicts, and attempts to justify organizational relevance are consistent with predicted behaviors. There are examples of the Corps citing the missions of smoke, incapacitating agents, nerve agents, biological agents, and radiological agents to support an imperialistic agenda.

However, when the Corps did advocate its biological capabilities to justify a program, it was often combined with a chemical program. What is generally not observed within these programs is the independent biological threat predicted by the bureaucratic politics model. The lack of this indicator means that while the programmatic decisions appear imperialist, most of the execution utilized a chemical weapons approach or a combined chemical/biological threat. Thus, these data points indicate that when the Corps was subject to imperialistic behavior, it was most often accomplished through a chemical frame.

The lack of significant imperialistic influence over the program is a disadvantage for U.S. biological posture. When facing a stagnant program, competition generated by imperialism can force organizations to create new programs and new approaches to justify their existence. Therefore, imperialism can serve to counter an organizational frame, and help move a program in a new direction. However, what these data show is that even when new programs were proposed, the chemical frame was too strong, and new ideas ultimately ended up being executed with a chemical-centric approach.

Realism and Biodefense, 1946–1970

For the World War II period, it has been demonstrated that the fear of a Japanese, and then German, biological program drove the development of the U.S. program. Although open hostilities had ended, there is reason to believe that external threat would continue to drive the program. First of all, the role of external threat was rapidly filled by the Soviet Union. Secondly, it is the only time period of analysis in which the United States had an active biological program with operational weapons.

As the victor in World War II, the United States was able to obtain ground truth information on the state of German and Japanese biological weapons programs. As already discussed, it was in part concern of a Japanese biological program that prompted U.S. work in biological weapons. Fears of German biological weapons were also cited in many threat assessments from the war period.

In the case of Germany, it was discovered that the Germans did not have a large biological weapons effort. However, it was discovered the Germans had made substantial advances in chemical warfare, having developed "G" nerve agents. Also of great importance to the realist was the fact that the Soviets had captured significant portions of the German chemical production infrastructure, potentially placing the United States at a disadvantage in terms of chemical agent production capability.[132]

The Japanese, on the other hand, revealed a large and aggressive biological weapons research program, including reports of possible weapons use in China, as well as large-scale testing of agents on human prisoners. Sheldon Harris captures the extent of the program in detail in his book *Factories of Death*.[133] Harris also documents the subsequent efforts of the U.S. and Soviet governments in their attempts to acquire access to Japanese biological researchers and the data they obtained from their test program.

While there is some debate as to how far the Japanese progressed with their program, and the usefulness of the information obtained by the United States, the realist could point to concrete evidence that an enemy state had allocated significant resources to biological weapons. The United States also knew it was likely that the Soviet Union had obtained as much Japanese data on biological weapons as they had.

A continuing source of debate over the biological threat is the fact that biological weapons have never seen large-scale battlefield use, which is significant because unlike most other weapons, the United States is not able to frame the threat of biological weapons based on actual historical use. However, unique to this time period, the United States had an active weapons program that served as a source of test data and information on the effectiveness and threat posed by biological weapons. Access to this information would have provided valuable data to decision makers utilizing a realist model, and should have allowed the United States to make the most concrete threat-based decisions during this time, relative to the other periods examined.

Perceptions of Threat

One way to assess the importance the United States placed on the biological threat is by looking at intelligence estimates and statements made by high-level officials. While a rational actor would be able to find evidence within these statements to support a Soviet biological threat, there are also questions as to the effectiveness of U.S. intelligence capabilities. The estimates also reflect a general feeling that the Soviet Union's chemical capabilities were greater that its biological capabilities, an important delineation for a rational actor decision model.

As early as 1949, there was concern in the government that the Soviets were prepared for biological warfare, and would use these weapons in a large-scale war.[134] In 1950, an Ad Hoc Committee was commissioned by the Secretary of Defense to assess biological and chemical weapons. The committee put forth several key points that reflected a rational assessment of biological weapons relative to chemical weapons. Specifically, the committee found that the chemical threat was more concrete based on prior use in warfare. They also noted the Soviets had a substantial stockpile of G agents, as well as captured German production facilities and technicians.

However, the committee did not dismiss the threat from biological weapons, but rather assessed that biological weapons might become exceedingly important, and that the United States was in danger of a variety of possible biological attacks. Overall, the committee found that the United States was not prepared for biological or chemical warfare. They blamed the indecisiveness associated with the postwar period as contributing to this lack of ability and recommended increased assets be given to the biological and chemical weapons programs.[135]

The concern over biological weapons expressed by the committee is echoed in intelligence estimates from several different government agencies. A 1951 report indicated a "high probability" that the Soviets had a biological program, while also stating the Soviets had a "known" chemical program.[136] A 1952 CIA memo concluded that "the USSR is well aware of the basic principles of Biological Warfare and has the capabilities to produce BW agents and munitions" and "in general Biological Warfare … is a serious threat which must have a place in all planning for defense."[137] Another 1952 CIA document estimated the Soviet military had capabilities to "carry out sabotage and clandestine attacks against U.S. and its allies with atomic, biological and chemical weapons."[138]

A 1954 Air Force assessment of current intelligence established "the capability of the enemy to wage biological warfare against the United States."[139] The threat was not confined to European battlefields—in 1960, NORAD stated a concern with chemical and/or biological agents being employed in North America.[140] Meeting notes from the National Security Council in 1960 reflected the attitude that the "US has a relatively poor posture vis-à-vis the USSR," noting that compared to the Soviet Union, the United States only had one-thirtieth the number of troops trained in chemical/biological operations. Interestingly, these notes also include a subsequent discussion on incapacitating agents, and note "bright" prospects for the U.S. "CB" program.[141]

It is also possible to find quotes from the Soviet Union referencing their weapons capabilities. For example, the Army provided evidence that the Soviets were pursuing the development of biological weapons:

> Soviet medical and technical reports which have been published show that they are equally well-versed in biological warfare. Their BW tests have been conducted over a long period of time. Their drug industry is capable of supporting large-scale BW on short notice. ... Soviet General Drugoves said: Many of our scientists 'regard research on the actions of poisons and on the development of antidotes to be their patriotic duty'.[142]

Several of these statements were also presented in a 1960 U.S. Army report to Congress, including one that appears to establish a biological component to Soviet doctrine: "Soviet Admiral Gorshkov has stated that future war will be characterized by 'various means of mass destruction, such as atomic, thermonuclear, chemical, and bacteriological weapons.'"

While there are many statements of a biological threat, there are also statements of skepticism. A 1952 memo described intelligence on the Soviet biological program as "sparse," saying it "does not provide a satisfactory basis for overall evaluation."[143] Writing five years after her first history, Miller noted that the United States was unable to identify even one Soviet production facility. Yet despite this decline in available intelligence, there was still a general feeling that the Soviets had a biological program, as reflected in the statements above from subsequent time periods.[144] A 1969 CIA report also reflected a decreased assessment of Soviet biological capability. Whereas the 1951 report had assessed a "high probability" that the Soviets had a biological program, in 1969, Soviet biological capability was described as "conducting research and development on the possible military application." The same report described chemical weapons as a "known" Soviet capability.[145]

While intelligence estimates were questionable, the United States did have one known factor available to assist in the threat calculation: the U.S. offensive program. While the U.S. program did not always deliver as promised, by the end of the 1960s the United States had a well-developed biological capability that demonstrated the seriousness of the biological threat. The United States had matured its program to a point where the military had demonstrated the capability to contaminate over one hundred square miles with a single aircraft.[146] As intelligence threats are often based on mirror images of one's own capabilities, it is reasonable to expect that the United States assumed the Soviets had the same capability.

With the conflicting intelligence information, it is impossible to make an absolute case that the external threat was crystal clear and was driving U.S. posture. It is possible to speculate that individuals interested in advancing a particular program would be able to find an appropriate intelligence estimate to justify their proposal. Based solely on intelligence estimates, the best argument to be made is that external threat could be used to support imperialistic programs as needed, and that the chemical threat was more concrete than the biological threat.

Vulnerabilities

If a state believes it faces a threat, realism predicts that it will take action to alleviate the threat. Regardless of the accuracy of the intelligence, the United States did believe that biological weapons were a threat, and that its own capabilities lagged behind those of the Soviet Union.

There are indications that the United States was concerned with its biological weapons capability and felt it was in an inferior position relative to the Soviet Union. A 1952 memo to the Secretary of Defense expressed concern over current U.S. capabilities, stating that "if the signal to 'retaliate' were given tomorrow, or even within the next year, the United States could make little more than a token effort. While there is a greater awareness of the need for CW and BW readiness, the accelerated programs in these fields probably will not place the United States in a position to have a significant CW and BW capability before mid-1954."[147]

This feeling was still present in 1962 when Major General Stubbs, Chief of the Chemical Corps, testified as to Soviet capabilities to arm ICBM's with dry biological agents and to achieve thirty percent casualties across the entire United States. In the same hearing, the Army Chief of Research and Development testified that one-sixth of Soviet ground potential in Europe was chemical. Stubbs concluded by confirming that in his opinion there was a chemical and biological "gap" between the United States and the Soviet Union.[148]

The realism model also predicts that national capabilities should be proportional to the degree of the perceived threat. There are several examples of concern over the need for greater understanding of the threat, and statements directing the program to respond as dictated by the threat.

For example, in 1954 the SECDEF directed departments to develop defensive readiness based on threat, and called for greater intelligence collection.[149] The defense department also directly told agencies "to develop and maintain an adequate defensive posture … based upon estimates of potential enemy capabilities."[150] In 1955, the Chemical Corps took a realist approach to justify its program, stating that "foreign research and development will be studied to insure an essential margin of superiority in our weapons and equipment."[151] Likewise, the Air Force stated a requirement for a biological detection system that was consistent with the intelligence information that the agents were available to potential enemy nations.[152]

The Military Response

As the United States perceived an external threat from chemical and biological weapons, and then assessed that it was vulnerable to the threat, realism would predict that it would take action to counter the threat. Because defensive actions reduced vulnerabilities, and offensive actions increased relative power, combining these actions would balance the perceived Soviet advantage in this area.

One of the first actions taken by the United States was to increase its biological weapons capability. There is copious evidence that the nation feared Soviet use of chemical and biological weapons, and that it intended to use them in battle also, if needed. The short-lived high priority Air Force CW/BW office is explained by the nation seeking to increase its power relative to the Soviet Union in the face of a perceived weakness in nuclear weapons.[153]

In 1952, the SECDEF issued a directive regarding chemical and biological warfare, stating that "the three military departments were directed to increase their support of, and participation in programs to bring us to the required state of readiness." Some specific service responses to this direction included the Army allocating funds for a second GB (chemical nerve agent) production facility, increased inter-service and scientific assessment of requirements, development of Navy chemical warfare and biological warfare doctrine, and a time-phased Air Force plan to have CW-BW capabilities by 1954.[154]

Two years later, the SECDEF issued additional chemical and biological weapons guidance, which contained general recommendations with greater emphasis on offensive chemical warfare than on biological warfare. In areas such as intelligence, defense, and training, the guidance took a combined chemical/biological view. Regarding chemical weapons, direction was issued giving chemical ammunition the same priority as conventional ammunition, stockpiling of offensive and defensive material was directed, and maximum effort was given to the fielding of the agent GB. Biological weapons received less operational priority, but continued research and development was directed, with an emphasis on the development of a lethal agent/munitions combination by July of 1955.[155]

In addition to directing research and development of hardware, the United States took actions to improve the capabilities of its operational forces relative to the threat. Realism would predict that the military would develop doctrine and increase both offensive and defensive training to address the realities of the new weapons. Several of the training documents produced over this period show that the United States was taking steps to address both the chemical threat and the biological threat, but often the chemical frame resulted in inadequate biological training. There are a few additional pieces of data that show the external threat/training relationship.

For example, the 1952 SECDEF memo cited above directed the services to address readiness issues partly through enhanced training. Additional guidance from the Department of Defense also directed services to "insure that training in offensive and defensive biological and chemical warfare keeps pace with the development of doctrine, tactics and techniques."[156] There are examples of the services taking action to improve training. A 1954 CCTC memo regarding the status of CBR was critical of chemical training, calling for a "considerable increase in emphasis on training in the light of Soviet G-Gas capability in the past year." The same memo also addressed the radiological threat, calling it an "increasingly important part of field exercises."[157]

In addition to defensive training, the DoD developed doctrine for employment of chemical and biological weapons. As U.S. programs matured, the DoD considered chemical and biological agents as options for future battle and developed doctrine for their use. A 1950 Air Force war plan assumed that by 1954 strategic bombers would deliver nuclear and biological weapons on the same strike mission.[158] A 1962 memo from the Joint Chiefs of Staff directed the services to "immediately evaluate and modify operational plans as necessary, to provide for the specific employment of chemical and biological weapons, so as to be prepared for the use of these weapons if directed. Stockpiles of modern munitions should be strategically positioned to support these operational plans as soon as possible."[159]

By these actions, it is clear the United States perceived biological weapons as both a threat to the nation and a weapon to be used in future wars. The increases in defenses and weapons capabilities represent power-balancing actions by reducing vulnerability, while at the same time increasing offensive capability. However, the majority of the policies addressing biological weapons were joint policies—addressing chemical weapons and biological weapons in the same power equation.

Project 112

One of the most intriguing programmatic responses occurred towards the end of this time period. Under Secretary McNamara, a comprehensive review of the U.S. military was initiated. The 112th program to be reviewed was the chemical and biological program. From this review, a multi-year test program, Project 112, was developed. It is also important to note that this program was developed at the same time the Kennedy administration was investigating the "flexible response" national strategy.

Most of the information regarding Project 112 remains classified. Forced by Congress to give basic details of the program, the DoD revealed that it consisted of fifty-four named tests, each composed of a series of sub-tests. These tests involved either chemical agents or biological agents, sometimes live and sometimes simulated. Some tests even utilized human volunteers. While some of the imperialistic implications of the program have already been discussed, there is also an external threat component to the program as related in testimony.

In recent statements before Congress, the program was defended as purely defensive in nature, developed as a direct response to the external threat posed by the Soviet Union. For example, it was stated that "this project, conducted during the 1960s and through the early 1970s, had similar purpose in U.S. military efforts to remain a superpower during the Cold War," and also that "the results of the testing program were used to develop defense mechanisms against enemies' potential use of biological, chemical, or nuclear weapons."[160]

However, there was one reference to offensive testing when a member of the committee stated "but we were testing, at least in part, for offensive application, as you stated earlier, we stopped this when we changed our doctrine on the use of chemical weapons as an offensive tool."[161] A 1962 Chemical Corps memo also alluded to offensive and defensive considerations when it described the effects of the program to date as "increased awareness at various levels of command of the potential of an adequate CBR capacity, and an increased interest in the problems attendant to the achievement of this capability." The same memo also mentioned the financial benefits of the program for the Chemical Corps, such as new requirements from other services, issuance of money, advancements on multiple new munitions programs, and additional funding for production facilities.[162]

Summary of Tests Performed Under Project 112 (1963–1974)*

Year	Biological	Live Agent	Chemical	Live Agent
1963	4	0	2	1
1964	4	1	3	3
1965	3	0	7	6
1966	3	0	6	5
1967	3	2	1	1
1968	2	0	3	3
1969	3	1	3	1
1970	3	0	1	0
1971	No Tests		No Tests	
1972	No Tests		No Tests	
1973	1	0	0	0
1974	0	0	2	0
Totals	**26**	**4**	**28**	**20**

* Force Health Protection, 2003

While almost all information on this program remains classified, the DoD has published a website listing the type of test and date performed. From this data, twenty-six tests were biological in nature, four of which utilized live agents. Likewise, there were twenty-eight chemical tests, twenty of which use live agent.[163] The table also reveals the impact President Nixon's decision had on the testing program, as the program essentially ended in 1970. The ratio of chemical tests to biological tests is relatively even, although there is a higher prevalence of live-agent testing involving chemical agents. This balance is not often observed in other programs of the time, and may indicate a greater external threat influence over the program versus the chemical frame.

One other note of interest is that of those designed to test employment of an actual weapon delivery system, chemical agent tests outnumbered biological agent tests twelve to six. This disparity may indicate chemical weapons doctrine was more advanced, or it may be a continuation of the chemical frame behavior of intending to utilize chemical dispersal methods for biological agents.

Looking at the purpose of the tests, many are defensive in nature, designed to test the effectiveness of protective equipment. Some were developed directly from external threat, such as observations of Soviet long-range bombers equipped with heated bomb bays.[164] Many, though, showed the influence of Vietnam. There were several tests that examined the ability of chemical agents, as well as biological agents, to penetrate and disperse within jungle canopies, especially in the mid-1960s. Such tests indicate a strong external threat influence over the program, although it is not clear if the biological tests were conducted in a manner that would be indicative of a chemical frame.[165]

Financial Response

Changes in doctrine or programs are associated with changes in resource allocation. Realism predicts that resources will be allocated relative to the threat. It is possible to see changes in funding levels that correlate to some of the significant historical events already discussed.

The biological program suffered in resources immediately after World War II. For example, the number of personnel involved in the program dropped from four thousand to four hundred the year after the war ended.[166] The 1950 Ad Hoc Committee also noted the low level of resources, with specific references to Soviet biological capabilities and corresponding weakness in U.S. biological capabilities, while noting inadequacy in funding for biological weapons research.[167] At this point, the budget for the program was $5.6 million in 1950, $8.8 million in 1951 and $7.6 million for 1952.[168] The Ad Hoc report was issued just prior to the outbreak of the Korean War. The increased threat from the wartime environment helped secure some of the additional funding advocated by the report, as well as placing pressure on the Chemical Corps to accelerate implementation of the committee's recommendations.[169]

In the years after the Korean War, the Corps was faced with another drawdown. While statements have already been cited demonstrating concern over the external threat, budget and personnel allocations did not always correlate. In 1956, the Corps noted a $1.8 million decrease in funding, to the lowest level since 1952. The same report also noted the Corps was unable to fill five percent of its authorized positions.[170] As already discussed, in 1954 President Eisenhower changed U.S. policy in reference to first use of chemical and biological weapons. Requests for increased funding soon followed this announcement. In 1959, the Secretary for Research, Development, Test and Evaluation recommended a fivefold expansion over a five-year period.[171] In 1960, the recommendation was made to triple the investment in biological weapons, with a note that the entire CBR budget for 1960 of $35 million was one-thousandth of the defense budget.[172]

As already discussed, in 1961 President Kennedy increased emphasis on incapacitating agents, and also implemented Project 112. Some of the financial resources dedicated to the biological program as a result of this project included resuming the anti-crop program, starting work on Q fever and tularemia, establishing the Desert Test Center, and allocating $20 million for the Pine Bluff biological production facility and $2.3 million for the acquisition of broad-spectrum antibiotics.[173]

The increases in programs and associated testing were matched by increases in funding. In the years prior to Project 112 (1958–1960), funding averaged about $40 million per year.[174] In subsequent years, funding for the entire program doubled from a projected $206 million to $412 million for the 1964-1968 time frame, of which the biological program's share grew to $38 million in 1966.[175] This figure matched the entire chemical and biological program budget from only eight years prior.[176]

It is not possible to make an argument that the increases in funding were entirely based on external threat. The increase in funding associated with the Korean War could easily be predicted by realism. The increase in funding after President Eisenhower's change in doctrine could be explained by a technical definition of realism in that when the head of state changes policy, the state's organizations take action to follow the new policy. However, as Goldman stated, the military lobbied for the change (possibly by overselling incapacitating agents) in order to justify increases in funding, implying imperialism may have had a role in this increase.[177]

Finally, Project 112 may represent both external threat and imperialistic influences. It is possible to argue, as reflected in the cited Congressional testimony, that the project and its associated funding were in response to perceived external threat, clearly a realist-based interpretation. However, it is difficult to identify a historical event that brought about such a significant change in external threat to justify the massive increases. The best realist argument to be made is that the program was initiated due to a "weak" military and a need to catch up with the Soviet Union.

However, this program also began at the same time that President Kennedy was implementing the "flexible response" doctrine, which could be interpreted as a realist attempt to expand state power, as in some ways the President is the state. However, it is also possible to make an imperialistic-based interpretation. If the decision was arbitrary, or based on a new Secretary's interpretation of a military mission, the program begins to appear bureaucratic in nature. It is also possible that the military viewed flexible response as a new mission area, much as the Chemical Corps used the LAC mission to advocate for new funds. The incapacitating agents under development by the programs would fit well with this doctrine. Once established, this program would serve, as many government programs do, as a perfect way to perpetuate funding for testing and new weapon development.

Conclusions—Realism

Examining the data presented in this section, it is possible to find evidence that the United States did respond in some instances to the external threat as predicted by realism. When faced with a new threat, the state assessed its vulnerabilities and took steps to reduce them. Therefore, it must be concluded that external threat exerted some influence on the U.S. biological posture for this time period.

However, the fact that there is evidence for behavior predicted by realism does not necessarily mean that the influence exerted by external threat dominated the U.S. posture over this period. Evidence of realism dominance would include not only recognition of the threat, but a response based on the perceived severity of each individual threat. The intelligence acknowledged that the chemical threat was concrete, and the Soviet biological threat was assumed, but never conclusively proven.

A purely realist response to this threat picture would require a separation of the two distinct threats posed by biological agents and chemical agents. In the case of biological weapons, a realist response would be demonstrated by an allocation of resources relative to how the biological weapons threat ranked not only in relation to chemical weapons, but also to the nuclear and conventional threats facing the United States at the time.

Examination of the defensive programs does reveal a bias towards chemical weapons, possibly as a result of the external threat influence. What does not reflect the greater chemical threat is the fact that the majority of the behaviors are based on a combined threat. The presence of the combined threat is not predicted by the external threat model, but is associated with the chemical frame. Therefore, it is not possible to state that external threat was the dominant factor influencing U.S. posture for this time period. Instead, it is another example of input from one factor being executed through a chemical frame.

The Decision to End the Biological Program

Other than the decision to initiate a biological program, the decision to end the offensive program was the most significant event to affect U.S. biological posture. While some of the details surrounding this decision have already been discussed, a more detailed examination of this decision shows how all three theories interact, and ultimately how a chemical frame resulted in the elimination of the U.S. biological program.[178]

These events are significant to the realist argument, as the military now considered riot control agents and herbicides as important weapons due to the Vietnam War. The fight to retain these weapons was not only internal to the United States, but within the United Nations as well. In 1966, Hungary had proposed a resolution to the United Nations declaring any use of chemical or biological weapons a crime. The United States, and in particular the DoD, was against this resolution, as the JCS understood that it "politically imperiled current United States policies in the use of riot control, incapacitating, defoliant and anti-crop agents."[179] In subsequent correspondence, the military made sure the U.S. response was worded to discriminate between "poisonous" agents and "incapacitating agents," reflecting the priority placed on herbicides and tear gas by the DoD.[180]

While the U.N. resolution was ultimately amended, allowing the United States to continue its current employment strategy, this incident highlighted the importance the DoD placed on riot control and herbicides. The debate also foreshadowed the issues that would be raised two years later in an internal debate to determine the fate of the entire program.

The beginning of the decision to end the program coincided with the 1966 National Security Action Memorandum from the Joint Chiefs of Staff, which has already been discussed. Just as the military was advocating fewer restrictions on the use of chemical and biological agents—in particular incapacitating agents—a series of events brought the program under increased scrutiny from Congress and the public. The 1968 sheep kill in Skull Valley Utah, while not widely reported at the time, led to public concern and a demand for action when combined with revelations that the United States was dumping old chemical weapons in the ocean.[181] In response to Congressional pressure, President Nixon issued *National Security Study Memorandum (NSSM) 59* in May of 1969, directing a review of both chemical weapons and biological weapons. Subsequent to the issuing of the NSSM, a chemical accident in Okinawa forced the Army to reveal that it had chemical stockpiles in Japan and Germany, which were put in place without the express knowledge of the host governments.

Initially, the DoD responded to the review by advocating a position that increased the role of chemical and biological weapons in the national strategy, and retained the first use (with Presidential authorization) policy. However, the DoD was facing an increasingly negative public perception of the chemical and biological programs. As the different departments announced their positions, the DoD found itself the only advocate of such an increase in the role of these weapons.

As a review of both chemical and biological weapons was directed, the DoD also faced an internal debate over the effectiveness of biological weapons. While the JCS submitted a report reflecting the utility of chemical and biological weapons, the PSAC submitted a report stating that biological weapons were unreliable and less effective than chemical weapons, based on their relatively short shelf life.[182] Due to conflicting reports, Secretary Laird withdrew the JCS report and reassigned responsibility for the DoD assessment of biological weapons to the Office of International Security Affairs.

Tucker notes that the ISA office was understaffed and inexperienced in chemical and biological weapons, and thus relied heavily on the PSAC report to formulate the DoD position, moving it much closer to the position taken by the Department of State. At the same time, Congress had legislatively linked chemical agents and biological agents as one program through the McIntyre Amendment, which placed prohibitive restrictions on funding and oversight of the programs, with no distinction between the two weapons classes.

By the time the principal agencies met to make a final decision, the only attendee in favor of retaining both chemical weapons and biological weapons was the Joint Chiefs of Staff. General Wheeler quickly realized he was outnumbered, as "the civilian members of the NSC, however, quickly formed a united front in opposing the arguments of the Joint Chiefs."[183] The best the military could do at the meeting was to make a stand over retaining riot control and herbicide agents, sacrificing the biological program and the offensive use of chemical weapons to do so. On November 25, 1969, President Nixon announced the final decision by renouncing use of all methods of biological warfare, lethal and non-lethal, under all circumstances. The President also stated that the United States would continue to have a defensive research program.[184]

While it would seem this declaration ended the problem, the issue of biological toxins was then raised. The JCS expressed a desire to retain production of incapacitating toxins, recommending they be considered chemical weapons.[185] This resulted in President Nixon issuing National Security Study Memorandum 85, directing a review of U.S. policy towards toxins.[186] After debate on the ability to synthesize toxins, and the similar production methods of bacterial agents and toxins, the President decided the U.S. policy on toxins would mirror his previous statement on biological warfare.

Looking at this particular decision point, it is possible to see how all three theories are at work, and how organizational frames played a significant role in the final decision. There are two significant realist components to the final decision. Most significantly, the military was heavily reliant upon herbicides and riot control agents in the Vietnam War. Relative to this concrete need, biological weapons, and even offensive lethal chemical weapons, were judged as less important, and were used by the military as bargaining chips in order to keep what it considered its most important weapon at the time.

A second realist component is based on the results of the Project 112 tests, which demonstrated the potential of biological weapons. While it has never been officially stated, several authors have proposed that the United States was actually frightened by the biological capability it had developed, and intentionally gave up the biological program. The logic behind this argument was partly due to disinformation, and partly to prevent a full-scale international biological arms race.

When discussing the internal debates, Tucker demonstrates how imperialistic behaviors also influenced the decision making process:

> Laird had become increasingly concerned that the NSSM study process was out of control. … Because the NSSM study groups were autonomous, it was not clear to him how the various issues and options were being chosen and why. Laird worried that the opinions would simply reflect the prejudices and parochial interest of bureaucrats far down the chain of command.

Noting the decision to move the report from the JCS to the ISA, Tucker says, "Laird … intended to serve only one term as secretary in pursuit of a defined set of policy goals, he did not hesitate to take an independent position from those of the uniformed military. On the issues of biological weapons, he showed no 'downward loyalty' to the Army Chief of Staff."

Finally, in language reflective of Wilson's arguments about the power of constituencies, he identified a "lack of institutional support for biological warfare from within the armed services—with the sole exception of the Army, which defended the interest of the Chemical Corps" and noted that "unlike nuclear and chemical weapons, biological weapons did not have powerful constituencies either inside or outside the U.S. government."[187]

While these examples show the interplay of external threat and imperialism within the decision process, an important point to remember is that the decision to terminate the biological program arose from a series of chemical accidents. Prior to the accidents, the public and even members of the countries' leadership were unaware of the biological program. However, the response to the accidents was to review the "chemical/biological" program, an action strongly indicative of a chemical frame. It is also interesting to note that although the NBC term is ubiquitous within the military, nuclear weapons were not included for review, showing the severability of nuclear, but the close chemical/biological association.

It can also be argued that because of the significant effort that went into drafting this policy, at least some high-level officials realized the difference between chemical agents and biological agents and, at least temporarily, broke the chemical frame. Leading up to the decision, one official suggested, "CBW" be broken into seven distinct categories to facilitate decision-making.[188] President Nixon officially broke the frame (at least on paper) by executive order on November 25, 1969, deciding that "the term Chemical and Biological Warfare (CBW) will no longer be used. The reference henceforth should be to the two categories separately—The Chemical Warfare Program and the Biological Research Program."[189]

Secretary Laird then expanded on this guidance by issuing his own directive on CBW terminology. He stated it "connotes a general interrelationship between chemical and biological fields when, in fact, no such relationship exits." He further stated that "it is virtually impossible however, to conceive of the circumstances in which chemical warfare and biological warfare, in a simultaneous or joint way, would be planned for and implemented." Finally, he addressed the perception perpetuated by the combined term, stating its use "will continue to confuse the American public, our allies, our potential adversaries, and even those in our own government responsible for defense programs."[190] The fact that officials in such high positions within the U.S. government felt the need to issue directives on how these two programs were to be viewed indicates how strong and widespread the chemical frame had become.

To summarize the interaction of the three theories in this decision, it was the chemical frame that brought the biological program into the review, as it was viewed as part of the chemical program. Then, after the military was forced to assess the benefits of both programs, the frame was broken in favor of the need to address an external threat (Vietnam), which was solved in a bureaucratically negotiated compromise.

Conclusions—1946–1970

The overall conclusion drawn for this time period is that a chemical frame exerted the strongest influence over the status of U.S. biological posture. Even when other factors were influencing U.S. actions, these actions were often executed through a chemical frame.

This period in history saw the rise of the Soviet Union and the beginning of the Cold War. The United States faced an enemy superpower with the capability to cripple it in a direct military confrontation. Not surprisingly, this period was characterized by significant concern over the strengths of the two nations in all aspects of power—a fertile environment for realist theory. Yet analysis of the data indicates organizational frames dominated the development of U.S. biological doctrine over this time period.

There is evidence that external threat did influence aspects of U.S. policy over this period. The nation exhibited concern over perceived threats, and responded by strengthening itself relative to those threats in classic realist fashion. The country allocated resources, trained forces, and created defenses to address the Soviet threat. However, when looking specifically at the execution of these actions, as reflected in the relationship between chemical agents and biological agents, they were often considered a single threat, providing evidence that a chemical frame was shaping the actions taken in response to the external threat.

There is evidence of bureaucratic politics influencing biological posture over this time period as well. It is possible to argue that Project 112, first-use doctrine, and Large Area Coverage all have imperialistic components. Definite imperialistic behaviors were observed in the decision to end the biological program. However, the same observation that negates the external threat argument also negates the imperialistic case. While some of the actions are imperialistic, they involve a combined chemical/biological program, again demonstrating an instance where actions taken under one theory were ultimately executed through a chemical frame.

The most consistent observation is that regardless of the threat, program, or decision, the chemical program and the biological program were viewed as one and the same. The close relationship between chemical agents and biological agents provides the greatest support to the theory that a chemical frame was influencing the trajectory of the U.S. biological posture. The preponderance of observed behaviors in organizational structures, hardware development, official statements, research programs, and priorities are consistent with the behaviors predicted by the organizational frames model.

Therefore, a reasonable interpretation of this time period is that while the nation itself responded in a realist manner, the resulting doctrine is reflective of a chemical frame. This is possible when the individual organizations, which may have used external threat data to justify their programs, were composed of individuals under the influence of a chemical frame. As a result, the hardware produced and the working-level execution of executive orders occurred in a chemical frame environment, ultimately producing a U.S. biological posture most reflective of a chemical bias and not optimally configured to address the biological threat.

Notes

1. Dorothy L. Miller, *History of Air Force Participation in Biological Warfare Program 1944–1951* (Wright-Patterson AFB: Air Materiel Command, 1952).

2. Reid Kirby, "The Evolving Role of Biological Weapons," *Army Chemical Review* (July–December 2007): 22–26.

3. Ibid.

4. David I. Goldman, "The Generals and the Germs: The Army Leadership's Response to Nixon's Review of Chemical and Biological Warfare Policies in 1969," *The Journal of Military History* 73 (2009): 531–569.

5. *U.S. Army Activity in the U.S. Biological Warfare Programs* (Washington, DC: Department of the Army, 1977).

6. As will be discussed in more detail later, all U.S. policies at this time were chemical/biological strategies, and not specific to use of biological weapons.

7. Chemical Corps Board, "Summary of Historical Record, 1 Jul 1947 to 31 Dec 1947," accessed 29 July 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/servlets/purl/16009079-gqOqUx/16009079.pdf.

8. Ibid.

9. Chemical Corps Procurement Office, "Proposed Contract for G Agent Manufacturing and Munitions Loading Plant," 6 July 1950, accessed 5 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1950_ProposedContractforGAgentmanufacturingandMunitionsLoadingPlant.pdf.

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13. Ibid.

14. "Recommendations of Research Council, Result 17–19 February Meeting," 25 April 1949, accessed 1 September 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/servlets/purl/16009058-7w1N2H/16009058.pdf.

15. A regular pattern in many countries is to attempt to disperse biological agents using the same techniques utilized for chemical agents, which were initially based on bursting-type weapons.

16. Chemical Corps Advisory Board, "Minutes of Meeting" (see ch. 5, n. 12).

17. "Minutes of Meeting of the Research Council of the Chemical Corps Advisory Board," 16 June 1948, accessed 29 July 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/index.jsp.

18. O. Miller, "Ad Hoc Advisory Committee on Chemical Corps Mission and Structure," 1955.

19. Chemical Corps Historical Office, *Summary of Major Events and Problems, Fiscal Year 1956* (U.S. Army Chemical Corps, 1956).

20. Department of the Army, *Field Manual 21-40: NBC Defense* (Washington, DC: U.S. Government Printing Office, 1977).

21. Dorothy L. Miller, *History of Air Force Participation in Biological Warfare Program 1951–1954* (Wright-Patterson AFB: Air Materiel Command, 1957).

22. Miller, *Biological Warfare Program 1944–1951* (see ch. 5, n. 1).

23. *Training Circular No. 16: CBR Training for POR Qualifications* (Washington, DC: Department of the Army, 1954).

24. *The United States Army Chemical, Biological and Radiological Weapons Orientation Course* (Washington, DC: The United States Army, 1961).

25. *Army Subject Schedule 3-54B20: MOS Technical Training and Refresher Training of Decontamination Specialists MOS 54B20* (Washington, DC: Department of the Army, 1967).

26. Department of the Army, *Manual 101-40: Armed Forces Doctrine for Chemical and Biological Weapons Employment and Defense* (Washington, DC: U.S. Government Printing Office, 1964).

27. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

28. "The Chemical Corps School Report on LOGEX-5," 14 May 1954, accessed 29 July 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/index.jsp; Army, *Weapons Orientation Course* (see ch. 5, n. 24.).

29. Chemical Corps Technical Committee, "Minutes of Meeting 2, 29 July 1954" accessed 28 June 2011 from Federation of American Scientists, http://www.fas.org/blog/cw/document-archive/documents-by-type/historical-documents.

30. Neil Burnett, "Biological Weapons Systems" (thesis, United States Army Command and General Staff College, 1963).

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33. Omar N. Bradley to the Secretary of Defense, memorandum, “Chemical Warfare Policy,” 18 January 1950, National Security Archive, Washington, DC.

34. R. Lovett, “Department of Defense Directive 200.01-ITS,” 21 December 1951, accessed 29 July 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/index.jsp.

35. *Pamphlet 3-2: Research in CBR* (Washington, DC: Department of the Army, 1960).

36. National Security Council, meeting brief, “BW detection and Identification,” 26 October 1960, accessed from the Declassified Documents Reference System.

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38. W. Richardson to Commandant of the Marine Corps, memorandum “Joint Doctrine for Chemical and Biological Weapons Employment and Defense,” 30 March 1962.

39. Director of CBR Operations, *Performance Characteristics of Some Chemical and Biological Weapons Systems* (Washington, DC: Department of the Army, 1962).

40. *Chemical and Biological Warfare Research and Development Funding* (Washington, DC: Department of Defense, 1970).

41. C. E. Hutchin to the Secretary of Defense, memorandum, “Chemical, Biological and Radiological Warfare,” 15 December 1951, Chemical and Biological Warfare Collection, National Security Archive, Washington, DC.

42. “Report of the Secretary of Defense’s Ad Hoc Committee on Chemical, Biological and Radiological Warfare,” 30 June 1950, accessed 2 August 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/index.jsp.

43. Ibid.

44. Director of Defense Research and Engineering, "Summary Agenda, 20th Meeting Defense Science Board," 10–11 May 1961.

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58. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

59. Miller, *Biological Warfare Program 1944–1951* (see ch. 5, n. 1).

60. William M. Creasy, "Presentation to the Secretary of Defense's Ad Hoc Committee on CEBAR," 24 February 1950, RG 218, box 207, Chemical and Biological Warfare Collection, National Security Archive, Washington, DC. This reference was to the more hardy biological agents, but is still indicative of a chemical frame.

61. Chemical agents will denature over time as well, but at a significantly slower rate than biological weapons.

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74. U.S. Army Surgeon General, “Medical Department: Research and Development Program,” 1947, National Archives, Washington, DC.

75 . Committee on Medical Sciences, Research and Development Board, Department of Defense, “Integrated Technical Estimates,” 23 May 1950.

76. F. Pace, to the Secretary of Defense, memorandum, “Biological Warfare Defense in the Far East,” 22 Apr 1952, RG 330, box 367, Records of the Office of the Secretary of Defense, National Archives and Records Administration, College Park, MD.

77. Tamplin, *Anti-Personnel BW/CW* (see ch. 5, n. 66).

78. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

79. Creasy, “Presentation” (see ch. 5, n. 60).

80. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21); Tamplin, *Anti-Personnel BW/CW* (see ch. 5, n. 66).

81. Weapons Systems Evaluation Group, Office of the Secretary of Defense, “WSEG Report No. 8: Characteristics of Antipersonnel BW Weapons Systems and Special Considerations Relevant to Operations Against Personnel,” 15 July 1952.

82. Chemical Corps Advisory Committee, “Report of Recommendations,” 15 December 1958.

83. E. Johnson to the Secretary of Defense, memorandum, "Chemical and Biological Warfare Defensive Material," 6 Aug 1952.

84. Medical treatment of nerve agent exposure is possible, but involves the immediate administration of an antidote rather than the type of medical diagnosis and treatment that would follow a disease model.

85. A. R. Hylton, "The History of Chemical Warfare Plants and Facilities in the United States," 13 November 1972, accessed 13 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1972_Chemical%20arfare PlantsAndFacilitiesUSA.pdf.

86. "Minutes of Meeting of the Research Council of the Chemical Corps Advisory Board," 10 January 1947, accessed 29 July 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/index.jsp.

87. Creasy, "Presentation" (see ch. 5, n. 60).

88. Ibid.

89. *Pamphlet 3-2* (see ch. 5, n. 35).

90. George H. Milly and E. W. Hollingsworth, *Military Employment of Chemical and Biological Weapons* (Edgewood Arsenal, MD: Army Chemical Center, 1963).

91. "Recommendations of Research Council 17-19 Mtg," 25 April 1949, accessed 1 September 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/ opennet/servlets/purl/16009058-7w1N2H/16009058.pdf. The Chemical Corps also had responsibility for flame, smoke, and obscurants, hence the concern with development of a flamethrower.

92. As with most other major programs of this nature, Scorpion and Wasp identified issues with chemical and biological weapons, as would be expected from a chemical frame.

93. Chemical Corps Technical Committee, "Minutes of Meeting, No. 27," 30 March 1962, accessed 1 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1962_chemicalcorpstechnicalcommittee.pdf.

94. Kirby, "The Evolving Role" (see ch. 5, n. 2).

95. Ibid.

96. Chemical Corps Advisory Board, "Minutes of Meeting" (see ch. 5, n. 86).

97. William C. Patrick, "The U.S. Offensive Biological Warfare Program, 1943–1969," in *Global Biosecurity: Threats and Responses,* ed. Peter Katona et al. (New York: Routledge, 2010), 1–4.

98. Miller, *Biological Warfare Program 1944–1951* (see ch. 5, n. 1).

99. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

100. *Brucella suis* is the causative bacterial agent for brucellosis. Symptoms of the disease appear approximately one week after exposure. The fatality rate is relatively low (5%), but the disease is debilitating, causing fever, malaise, and joint pain.

101. L. Coggeshall, "WSEG Report No. 8: An evaluation of Offensive Biological Warfare Weapons Systems Employing Manned Aircraft, Recommendations and Conclusion of the Ad Hoc Medical Committee," 1952, RG 330, box 366, Records of the Office of the Secretary of Defense, National Archives and Records Administration, College Park, MD.

102. W. Whitman, to the Secretary of Defense, memorandum, "WSEG Report on BW," 23 July 1952, RG 330, box 366, Records of the Office of the Secretary of Defense, National Archives and Records Administration, College Park, MD.

103. W. Whitman, to the Secretary of Defense, memorandum, "Research Program on BW," 14 August 1952.

104. Herbert Scoville to Paul Weiss, memorandum, "Comments on Draft BW-CW Panel Report," 8 May 1959, Office of the Special Assistant for Science and Technology, Eisenhower Library, Abilene, KS.

105. Miller, *Biological Warfare Program 1944–1951* (see ch. 5, n. 1).

106. Pound for pound, biological agents offer the greatest efficiency in area contaminated in relation to amount of material required.

107. Chemical Corps School, "Special Text 3-162" (see ch. 5, n. 70). The test focused mainly on the coverage of particulates released at high level. While the tests revealed coverage a thousand miles from the release point, little evidence is available to show that any tests were conducted to evaluate the ability of agents to survive that long in the environment.

108. Scoville, memorandum (see ch. 5, n. 104); Miller, *Biological Warfare Program 1944–1951* (see ch. 5, n. 1).

109. J. R. Mares to J. R. Killian, memorandum, “Biological and Chemical Warfare,” 4 June 1959, accessed from the Declassified Documents Reference System.

110. National Security Council, “BW Detection and Identification” (see ch. 5, n. 36).

111. This statement reinforces the misunderstanding of the nature of biological weapons. While the requesting agency may have understood that only biological weapons are truly “clandestine,” the individual preparing the briefing notes did not appreciate that it is difficult to have a clandestine nuclear or chemical attack.

112. Leo P. Brophy, Wyndham D. Miles, and Rexmond C. Cochrane, *United States Army in World War II: The Technical Services—Chemical Warfare Service: From Laboratory to Field* (Washington, DC: Center of Military History, 2010).

113. F. Seller to All Branch Chiefs, memorandum, “Study of RDB Report,” 6 April 1953.

114. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

115. Chemical Corps Advisory Board, “Minutes of Meeting” (see ch. 5, n. 86).

116. F. J. Blouin, “Note by the Secretaries to the Holders of J.C.S. 1937/118,” 30 August 1960.

117. M. Stubbs, memorandum, “DOD Project 112—Biological and Chemical Weapons and Defense Programs,” 8 May 1962.

118. From a research standpoint, the move to Army Materiel Command represents a significant absence of subsequent data, as AMC committee records are still classified.

119. Chemical Corps Advisory Board “Minutes of Meeting” (see ch. 5, n. 86).

120. Chemical Corps Technical Committee, “Project Data Sheets,” 1954, accessed 14 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1957_BWdryagentdisseminator.pdf.

121. Brophy, et al., *From Laboratory to Field* (see ch. 5, n. 112).

122. J. Smart, “Sigmund R. Eckhaus, Transcript of History Interview,” 24 December 1985, accessed 2 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1985_SigmundREckhausinterview.pdf.

123. Goldman, “The Generals and the Germs” (see ch. 5, n. 4).

124. Ad Hoc Committee, “Report” (see ch. 5, n. 42).

125. C. Wilson, “Department of Defense Directive 3145.5: Chemical (Toxic) and Biological Warfare Readiness,” 5 March 1954.

126. R. Robertson, “Department of Defense Directive 3145.1: Chemical (Toxic) and Biological Warfare Readiness,” 6 October 1956.

127. Goldman, “The Generals and the Germs” (see ch. 5, n. 4).

128. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

129. *U.S. Army Activity* (see ch. 5, n. 5).

130. National Security Council, “BW Detection and Identification” (see ch. 5, n. 36).

131. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

132. D. J. Wiseman, “Special Weapons and Types of Warfare,” 1951, accessed 5 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1951_Specialweaponsandtypesofwarfare.pdf.

133. Sheldon H. Harris, *Factories of Death: Japanese Biological Warfare, 1932–45 and the American Cover-Up* (New York: Routledge, 2002).

134. Miller, *Biological Warfare Program 1944–1951* (see ch. 5, n. 1).

135. Ad Hoc Committee, “Report” (see ch. 5, n. 42).

136. *NIE–18: The Probability of Soviet Employment of BW and CW in the Event of Attacks on the U.S.* (Washington, DC: Central Intelligence Agency, 1951).

137. Central Intelligence Agency, “Intelligence Evaluation of Biological Warfare,” 10 April 1952, accessed October 2011 from Freedom of Information Act Electronic Reading Room, http://www.foia.cia.gov/best-of-crest/CIA-RDP80R01731R002900470095-0.pdf.

138. Ibid.

139. Chemical Corps Technical Committee, "1954 Project Data Sheets," 14 May 1954, accessed 6 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1954_CWfieldtesting&technology.pdf.

140. North American Air Defense Command, "Biological and Chemical Warfare," 22 August 1960, accessed 14 Jul 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1960_Biological&ChemicalWarningSystems.pdf.

141. Herbert Scoville to Paul Weiss, memorandum, "Comments on Draft BW-CW Panel Report," 8 May 1959, Office of the Special Assistant for Science and Technology, Eisenhower Library, Abilene, KS.

142. *Pamphlet 3-2* (see ch. 5, n. 35).

143. R. Lovett to the Director of Central Intelligence, memorandum, "Biological Warfare Intelligence," 16 August 1952, RG 218, box 152, Records of the U.S. Joint Chiefs of Staff, National Archives and Records Administration, College Park, MD.

144. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

145. Director of Central Intelligence, "Soviet Chemical and Biological Warfare Capabilities," 13 February 1969, accessed 31 October 2011 from Digital National Security Archive.

146. Jonathan B. Tucker, "A Farewell to Germs: The US Renunciation of Biological and Toxin Warfare," *International Security,* 27, no.1 (2002): 107–148.

147. C. E. Hutchin to the Secretary of Defense, memorandum, "Chemical and Biological Warfare Readiness," 25 April 1952, accessed from The National Security Archive, http://nsarchive.gwu.edu/radiation/dir/mstreet/commeet/meet4/brief4.gfr/tab_l/br4l1d.txt. This date seems to slip with each new program, as will be evidenced in this section. The continual change in the expected date of operational readiness could be due to technical complications; it could also reflect that the country was only paying lip service to the external threat, and not actually allocating the appropriate resources to fully implement the programs.

148. J. Baar, "Army Seeks Poison Gas Missiles," 16 May 1960, accessed 2 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1960_ArmySeeksPoisongas.pdf.

149. Chemical Corps Technical Committee, "Minutes of Meeting 2" (see ch. 5, n. 29).

150. "Department of Defense Directive: Chemical (Toxic) and Biological Warfare Readiness," 5 March 1954, accessed 3 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1954_ChemicalandBiologicalwarfarereadiness.pdf.

151. Chemical Corps Technical Committee, "Minutes of the Meeting, No. 2.," 10 June 1955, accessed 29 June 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1955_minutesofmeeting_chemicalcorpstechnicalcommittee_%20V-Agents.pdf.

152. Chemical Corps Technical Committee, "1954 Project Data Sheets" (see ch. 5, n. 139).

153. Kirby, "The Evolving Role" (see ch. 5, n. 2). Two items of note in regards to this office: first, it is a chemical/biological office reflective of a chemical frame; second, it was an Air Force organization, and primary responsibility for biological weapons remained with the Army.

154. Hutchin, memorandum (see ch. 5, n. 147).

155. Office of the Adjutant General, "*Chemical and Biological Warfare,"* 9 July 1954, accessed 5 Jul 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1954_ChemicalandBiologicalWarfare.pdf.

156. "Department of Defense Directive" (see ch. 5, n. 150).

157. Chemical Corps Technical Committee, "Minutes of Meeting 2" (see ch. 5, n. 29).

158. Miller, *Biological Warfare Program 1944–1951* (see ch. 5, n. 1).

159. Joint Chiefs of Staff, "Memorandum" (see ch. 5, n. 37).

160. *Serial No. 107-43: Military Operations Aspects of SHAD and Project 112: Hearing, Before the Subcommittee on Veteran's Affairs,* 107th Cong. (Washington, DC: U.S. Government Printing Office, 2002); Committee on Veterans Affairs, *House Report 108-213: Health Care for Veterans of Project 112/Project SHAD Act of 2003,* 108th Cong. (Washington, DC: U.S. Government Printing Office, 2003).

161. *Serial No. 107-43* (see ch. 5, n. 160).

162. Marshall Stubbs, "Pentagon Ponders Armed Forces Special Weapons Agency to Boost CBR Warfare," *Army, Navy, Air Force Journal* (1962): 65–67.

163. These are the numbers of named test programs, each consisting of several sub-tests. The total number of tests performed could easily range from five hundred to over one thousand.

164. Heated bomb bays would indicate the aircraft was modified to carry biological agents that would degrade if exposed to ambient conditions at flight altitude.

165 . Force Health Protection, "Chemical-Biological Warfare Exposures," 2 December 2003, accessed 7 March 2012, http://fhp.osd.mil/CBexposures/factSheets.jsp.

166. Miller, *Biological Warfare Program 1944–1951* (see ch. 5, n. 1).

167. Ad Hoc Committee, "Report" (see ch. 5, n. 42).

168. Miller, *Biological Warfare Program 1951–1954* (see ch. 5, n. 21).

169. Department of the Army, *NBC Defense* (see ch. 5, n. 20). Interestingly, there is little reference to the Korean War in the available data.

170. Chemical Corps, *Summary* (see ch. 5, n. 19).

171. *U.S. Army Activity* (see ch. 5, n. 5).

172. *Pamphlet 3-2* (see ch. 5, n. 35).

173. *U.S. Army Activity* (see ch. 5, n. 5).

174. *Chemical and Biological Warfare* (see ch. 5, n. 40).

175. Goldman, "The Generals and the Germs" (see ch. 5, n. 4).

176. *U.S. Army Activity* (see ch. 5, n. 5). The biological program was still receiving fewer resources than the chemical program, as this number is only one-third of the entire program budget of $115 million for 1966.

177. Goldman, "The Generals and the Germs" (see ch. 5, n. 4).

178. Unless otherwise cited, the history of this decision is derived from articles by Goldman (see ch. 5, n. 4) and Tucker (see ch. 5, n. 146).

179. E. Wheeler to the Secretary of Defense, memorandum, "Hungarian Resolution on the Use of Poison Gas," 15 November 1966.

180. L. J. Kirn to the Chairman, Joint Chiefs of Staff, memorandum, "Hungarian Resolution on the Use of Poisonous Gasses," 15 Nov 1966.

181. This practice was referred to as CHASE, which stands for Cut Holes And Sink Em. Under this program, old munitions were loaded on obsolete ships, which were then towed out to sea and sunk.

182. Tucker, "A Farewell to Germs" (see ch. 5, n. 146).

183. Ibid.

184. Henry Kissinger, "National Security Decision Memorandum 35: United States Policy on Chemical Warfare Program and Bacteriological/Biological Research Program," 25 November 1969, accessed 11 March 2015 from Federation of American Scientists, http://fas.org/irp/offdocs/nsdm-nixon/nsdm-35.pdf.

185. National Security Council, "Decision Index: Arms Control and Disarmament," 15 June 1970.

186. Kissinger, "Memorandum 35" (see ch. 5, n. 184).

187. Tucker, "A Farewell to Germs" (see ch. 5, n. 146). This example highlights a danger with increased autonomy. While retaining control gave the Chemical Corps power, it also prevented the other services from developing a strong investment in the program, which meant they had much less to lose when it was identified for cuts and made little effort to fight for the program.

188. Morton Halperin to Dr. Kissinger, memorandum, "U.S. Policy, Programs and Issues on CBW," 28 August 1969, box 817, folder 4, Nixon Presidential Materials, National Security Council Files, National Archives and Records Administration, College Park, MD.

189. Kissinger, "Memorandum 35" (see ch. 5, n. 184).

190. Laird, "Memorandum for The Secretary of State," 9 December 1969, accessed 30 October 2011 from Digital National Security Archive.

CHAPTER 6

The Cold War to the First Gulf War (1971–1991)

> In the run-up to Operation Desert Storm in 1990, the Department of Defense (DOD) had no systematic understanding of or approach to prosecuting a regional war against an adversary armed with and prepared to use nuclear, biological, or chemical weapons.
>
> —Bernstein, Caves, and Carus, *Countering Weapons of Mass Destruction*[1]

Historical Setting

As this period began, the biological weapons community was being forced to adjust to a radical change in U.S. biological posture, as President Nixon had just issued his executive order to end the offensive program. Evidence of the effects of such a change would be expected in the years following the decision.

The conclusion from the previous chapter was that a chemical frame was the major factor influencing the development of U.S. biological posture. As this frame appeared strong and well entrenched, there is reason to believe it would continue through this time period as well. However, there is reason to expect its dominance might be challenged.

The debate prior to President Nixon's decision forced many high-ranking individuals to become familiar with the U.S. chemical and biological programs. At least in the upper levels of government, the frame had been broken on paper by specific references to distinct chemical programs and biological defensive programs. If high-level interest in these policies continued, it should have eventually trickled down into all levels of the program, lessening the influence of the frame.

This period witnessed several historical events that would be expected to influence the effects of the factors being examined in this analysis. The first few years of this period saw the United States withdrawing its forces from Vietnam. The military and the nation were demoralized, and there was little desire to invest in the military, creating a hostile environment for imperialistic behaviors.

As the United States was withdrawing from Vietnam, the Chemical Corps faced the most serious challenge to its existence thus far: in 1973, the Army Chief of Staff recommended to Congress that the Corps be disbanded. The Corps received little input into the plan, and morale dropped after the announcement, with approximately one-third of the Chemical Officers leaving the Corps for other career fields. The reasoning behind this plan was best expressed by General Abrams: "The combat services were the ones that had to live and die on the battlefield, and it was their responsibility—not some technician's responsibility—to make sure they had defensive capability against CBW agents."[2] As Mauroni summarizes, the Corps had become "too technical."

Although the Army desired to disband the Chemical Corps, it was up to Congress to officially act upon the recommendation. Congress took no immediate action, and while they were debating the issue, another Arab-Israeli war began in October of 1973. This war was significant in that the Arab forces were equipped with modern Soviet equipment, and many used the war as a proxy to evaluate the relative effectiveness of U.S. and Soviet weapons.

Of particular significance to the biological program was the massive amount of Soviet chemical defensive equipment, such as protective suits, gas masks, and nerve antidotes found on the battlefield. The presence of this equipment alarmed the Israelis and caused the United States to reassess its view of the threat from Soviet chemical weapons and, to some extent, biological weapons. Plans to eliminate the Corps were put on hold while the Army conducted studies on the problem. In 1976, the Army decided to keep the Corps and initiated plans to rebuild the personnel base, which had been decimated over the previous few years.

Another notable event took place in 1974, when Congress ratified the 1925 Geneva Protocol on "Asphyxiating, Poisonous or Other Gases." A few months later, in 1975, President Ford issued *Executive Order 11850*, which modified U.S. policy on the use of chemical weapons, renouncing the first use of herbicides and riot control agents, which had been strongly defended by the military prior to President Nixon's 1969 decision to end the offensive biological weapons program.

Another important diplomatic event took place when the Biological Warfare Convention entered into force in 1975. While the United States has generally regarded this treaty as flawed and unverifiable, it did not significantly alter the U.S. position on biological weapons, as President Nixon had already disavowed any use of such weapons. However, the Congressional debate and interests associated with the two treaties could serve as focusing events, reinforcing the distinction between chemical weapons and biological weapons.

As the Arab-Israeli War had shocked the United States regarding chemical weapons, an accident in the Soviet city of Sverdlovsk served as a similar shock to how the United States viewed the biological threat—in 1979, an outbreak of inhalation anthrax was reported. While the Soviets blamed the outbreak on contaminated meat, to western intelligence it appeared to be the result of an accident at a Soviet biological weapons production plant. At about the same time, the United States was also concerned with "yellow rain"—an alleged use of Soviet-supplied biological toxins in Laos. This concern was amplified by the use of Soviet-supplied chemical weapons in Laos, Kampuchea, and Afghanistan in the late 1970s.

The external threat associated with the Soviet Union and the Cold War continued for almost all of this period, punctuated by times of higher tensions, such as the Soviet involvement in Afghanistan and the buildup of the U.S. military initiated by President Reagan. The intensity of the Cold War did begin to wane in the latter years of this period, as the Soviet Union faced severe economic challenges and initiated a series of openness policies, resulting in a gradual loss of influence over the Eastern Bloc countries.

As the United States began to relax its posture, it found itself at war with Iraq over the invasion of Kuwait. In the run-up to this war, the U.S. military realized it was facing an enemy with a known chemical capability and a suspected biological capability. It also realized it was understocked in defensive equipment, and possessed no fielded capability to detect biological weapons. This lack of defensive capability sets the stage for the final period of analysis in the next chapter.

Historical events during this period suggest potential involvement from all three theories. In addition to a possible continuation of the already strongly established chemical frame, there is reason to believe external threat would influence U.S. posture over this time period. The Cold War proxy conflicts, biological accidents, and military build-ups could all serve as catalysts to alter national policy in response to external threat. As the United States became increasingly suspicious of a Soviet biological program, a realist would expect to see a corresponding change in U.S. defensive posture.

There is also reason to believe that imperialism influenced U.S. posture over this period. While the 1970–1975 time frame was bleak for the Chemical Corps, the United States changed course towards the end of the 1970s and began to rebuild the program, and the military in general. The associated increase in resources could create an environment conducive to imperialistic behavior.

As with the previous period of analysis, it is possible to observe behaviors associated with all three theories. However, the continued strong presence of a combined chemical/biological approach in most areas of analysis indicates the chemical frame ultimately dominated this time period.

Organizational Frames and Biodefense, 1971–1991

The argument made for the previous time period was that a chemical frame significantly influenced the direction of the DoD’s biological program. It was also noted that the national debate over the fate of the chemical program and the biological program broke the frame for those in high levels of the government. One might expect that with such attention the frame would be broken at the lower levels as well. However, many of the previously observed behaviors associated with a chemical frame continued in this next time period as well. Within the defensive programs of this period, behaviors predicted by organizational frames were still prevalent, including combining chemical and biological threats in training and doctrine, combining weapons in policy development, assigning unequal priority, and developing combined hardware and defensive measures.

These behaviors could also be observed in organizations outside the immediate chemical and biological weapons defense communities. Evidence of a combined chemical/biological threat in sources such as Navy training programs, general Army operational doctrine, and Congressional testimony demonstrates that a chemical frame had reasserted its influence throughout the entire Department of Defense and national leadership.

It is important to note that over most of this period both the Soviet Union and the United States maintained overt chemical programs, while claiming they were complying with the ban on biological weapons. This perceived difference in threat could explain some of the observed bias towards chemical weapons, as would be expected if rational choice was influencing the defensive program.

Today we know that the Soviets maintained an extensive offensive biological program during this time. The intelligence estimates cited later in this section indicate there was a basic and growing suspicion that the Soviets were maintaining an offensive biological program. This information would have been available to the decision makers of the time, and therefore one would expect concern over a Soviet biological weapons threat, as well as the chemical threat. However, allocation of resources over this period shows a strong bias towards chemical agents, despite available data indicating a substantial threat from biological weapons.

Biased Allocation of Resources

Looking at the overall effort allocated to biological defense during this period, there is an inherent bias towards chemical programs beyond what would be expected from a rational actor response. With military expenditures, for example, funding levels from 1970–1976 were relatively flat for both national defense (approximately $100 billion) and for chemical defense ($30–40 million), while the same period saw a steady decline in biological defense, as spending dropped from $20 million to $10 million, likely in part to President Nixon's 1969 policy decision.

Starting in 1976, both national defense spending and chemical defense spending began to increase. Spending on chemical defense increased from approximately $40 million in 1976 to $210 million in 1986, then fluctuated from $200 million to $280 million through 1992. In contrast, spending on biological defense remained flat at about $20 million through 1982, when it finally began to increase, reaching $80 million by 1987, where it remained through 1992. While both programs received substantial increases in funding, the increase in biological defense occurred eight years after the increase in chemical defense. In addition to timing, the magnitude of increase favored the chemical program, as the funds allocated to chemical defense increased sevenfold over 1976 levels, while funds for biological defense only increased fourfold.[3]

Part of this disparity may be explained by the timing of the 1973 Arab-Israeli War and the 1979 accident at Sverdlovsk. There was a corresponding rise in defense spending approximately three years after these events, which would be expected as a response to changing external threat. However, it does not explain the imbalance in the relative increase in funds for each program.

In addition to financial imbalance, a chemical frames theory predicts an imbalance in other resources, such as time and effort allocated to training. Generally, training for this period was regarded as poor. A 1975 report noted that since 1966, the "training program has been continuously degraded. The hours devoted to training have been reduced, and the quality of instruction has deteriorated."[4] Similar quotes are cited later from defense officials assessing the ability of U.S. troops to fight in a chemical environment in light of the impact of the 1973 war on the perceived chemical threat.[5]

A Navy training guide from 1972 highlights these behaviors.[6] Reflecting a chemical frame, this manual contained no specific biological threat or scenario, while addressing distinct chemical and nuclear scenarios. The training manual had seven recommended training stations: five specific to chemical agents, two specific to nuclear attack, and none specific to biological agents. Other sections also showed a similar bias, such as one on "Protective Measures" that had a "Nuclear" section and a "Chemical or Biological" section, "Ship Decontamination" being regarded as nuclear or "chemical and biological," and "Warning and Alarms" being taught as nuclear or "BW/CW."[7]

Similarly, in *Army Field Manual 21-48: Planning and Conducting Chemical, Biological, Radiological (CBR) and Nuclear Defense Training*, the recommended training scenarios show five chemical scenarios, four nuclear scenarios, four chemical/radiological/nuclear scenarios, eight chemical/nuclear/biological/radiological scenarios, and only one solely biological scenario.[8] There is even evidence that the Soviets were subject to the chemical frame. A Soviet training course reflected the same references to WMD or nuclear with a chemical/biological threat description, but did not mention biological weapons any more than U.S. documents.[9]

By 1985, the biological threat had become greater, yet the training bias remained the same. For example, the 1983 Command and General Staff syllabus contained a section on "NBC" operations. The description of this section addressed the impact of nuclear weapons, chemical weapons, smoke on the battlefield, NBC threat, CB clothing, and staff operations in an NBC environment, yet had no section dedicated solely to biological weapons.[10]

A nuclear, biological, and chemical training manual developed as a thesis for the Air Command and Staff College showed the same chemical frame.[11] In many cases, biological agents were not addressed at all. For example, the three threat scenarios listed under the "decontaminate your skin and personal equipment" task were a chemical attack, transit of chemical contamination, and exposure to nuclear fallout. Similarly, chemical attack scenarios were used to set the conditions for tasks addressing drinking and sleeping, changing protective gear, and unmasking. There was no scenario with a dedicated biological threat, and any time a biological agent was included, it was combined as a chemical/biological threat environment.[12]

While a preponderance of the training material was chemical-centric, there were some training materials that provided a balanced approach. An Army correspondence course in decontamination had equal lessons dedicated to chemical, biological, and radiological weapons. By addressing the distinct nature of biological agents, this course served as a counter to the chemical frame, showing that at least one training developer thought the differences between chemical and biological weapons warranted distinct chapters on both weapons.[13]

It is evident that the military was dedicating an unequal amount of time to chemical training relative to biological training, and was combining biological training with chemical training. While this imbalance in time and effort could be because chemical weapons represented a greater external threat, the combined chemical/biological view is not associated with external threat, but rather is prescribed by a chemical frame.

Perceptions

In addition to the manifestation of the chemical frame in allocation of resources, evidence of the frame would be expected in individuals' perceptions regarding biological weapons. If a chemical frame were influencing perceptions, such behavior would be observed in sources such as reports, testimony, and organizational behaviors—and these sources do in fact reveal the strong chemical agent/biological agent relationship indicative of a chemical frame. This relationship is observed at the highest levels of government, indicating how widespread the chemical frame had become.

Perhaps the most direct acknowledgment that a chemical frame had created an interdependent status of biological and chemical weapons was expressed in the 1969 memo from Secretary of Defense Laird quoted in the previous section. However, it appears this stance was not widely embraced, as a subsequent memo stated that "current documents of various agencies continue to use … 'CBW' … even though such terminology is seriously misleading and should be stricken from our lexicon … because there exists no generic interrelationship between the chemical and biological fields."[14]

Also cited in the previous section was guidance directly from the White House establishing new chemical and biological terminology. As with Secretary Laird's original statement, the White House guidance does not appear to have taken hold within the community. The 1969 wording was repeated in *Presidential Directive/NSC-28* issued in 1978. This directive again stated that "the term Chemical and Biological Warfare (CBW) will no longer be used. The reference should be to the two categories separately—The Chemical Warfare Program and The Biological Research Program."[15]

The publication of directives addressing the separation of the chemical and biological programs indicates that the chemical frame (as manifested in the combined chemical/biological approach) had been recognized at high levels of the government and was considered inappropriate. However, the need to repeat the guidance shows that it failed to make an impact on the lower levels within the government and military, who continued to work under the influence of the chemical frame.

Various reports and studies in the years following these directives indicate that the guidance to separate the weapons did not make much of an impact. As observed before, chemical weapons and biological weapons were constantly combined, and at times a weapon would be included in a report that, given the title, should have nothing whatsoever to do with that weapon.

The frame is still evidenced in a 1971 study by the Army to assess CBR defense, the purpose of which was "to examine CBR/N defensive doctrine, organization, and equipment as a system in order to ensure adequate CBR defense." When defining the threat, the authors of the study combined chemical and biological weapons, stating that "since both chemical and biological agents exhibit greater agent effects/physiological symptoms at these temperatures, the analyses will consider the use of CB agents principally during the period of Jul–Sep in the conflict areas."[16]

A 1977 Army study dedicated to biological defense also exhibited several different behaviors associated with the chemical frame. First, while the title of the study—*The Biological Defense Protocol: The Biological Defense Preparedness of U.S. Army Forces*—suggests a biological focus, the study was made in terms of "cost effectiveness, and the increased emphasis in chemical defense," and cited the 1973 Arab-Israeli War as increasing the need for chemical defense. The inclusion of chemical weapons in the study would indicate the presence of a chemical frame, but could also support realist behavior based on a greater perceived level of chemical threat versus the biological threat. However, this is probably not the case, as the study acknowledged a biological threat as well, citing intelligence information of "extensive" Soviet biological defense training for both military and civilians.[17]

Irrespective of the threat level, the study made several statements exhibiting the combining of biological and chemical threats, as predicted by the frames model: "The attitude in the armed forces regarding biological warfare was a general complacency. This same attitude extended to chemical defense as well," and "biological defense is allied with chemical defense in that the protective mask and protective shelters … defend against both," and most reflective of the frames model, "though many commanders and staff officers view an adequate chemical defense as an adequate biological defense, some aspects of biological defense are not associated with chemical defense."

A Defense Science Board study in 1985 again demonstrated the combining of chemical and biological weapons predicted by a frames model, starting with the title of the report itself: *Chemical Warfare/Biological Defense*. However, contrary to the title, the letter initiating the report had requested a study focused on chemical weapons. Specifically, it had requested information on chemical intelligence, adequacy of chemical research and development, medical treatment of chemical or "other," and an assessment of the impact of biotechnology on Soviet capabilities.

A specific recommendation from this report addressed using biotechnology to develop "anti-CW/BW vaccines or antidotes," specifically mentioning broad receptor site responses.[18] Another example is one of several instances where advances in biotechnology were cited as increasing the threat of biological and chemical weapons "Biotechnology techniques now make it possible for a potential adversary to field new CW agents." While the subsequent paragraph is redacted, a possible explanation is that at various points in history, biological toxins have flipped between being considered biological or chemical weapons.[19]

A report issued the following year by the GAO exhibited the same behavior of an almost default inclusion of biological weapons any time chemical weapons were addressed. In this case, the report was titled *Chemical Warfare: Progress and Problems in Defensive Capability*, and was written with the purpose of reviewing "the Department of Defense program to improve its defensive chemical warfare capabilities."[20] While the report did follow the title and assess chemical defense, it also included one hundred fifteen references to biological weapons. Some of these references were generic statements, such as "chemical and biological defense" regarding sections on training, doctrine, threat, and defense. However, the report did make specific references to vaccines, drug development, and medical training to counter biological agents.

Also of interest is the fact that the authors were aware that nuclear was not part of the chemical problem, despite their repeated use of NBC terminology, as evidenced in a chart listing defense agreements that "omits the agreements on nuclear defense that have no relevance to biological and chemical defense." Yet there is no evidence of a similar distinction with biological weapons. Of the seventeen entries on the chart, thirteen reference biological weapons, while only one is specific to chemical weapons.

There are also many examples of chemical and biological weapons being combined within the same strategic debate. A 1970 report to Congress on chemical and biological warfare raised issues on adequate deterrence for chemical/biological attacks, as well as questioning how to educate the public on chemical/biological weapons. The report also included Congressional funding language that blatantly combined chemical and biological weapons into one category.[21] The official military response to this report did separate chemical and biological weapons in the discussion, but then reverted to a combined chemical/biological frame when discussing deterrence, retaliation, and intelligence.[22]

A final manifestation of a chemical perception within an organization is the type of education required to perform a "WMD" job. As in other areas, the bias was towards individuals with chemical backgrounds. An internal memo from the office of Defense Research and Engineering demonstrated the combining of chemical and biological qualifications, justifying the existence of personnel and listing several critical jobs. One such listing was for a "Deputy for Chemical Technology," whose responsibilities included monitoring programs in "Chemical Warfare and Biological Defense." Also identified were areas of required knowledge, which included "chemistry, microbiology, environment and weapons used in defense and attack." This position is "the single focal point for all OSD, JCS and Military Department action and planning in chemical warfare and biological defense." Interestingly, also identified was a "Deputy for Biomedical Research and Technology," who was the only physician within the organization, yet was focused on medical research, biomedical research, and environmental pollution effects.[23]

Another example of a bias in personnel is evident in the educational distribution of scientists and engineers associated with the program. The *Fiscal Year 1981 Chemical Systems Laboratory Historical Report* listed the distribution of scientists and engineers within the organization as follows: 71 chemical engineers, 73 other engineers, 167 chemists, 31 physicists, and 144 "other" combined, consisting of physical scientists, mathematicians, and biologists.[24]

The *1986 Advanced Planning Brief for Industry* produced by the U.S. Army Armament Munitions Chemical Command contained a similar report. While this command was responsible for chemical and biological defense, it reported the educational background of its scientists as 149 chemists, 136 chemical engineers, 83 physical scientists, 86 mechanical engineers, 62 general engineers, 27 physicists, 21 biologists, and 5 pharmacologists.[25]

Frames in Testimony

In addition to written policies and documents, frames theory predicts that biological weapons will be similarly treated in oral statements and testimony. Congressional testimony and official statements present numerous examples of chemical weapons taking precedence over biological weapons, as well as examples of chemical and biological weapons being regarded as a single weapons class or threat. Of particular interest are the Congressional hearings immediately following President Nixon's decision, when non-frames behavior would be expected.

In 1970, the Committee on Foreign Affairs conducted a multi-day hearing titled "Chemical-Biological Warfare: U.S. Policies and International Effects." Starting with the title, and reinforced by the testimony of many senior members of the U.S. government, the transcript demonstrates behaviors predicted by a chemical frames model. Examples include referring to nuclear versus "chemical/biological" weapons classes, claiming chemical or biological agents can be put in "almost anything we have got" (referencing weapons), combining chemical and biological weapons in employment, defense, and retaliation considerations, and when characterizing the Soviet threat.[26]

In the same testimony, there are examples of behavior inconsistent with the chemical frame. Testimony from a member of the Secretary of Defense's staff proposed five categories of weapons: chemical-lethal, chemical-non-lethal, biological-lethal, biological non-lethal, and anti-plant. Also included is the text of a Congressional investigation of Chemical, Biological Warfare and National Security, which recognized that "the term 'chemical and biological warfare' is a misleading one. It is not a form of warfare, but rather a conglomeration of weapons which must be incorporated into the military strategies and doctrines." As in other areas, the fact that individuals outside the traditional program identified problems with how chemical and biological weapons were viewed serves to support the existence of a chemical frame within the defense community.

Testimony in the years immediately following President Nixon's decision showed little evidence that the frame was broken, even at the highest levels of government. A hearing on military posture in 1975 did use the prescribed "biological research program" wording in the main text of the hearing. However, some of the witnesses (including the Assistant Secretary of the Army) reverted to the "chemical-biological warfare" or "chemical-biological defense" terminology in their spoken testimony.[27]

Two other Congressional hearings also failed to use the prescribed terminology, instead reverting to terms associated with the chemical frame. A 1973 hearing on resolutions restricting the movement of chemical weapons without Congressional approval did not follow the guidance, instead making repeated references to "chemical/biological" warfare and weapons. There is also an interesting section where the debates over the effectiveness of biological weapons held prior to President Nixon's 1969 decision were used as a reference for the ongoing debates over a chemical weapons treaty.[28] A subsequent hearing in 1974 on "U.S. Chemical Warfare Policy" again used terms expected of a chemical frame, making repeated references to "chemical/biological warfare."[29]

The quick reversion to the combined view, despite national debate and published guidance at the time, illustrates the strength of the chemical frame. It indicates that with a high level of attention, the frame could be broken, but as soon as the attention was diverted, the frame reasserted itself.

Frames in Hardware

One of the expectations of the organizational frames model is that while the program may appear balanced and sensible to those within the frame, it will seem unbalanced to those outside the frame. One way to observe this imbalance is to examine the physical outputs of the program. The areas of decontamination and detection in particular reveal the presence of a strong chemical frame.

The decontamination program is one that to this day demonstrates an extremely high degree of combined requirements. While there are sound logistical reasons to combine defensive capabilities where possible, combining decontamination requirements forces researchers to develop a product that would be equally effective at decontaminating influenza from a hospital room and removing oil stains from a concrete floor. This approach greatly complicates the problem, yet it was the stated goal for almost every decontamination program during this period.

In 1971 a requirement for a new decontamination research program stated that "an all-purpose decontaminant is required for use after CB agent accidents or hostile attacks." The product was to be capable of "neutralizing all known CB agents." If that requirement was not challenging enough, there were additional requirements such as "must not corrode aircraft surfaces or electrical equipment," "no rinse required after use," "non-hazardous to personnel," and "residue should be readily disposed of or safely absorbed in the environment."[30]

Not surprisingly, these requirements were not met, but the thought process persisted. In 1980, a briefing to a symposium on decontamination titled "Biological Decontamination from the Army's Point of View" listed the number one characteristic of a decontaminant as being "effective against both biological and chemical agents."[31] A 1985 decontamination program based on the C8 decontamination solution developed in Germany was required to "decontaminate the exterior of all materials … against all probable threat chemical and biological agents to include toxins."[32] Finally, in 1986, the Decontamination Systems Division listed "decontaminate all agents" as its top technology goal.[33]

The military has had significant problems achieving any of these goals, and has conducted at least one internal study in an attempt to understand the reason. The 1984 report from the Army Science Board's Ad Hoc Subgroup on the Army Decontamination Program identified several organizational issues that had impacted the program. While the report did not identify any particular organizational theory, the concerns described in the report were similar to the behaviors associated with the chemical frame.

The Subgroup found fault with the Army's ability to use state-of-the art technology to advance decontamination ability. The report specifically cited a "lack of imagination" and stated that "no one seems to be thinking beyond the commonplace. There seems … to be no real support … to look at the whole problem in new ways." Interestingly, while the report identified behaviors expected from a chemical frame, it never separated the chemical threat from the biological threat, instead referring to the "CB" threat/challenge throughout the report.[34]

As with the requirements for decontamination, operational requirements for biological and chemical detection or sampling hardware from this period include many instances of combined requirements. As in other areas, documents produced immediately after the SECDEF's guidance failed to follow the prescribed terminology. In 1971, the Army's testing agency referred to CBR tests and CBR agents. Again, when nuclear weapons were broken out from the CBR reference, chemical and biological weapons remained combined, as in detection equipment to "provide notice of a CB agent attack," or equipment to protect against "CB agents."[35]

Subsequent development programs repeatedly exhibited behavior predicted by the chemical frame. For example, the Chemical/Biological Agent Sampling Kit (CBASK) had a requirement to "safely collect and transport samples of suspended CBW agent contamination."[36] The Chemical Biological Mass Spectrometer was required to "be capable of detecting nerve, blister and blood agents," as well as being "capable of detecting biological agents as aerosols in the air and solid on the ground."[37] The "BC detector" was a program initiated in 1986 with a planned fielding in 1999. It was designed to "incorporate maximum detection capability within one unit" to "reduce the number of fielded detectors."[38] Another briefing described a high-tech NBC system to provide "NBC reconnaissance," decontamination, and "smoke support." While this was an "NBC" system, the only threat described in the requirements section was Soviet use of chemical weapons.[39]

Even when the systems were not explicitly designed to combine chemical and biological detection, the requirements for biological detectors were extremely similar to those for established chemical detectors. For example, the Biological Detector and Warning System (BDWS) had a required response time of 2 +/- 1 minute, in which it had to detect 75 +/- particles per liter of air.[40] A similar requirement existed for the chemical/biological mass spectrometer, which had ninety seconds to identify and quantify both chemical agents and biological threat agents.[41]

This chemical frame is also present in requirements external to the DoD, perpetuating the frame within civilian research organizations. The detection section of a military briefing to industry contained requirements for several hardware systems that reflected the combined chemical and biological threat. This report contained requirements for a "CB Mini Mass Spectrometer," a "CB Mini Detector," an aerosol sampler for "chemical/biological agent detection," the XM87 NBC recon system, and a mass spectrometer for acquisition and processing of CB agent from air. As would be expected, the decontamination section stated the desire to develop a decontaminant able to "decontaminate all agents."[42]

The presence of the chemical frame within subordinate programs is not completely unexpected when the frame is obvious in a capstone document prescribing the vision for future NBC detection programs. Within this document, nuclear, biological, and chemical agents are generally addressed as a single threat, with some weapon-specific variations noted. However, even when hardware requirements are broken out between weapons, they share the same operational characteristics. Some examples of the combining of desired capabilities or material objectives only make sense under a frames model, such as "monitor approaching NBC clouds," "multipurpose integrated NBC detector," and "detect surface NBC contamination." Interestingly, under the function of "monitor personnel NBC exposure," the only desired capabilities listed were for radiation detection.[43]

The combining of chemical and biological defensive requirements within a single system would not necessarily be indicative of a frames model if all hardware was designed with dual potential. However, over this time period many chemical-specific systems were produced. A 1974 Congressional Research Service report on chemical and biological issues noted that significant advances in chemical-specific defensive items, including a chemical agent detector, liquid agent detector, and a chemical area scanning alarm.[44] A few years later, a 1981 U.S. Air Forces Europe (USAFE) study on chemical warfare and aircraft operations listed ten operational chemical detectors, seven developmental systems expected to be operational in the short term, and four developmental systems expected in the long term.[45] An Army laboratory report from 1981 shows only one dedicated biological detection system and one combined NBC detector under development at that time. [46]

Frames in Doctrine

In addition to physical hardware, organizational outputs also include written reports and doctrine. The military often conducts strategic studies to establish a foundation for doctrine development. Studies conducted over this period provide examples of chemical and biological weapons being combined as a single threat, as well examples of a chemical weapons approach driving the development of biological doctrine.

A 1971 Army study on defensive capabilities combined the weapons, as its purpose was to "examine CBR/N defensive doctrine, organization, and equipment as a system in order to insure that adequate CBR defense, with minimum degradation of combat effectiveness, is provided." This study also defined the threat as the "enemy employment and exploitation of tactical CBR/N weapons."[47] Having all CBR defense encompassed within one "system" would lock in the frame for any subsequent doctrine or hardware developed based on this study.

The chemical frame can also create a linkage where none should exist. For example, a 1981 Air Force study characterizing the chemical environment focused exclusively on chemical capabilities and training, but also included a discussion of the Soviet biological threat.[48] Another Air Force study also included chemical, nuclear, biological, and conventional threats in the study objectives, but subsequently stated that the study results were used to "upgrade simulation of sortie generation in chemical defense."[49]

Studies are often conducted prior to development or revision of doctrine, which is codified in military manuals and serves as the basis for actions taken by personnel. Manuals published over this time period that are specific to a particular type of weapon are generally well written and free of frames. However, in combined "WMD" manuals, or manuals dealing with operations and combat intended for a more general audience, a chemical frame is often apparent.

Army Technical Manual *TM 3-216: Technical Aspects of Biological Defense* exhibits such behavior. The manual generally does an adequate job of describing the unique nature of the different weapons, such as different effects, threat, and ability to detect. However, a chemical frame is also observed in such recommendations as "the measures taken by troops while under biological attack are similar to those taken while under chemical attack." The manual dedicates two pages to sampling and identification of biological weapons, but only one paragraph to epidemiology, which would have been the most likely indication of a biological attack given the lack of detectors at the time. In addition, all detection/defense actions appear biased by including an assumption that the individual will have immediate knowledge that a biological attack has occurred.[50]

In *Field Manual 101-40: Armed Forces Doctrine for Chemical Warfare and Biological Defense*, the threat, environment, and response are consistently described in reference to a "CB" environment or challenge. The chemical frame is evident in chapter titles such as "Chemical and Biological Munitions" and "Chemical and Biological Defense." There are also specific combined statements that lead to technical inaccuracies, such as "most weapons systems can deliver CB agents."[51]

Published in 1976, *Field Manual 100-5: Operations* provides insight into the Army's perception of chemical and biological weapons. Of interest is that the table of contents lists Chapter Eleven as "Chemical Operations," while the chapter heading within the document is "Chemical Warfare and Nuclear, Biological and Chemical (NBC) Defense." Despite the title, the chapter states that forces "must be organized, trained, and equipped to survive and operate effectively in a chemical warfare environment." The chapter makes minimal reference to any threat of a biological attack, but acknowledges that Soviet forces were well trained for "nuclear and biological defense."[52] Within this chapter, the only specific references to biological weapons are a mention that "chemical protective clothing and equipment provides protection from biological attack," and a discussion of immunization and hygiene as important defensive measures.[53]

Field Manual 90-14, published in 1985, addresses the rear battle, which consists of combat operations fought behind the traditional front lines. Forces stationed in the rear would include support forces or logistics centers. In the over one hundred pages of text in this document, the word "biological" is only used five times, and always in conjunction with chemical and nuclear weapons. In contrast, there are eleven specific references to chemical weapons and seven references to chemical weapons combined with nuclear weapons. Specific references to chemical weapons include chemical attack, chemical defense, chemical detection, and chemical experts.[54]

Field Manual 3-10: NBC Operations again shows the combined weapons frame, referencing “NBC weapons,” “NBC doctrine,” and the “NBC battlefield.” While there are separate sections dedicated to each weapon type, the general sections refer to NBC weapons. When the NBC frame is broken, nuclear weapons are identified as unique, while chemical weapons and biological weapons remain combined as a single weapon type. The chemical frame is most obvious in the section describing response to a chemical or biological attack. For instance, the manual recommends “you must keep contamination from touching your skin because it can kill you.”[55] It also recommends immediate MOPP 4 posture for either chemical or biological attack.[56] The manual also frames all attack responses in the context of a chemical attack, such as when it cautions that liquid or solid contamination can “continuously generate vapors.”[57]

Field Manual 91-12: Base Defense, published in 1989, also exhibits evidence of combining weapons classes. Again, there are unique references to chemical attacks, but biological threat references are always part of the “NBC” threat. For example, the manual combines chemical, biological, and nuclear into one defensive category, and addresses defensive measures by referencing suits, masks, detectors, and alarms as “part of base NBC defense,” yet later states that biological field detectors are not “widely available.” When biological weapons are addressed, immunization is listed as the prime defense, and the threat scenario implied is mainly one of covert delivery through food or water.[58] It is important to note that while this manual continues to exhibit a chemical frame, it does seem to have lost some of the heavy chemical references observed in earlier manuals.

Field Manual 63-21: Main Support Battalion, published at the end of this period, in 1990, provides guidance for units supporting combat units. This manual continues to illustrate behaviors predicted by the chemical frame model. One example is a reference to “chemical” equipment, which includes supplies needed to address chemical or biological weapons. When discussing clearing stations, there is specific reference to chemical casualties, with no reference to biological casualties. Perhaps the most obvious example is the reference to enemy attacks utilizing “nuclear weapons ***or*** chemical/biological agents” (emphasis added). As with previous documents, general threat statements and defensive actions are in reference to combined chemical/biological attack scenarios.[59]

Significantly, this document does take a step towards acknowledging some difference between chemical agents and biological agents. Regarding protection, it states that adequate biological defense can be achieved through the use of masks and hoods, combined with the standard duty uniform, which is a departure from other documents that simply addressed the NBC threat by recommending full protective posture for all attack scenarios.

One general document, *Field Manual 21-40: NBC Defense*, stands out among the documents examined, as it shows almost no evidence of a chemical frame (aside from the title). This manual has a separate section for each weapon, and the information is accurate and not tainted by another frame. It also acknowledges specific characteristics of biological weapons not often identified in other manuals. Some examples include acknowledging that weathering is an effective decontamination method, prescribing a mask only in response to a biological attack, and addressing MOPP as chemical-focused protective equipment.[60]

It is important to note the critical role these types of manuals play in framing how the military operates and perceives its environment. These manuals represent the primary, and possibly only, reference material for the vast majority of the operational forces. Unless the unit has a mission pertaining to chemical weapons or biological weapons, there would be no reason to go beyond the general guidance as to how chemical weapons and biological weapons behave. As the majority of the available manuals showed a chemical frame, it is not surprising that the frame took such a strong hold in the military.

A possible counter argument could be that the behaviors observed in these documents reflect a realist view that the biological threat was of minimal significance (relative to other threats). While some elements of this theory might be true, evidence produced later in this chapter indicates the biological threat was greater than would be suggested by military doctrine, indicating that the DoD was not responding to the biological threat as would be predicted by a realist model. It is also important to note that the continued reference to the combined chemical/biological weapon class is predicted by the chemical frame, and not indicative of a realist threat perception.

Medical Countermeasures

The last area to be examined in this section is the development of medical countermeasures against biological weapons. The previous period showed that medical countermeasures were largely discounted as an ineffective defensive mechanism. It could have been lack of technological capability, lack of funds, or a manifestation of the chemical frame that caused a similar attitude to continue throughout this period. It is difficult to be certain, as there was little national interest in the role of medical countermeasures at this time. Also of significance to this period was the transfer of responsibility for medical countermeasures from Army Materiel Command to the Army Medical Department in 1972.

A 1975 annual report from the Army Surgeon General reflected a general lack of interest in biological weapons defense, making only three references to biological weapons. Specifically, regarding the USAMRIID mission to develop countermeasures, it seemed that the Army regarded the mission as a means to have access to research facilities. The report stated that "although the primary mission of USAMRIID encompasses defense against biological agents, the capabilities of the facility allow research on a wide range of hazardous organisms of importance to military operations."[61]

An Army report on biological defense continued the previous attitude that limits in detection would not allow time for effective distribution of antibiotics. The impracticality of vaccination without adequate intelligence was also stated as a major concern. However, the report did at least acknowledge that countermeasures play some role in defense, as it noted that the DoD maintained ten grams of antibiotics for every military member, civilian employee, and family member assigned overseas. The statement that may be most indicative of a chemical frame relates to epidemiology, noting that "the reporting procedures include no attempt to identify the possibility of the disease being a result of a biological attack."[62]

A lack of interest is also reflected in the low level of resources allocated to countermeasures. For example, the Congressional Research Service noted that medical funding early in this period was averaging about $9 million per year.[63] In contrast, thirty years later (after the medical defense program received attention from Congress), this amount would approach $600 million.

Hoyt also notes a general national malaise in vaccine production during this time, with only six new vaccines produced over this period, versus eighteen for the previous period. Among the factors she cites are a changing regulatory environment and, more importantly, the erosion of the military/pharmaceutical/national pride combination that was established during World War II, which supported vaccine development through the 1950s and 1960s.[64]

A similar assessment is found in a 1996 GAO report, which sheds light on the state of the program just prior to the Gulf War:

> For many years, DOD has maintained a medical research and development program for biological defense. However, at the time of the Gulf War, the United States had neither fielded equipment capable of detecting biological agents nor stocked adequate amounts of vaccine to protect the force. When the Gulf War started, DOD also had not established adequate policies and procedures for determining which vaccines needed to be administered, when they were to be given, and to whom.[65]

Regardless of the reasons, the best evidence as to the lack of interest and effort put into the program is the firestorm of criticism the military received immediately following the Gulf War. With a little help from Congress, the U.S. military finally decided that it was serious about developing medical countermeasures.

Conclusions—Frames

The evidence presented for this section shows how strongly the chemical frame was entrenched within the military and the federal government. While this time period started with several high level directives attempting to break the chemical frame, the frame did not disappear.

Chemical agents and biological agents were routinely combined within political and doctrinal discussions. Training for the two weapons was combined most of the time, and while there was a large amount of dedicated chemical defensive hardware, most of the biological defensive equipment was developed as combined hardware. The general doctrine for the operational forces was typically written to defend against a chemical threat and as a result, in some instances, offered guidance that would be of minimal help in a biological environment.

The general confusion over appropriate defensive measures created by the chemical frame is of considerable concern. National policy, doctrine, and hardware all reflected inaccuracies or suboptimal solutions for the biological threat due to a lack of clear understanding of biological agents. As a result, at the end of this period the United States entered the Gulf War with biological defenses that would have failed our forces had the Iraqis employed such weapons.

Bureaucratic Politics and Biodefense, 1971–1991

There is generally little evidence that imperialism influenced the biological program during this time. The bureaucratic environment early in this period was hostile to the program, and to the military as a whole. While the 1973 war, the Sverdlovsk incident, and the military buildup of the 1980s did present some justification to expand the program, any observable imperialistic behavior is heavily biased towards the chemical program.[66]

In his paper "'Imperialism' in Bureaucracy," Holden includes maintenance and retrenching as behaviors that can be observed after an imperialistic expansion by an organization. He identifies retrenchment as likely to occur when organizational leaders foresee no favorable balances, or when they face an inflexible constituency. He also states that "retrenching agencies may be forced to re-orient themselves merely to maintain the *status quo*."[67] Given the legislative environment in the 1970s, these types of behaviors would be expected. Imperialism would be less likely until the 1980s, when more money would become available to the DoD.

Headwinds

The bureaucratic environment for the first several years of this period was not especially conducive to imperialism. The decision by President Nixon to abandon the offensive biological weapons program eliminated any opportunity for organizations to embrace the offensive use of biological weapons as an area of potential resources or power. At the same time, the nation was emerging from the Vietnam War, and the overall environment was one of drawdown and negativity towards the military establishment.

In the early 1970s, Congress took action to reduce military funding. This shift, combined with Nixon's revised policy and negative public perception, made imperialistic behavior almost impossible. Some actions even directed a reduction of the mission, such as *Executive Order 11490*, which moved the responsibility for defense against anti-crop agents (chemical and biological) to the Department of Agriculture.

Congress also used specific language that removed or severely restricted money for storage, testing, and procurement of chemical or biological weapons.[68] As a result of reductions in funding, the Army was forced to abandon real estate resources such as Pine Bluff Arsenal, and to cut biological defensive spending from $20 million down to $10 million.[69]

The Chemical Corps identified these restrictions as causing "program delays" and making execution "more expensive." For example, *Public Laws 91-121* and *91-441* required that the Secretary of Defense, the Secretary of Health, the President of the Senate, and the Speaker of the House be involved in any transportation, open-air testing, or disposal of lethal chemical agents. The Corps also expected a thirty percent cut in funding for Fiscal Year 1974. Not only did these restrictions hamper imperialistic tendencies, they imperiled the future of the Corps, as they hit at the same time it was trying to justify itself to the Army to avoid being disbanded.[70]

One of the most serious challenges to the program was the move to disband the Chemical Corps. In 1973, the Army took steps to eliminate the Corps, but the final decision to do so required Congressional approval. The Corps' fate was debated within Congress, the Department of Defense, and the Army until 1975, when the Army reversed its position and began to rebuild the Chemical Corps. This reversal in position was due in large part to a realist response to the 1973 Arab-Israeli war and the associated Soviet chemical equipment. While the proposed Army plan to disperse the chemical defense and biological defense missions among other units would not have ended such research, having the Army advocate the dissolution of the Corps sent a strong signal to service members as to the relative importance placed on chemical and biological weapons at the time.

The program faced another challenge when President Nixon issued *NSSM 157*, directing a review of the U.S. position regarding chemical weapons relative to the Conference of the Committee on Disarmament in Geneva.[71] Reminiscent of the 1969 debate, the military again had to review its position on chemical weapons, and took an imperialistic position that leveraged the treaty to advance the chemical weapons program.

As in the previous debate, the military found itself at odds with the State Department. Notes from the NSC reflect that the DoD was the only agency in favor of the treaty option to "limit [chemical] stocks to agreed retaliatory levels." Mentioned among the advantages of this option was that the DoD could use it to justify a modernization of existing weapons stockpiles, specifically upgrading current weapons to new binary weapons.[72]

Subsequent debate revealed the financial benefits associated with this position. The military estimated that upgrading to binary weapons would require four to five years of research, which would be part of a ten-year total acquisition plan. The cost to upgrade would require a doubling of the existing $45 million budget for the ten-year period. The military also identified that a retaliation policy would put U.S. forces at risk, noting that current defense posture and training was "inadequate." The cost to bring U.S. forces to an "adequate" defense posture was estimated at $72 million per year for eight years (expenditures at the time were $10 million).[73] This attempt at imperialism was effectively halted when Congress eliminated funding for binary weapons in 1975.[74]

While the DoD showed an imperialistic streak, it did temper its expectations, noting that "political factors … including both public opinion and governmental attitude make it extremely difficult to introduce, relocate or disperse chemical weapons." They were also aware that if they opted for a treaty that allowed modernization, and Congress did not approve resources to modernize, they would actually put themselves further behind if the Soviets modernized their own weapons. Along these lines, they noted that Congress had not allocated any money for offensive weapons since 1969, and the President had not requested any funds in the upcoming budget cycle.[75]

While international chemical negotiations dragged on with little success, two additional Presidential directives further hindered the imperialistic environment. In 1975, President Ford issued *Executive Order 11850*, renouncing the first use of herbicides and riot control agents.[76] In 1977, President Carter issued *Presidential Directive 15*, which effectively froze the U.S. program, stating that "the President has also directed that US chemical warfare forces be maintained without force improvement."[77]

Although the Army was essentially in a retrenching mode, it was able to keep its position as lead agency for the program. By retaining its historical responsibility for the program, the Army was at least able to maintain autonomy in this area. This responsibility did come with some associated resources, and allowed it to exert its influence over other services and joint defensive programs. In 1971, the Army and Air Force entered a Memorandum of Agreement, making the Army Materiel Command the focal point for the Joint Chemical and Biological Program (the Navy elected to retain its independence).[78] This agreement supported at least a maintenance behavior within the Army, but also indicated that the Air Force had little interest in claiming the chemical defense or the biological defense research missions as its own.

DoD Directive 5160.5, which defined the roles of all the services in chemical and biological defense, further codified the Army's position. Specifically, individual services were responsible for establishing service-specific requirements, and were allowed to spend money on engineering development of individual service-specific items. However, the Army retained responsibility for "all research, exploratory development, and advanced development" for all items, and the Army also retained lead responsibility for all phases of multi-service equipment.[79]

While most of the behavior was chemical-centered or chemical/biological combined, there is at least one piece of evidence indicating that the Army did use its biological knowledge to maintain resources. As President Nixon's policy allowed defensive research, the Army highlighted the potential benefits of defensive research to public health. An Army historical report specifically noted that vaccine research was "no longer structured to meet the requirements for BW defense, but as directed toward the control of communicable disease in man." Likewise, general support for USAMRIID included the argument that its research objectives would "benefit the civilian community as well as fulfill a military objective."[80]

Opportunities to Expand

Few imperialistic behaviors were observed during the early 1970s, as there was little national resolve, and no spare money in the budget. The 1973 war, the anthrax release at Sverdlovsk, and the buildup of the military under President Reagan all contributed to additional funding becoming available in the late 1970s and early 1980s. With the availability of new money, there was imperialistic behavior, yet a chemical frame most often tempered it.

An excellent example is the brochure *Chemical Warfare: Deterrence Through Strength*, published by the Army in 1984. This publication highlighted the weak position of the United States relative to the Soviet Union, and strongly advocated that this weakness be corrected by creating a retaliatory chemical capability—specifically, through development of new binary chemical weapons.[81]

A similar theme was reflected in a Deputy Assistant Secretary of Defense's testimony to Congress in 1985. He first cited the Soviet chemical threat, stated the low level of U.S. defense and retaliatory capability, and then requested additional resources for defensive and offensive chemical capability. He also included biological defense while describing some of the programs. Again, this is evidence of imperialistic behavior but focused mainly on the chemical threat, despite intelligence assessments (presented in the next section) which by 1985 had identified a substantial Soviet biological threat.

A desire to expand, with a focus on chemical weapons, is also found in the Army's Armaments, Munitions and Chemical Command long-range plan from 1984. The plan listed both chemical weapons and biological weapons as potential threats over the coming twenty years, yet the planning assumptions that served as the basis for future work included three specific chemical weapons programs (including two for new agent development/production), and eight combined chemical/biological programs, but no dedicated biological programs.[82]

There are also examples of the defense program taking credit for biological defense on paper, but with less emphasis on the development of actual hardware. This could be an example of frames behavior, where biological defense is subsumed under the chemical defense cover, or it could be an attempt at imperialistic behavior, where the organization is trying to take credit (and obtain additional resources) for addressing a threat where it had marginal success at best. The XM87 NBC reconnaissance system known as the "Fox" vehicle is of interest because despite the "B" in its official name, and its advertised reconnaissance capability, the vehicle had no biological capability beyond the ability to carry biological warning markers. This could be evidence of a chemical frame influence, where biological is subsumed with chemical weapons, or it could be an attempt at expanding or claiming capability where none currently existed in hopes of retaining responsibility for that mission area.

Also of interest from this time period are the data contained within the briefings to industry discussed in the organizational frames section. The combined chemical and biological equipment approach captures the essence of the imperialistic behaviors observed over this time period, and demonstrates the dominance of the chemical frame. If imperialism were driving behavior in this time period, one would expect such briefings to highlight the lack of biological capabilities, as well as the need for new dedicated, biological-focused technologies. Instead, the programs continue to address chemical weapons alone, or focus on a combined chemical/ biological approach.

Conclusions—Imperialism

There is little evidence of imperialistic behaviors relative to biological weapons early in this period. The budgetary and legislative environment facing the DoD in the 1970s made imperialistic behavior unlikely. Focus on the Vietnam War, along with directives regarding biological and chemical weapons by Presidents Nixon, Ford, and Carter, plus the reduction in funds, made it unlikely that any organization responsible for the lower-priority programs of chemical and biological defense would be able to find the resources or justification to expand programs. The observed behaviors of organizations trying to maintain the status quo, as well as emphasizing additional benefits of existing programs, are indicative of behaviors predicted by Holden, where organizations are struggling for existence.

Some imperialistic behavior did emerge in the 1980s, as observed in the public push for the development of binary chemical weapons, and a renewed interest in chemical and biological defense. However, this behavior is mostly focused on expanding offensive and defensive chemical programs. When biological weapons are addressed, they are almost always part of a joint chemical/biological program. Therefore, it is possible to argue that while imperialism exerted a minimal degree of influence over this time period, the imperialistic behaviors that are observed were executed through a chemical frame.

Realism and Biodefense, 1971–1991

For most of this period, the Soviet Union and the Cold War were the prime concern and driving factor for the external threat facing the United States. From a realist standpoint, the Soviet Union posed a mortal threat. In the power-balancing equations of realism, any perceived advantage could have serious implications for the state. As the United States grew more confident of the existence of a Soviet biological program, one would expect to see greater emphasis placed on defense.

President Nixon's decision to restrict biological research to defensive measures also impacted threat assessment. From the perspective of understanding the capabilities and threat posed by biological weapons, this decision removed an important data point. While previous planners could look to the U.S. offensive program for an understanding of what a biological weapon could do, all assessment of the biological threat for this period would have to rely on data from the defensive program, and on intelligence estimates of the Soviet program.

This period is also the first time the United States regarded chemical weapons and biological weapons as distinct weapons with different policies. Both the United States and the Soviet Union maintained offensive chemical warfare programs through most of this time period, and both were signatories to the Biological Weapons Convention. Therefore, it would not be surprising to see different threat levels associated with the two weapons.

The data available for this period does show differences in the relative threat between chemical and biological agents, consistent with an external threat perspective. However, the combined chemical/biological threat model is readily observable in the data, indicating a chemical frame was also influencing U.S. actions over this time period.

The Threat

It is possible to gain an understanding of how the United States viewed the biological threat during this time by looking at a chronological history of intelligence documents, which reflect that chemical weapons were always regarded as a threat to U.S. forces. Biological agents were never absent from the threat picture, but they were arguably regarded as less of a threat in the 1970s, and then gained importance in the 1980s.

Prior to this period, two *National Intelligence Estimates* (NIEs) of Soviet biological weapons had set the stage for the general attitude of the country entering this time. The first of these NIEs judged that the Soviets were researching biological weapons, but that they had no dedicated production facilities or stockpiles. The report did state that the Soviets could probably produce significant stockpiles within months of a decision to do so.[83]

In 1969, an NIE on "Soviet Chemical and Biological Warfare Capabilities" estimated that nuclear weapons had reduced the chemical role within Soviet doctrine, but found that "continued stress on the importance of chemical munitions is evident in Soviet military writings, organization, training and armament, suggesting the Soviets will continue to retain a significant proportion of chemical warfare warheads in inventory." Regarding biological weapons, this NIE found evidence for an emerging biological weapons program that could no longer be explained by sanitation or defense work, and that the Soviets had the capability "to develop, produce, and stockpile militarily significant quantities" of biological weapons.[84]

A document outlining Warsaw Pact military operations supported this assessment, showing a strong focus on conventional and nuclear operations. However, it also included distinct chemical operations, such as numbers of forces and employment concepts. It made little direct reference to biological operations, but did include an expected five percent loss of forces to "biological means" in the section discussing expected casualties.[85]

An assessment of Soviet civilian chemical and biological defense in 1978 noted an "extensive" chemical and biological defense program, giving equal weight to chemical and biological weapons. The report also noted the unusual precedence of the defensive program, given the existence of international treaties. Interestingly, this report did not reach the conclusion that the Soviet defensive plan was possibly the result of an existing (but secret) Soviet offensive capability. Rather, it concluded that the Soviets gave attention to biological weapons because of a combination of holdover from previous Soviet doctrine, U.S. public debate over binary chemical weapons, other potential advisories, or as an internal propaganda tool.[86]

In 1979, a significant event occurred in the Soviet Union when an apparent biological accident in the city of Sverdlovsk resulted in the deaths of civilians. Today, it is known that a biological production facility accidentally released weaponized anthrax. Despite Soviet denials, intelligence assessments at the time made a correct judgment:

> The information accumulated on the accident constitutes strong evidence that a biological production or storage site is at the Sverdlovsk facility. All indications point to anthrax … indicating an extremely large number of anthrax spores were released—effectively negating any assessment of peaceful or defensive research. … This flies in the face of the Convention. … Thus the evidence points strongly to illegal production or storage of biological agents and weapons.[87]

Yet even with smoking-gun evidence of Soviet biological capabilities, subsequent intelligence estimates were slow to definitively declare the existence of a Soviet biological weapons program. This attitude gradually changed over the 1980s, as intelligence estimates became more openly concerned with Soviet biological weapons capability.

At about the same time as the Sverdlovsk accident, there was also concern that the Soviets, through proxy governments, had employed not only chemical weapons, but also biological toxins, in several countries, giving rise to the "yellow rain" controversy that has come to be viewed with general skepticism, but is not yet completely resolved. It is important to remember that prevailing intelligence information at the time would be used to formulate national policy.

A 1982 CIA estimate on Southeast Asia came to a definitive conclusion that chemical weapons were used in Laos, chemical weapons and toxins were used in Kampuchea, and chemical weapons (and possibly toxins) had been used in Afghanistan. Drawing from these conclusions, the CIA made two implications of importance to the U.S. defensive program: "The Soviets had begun to weaponize toxins by at least the early 1960s and have used these weapons in Laos and Kampuchea, and possibly Yemen and Afghanistan," and "it means the Soviets have gained considerable experience through operational use of biotoxins. If we are correct the United States and its allies face a new threat not previously considered in intelligence estimates and defense planning."[88]

A subsequent report on chemical weapons in 1983 again made claims of Soviet use of chemical and toxin weapons in Afghanistan. While the report focused on chemical weapons, it is significant in that it addressed toxins, noting that they were specifically covered under the Biological Weapons Convention, and raised the point that Soviet doctrine regarded toxins as chemical weapons. The report validated the threat, noting "large" sections of Soviet military manuals that addressed toxins. It also noted a general lack in U.S. intelligence capability for both chemical and biological weapons, as well as noting the inability of NATO to detect toxins.[89]

The 1980s saw advances in biotechnology, such as gene splicing, which many argue have made the biological threat greater than ever. Intelligence estimates noted that the Soviets were utilizing new technology to expand both their chemical and biological weapons programs. This report raised concerns that they were using advances in biotechnology to develop new weapons for which the United States had no defense, and to develop new capabilities for large-scale production.[90]

Published near the end of this period, a 1986 report assessing Soviet biological weapons capability was the first of the available documents to make definitive judgments of a Soviet biological program. This assessment found the Soviets maintained an "offensive biological warfare program and capability … in violation of the Biological and Toxin Weapons Convention." This report concluded that the size and scope of this program was beyond anything that could be justified by reasonable peaceful purposes, and that the Soviets were incorporating biotechnology developments "in their offensive BW program to improve agent utility on the battlefield."[91]

By 1988, intelligence estimates were not only concerned with the Soviet Union, but also named Iran, Iraq, and Libya (plus several redacted countries) as having biological weapons, and judged that eleven other countries were attempting to develop biological weapons. Two other items are also of note in this estimate. First, as with most other evidence from this period, the chemical frame is apparent in references to combined "CBW" materials, proliferation, and facilities. Second, ominously setting the stage for the next period of analysis, the CIA assessed that "Iraq is now developing biological weapons and … we expect it to initiate full scale production of botulinum toxin, anthrax and [redacted] agent this year."[92]

The Response

While there was a continually growing concern over the presence and status of the Soviet biological program, the United States did not necessarily respond as would be predicted if the external biological threat were perceived as a dire threat driving decision-making. The early 1970s saw severe reductions in funds allocated to chemical and biological defense, which may be an example of ideology overriding valid threat assessments. For example, in spite of U.S. chemical defense capabilities that were described as "marginal at best," the five-year budget for chemical defense equipment was only $14.6 million, significantly less than a Joint Chiefs request of $1.137 billion. Likewise, despite the lack of biological detection capability, the budget only provided for $2 million per year for this area.[93]

Congressional testimony in 1970 was also indicative of the general atmosphere of the country regarding the threat. The questions were skeptical of the Soviet biological threat, and noted the inability of the United States to identify clear evidence of a biological production facility. Subsequent testimony raised a thinly veiled accusation that the "Pentagon" had evidence of Soviet capabilities, but was not willing to share the information with Congress.[94]

This committee also provides a window into the strategic thinking of the nation in this time period. A large portion of the testimony was focused on either how to address treaties and President Nixon's declarations, or how to address the use of tear gas and defoliants in Vietnam. There was also discussion that NBC defense could be obtained by maintaining a stated policy of nuclear or chemical retaliation in the event of an NBC attack. While this strategy might work on a global power politics scale, it would do nothing to provide actual defensive capabilities to forces on the ground.

About this time, the United States was also debating the benefits of the Biological Weapons Convention. While Morgenthau cautions against bringing moral judgments into power calculations, the treaty would serve as another reason to be less concerned with biological weapons.[95] There is evidence that the United States did put stock in the treaty, as many intelligence estimates on Soviet biological capabilities seem to use it as a default assumption that the Soviets did not have a biological program.

As an interesting aside, even the biological treaty was not immune to a chemical influence. The text of the convention mentioned the use or stockpiling of chemical weapons three times in the nine-sentence preamble. Draft language had contained even more references, causing alarm within the U.S. delegation. Some concerns expressed by the DoD included that "there are more references and a closer tie into chemical weapons," and that "the JCS consider that the addition of the words 'chemical and' in preambular paragraph 1 tend to change the entire thrust of the BW convention and may not be entirely consistent with NSDM 35's statement that BW and CW are to be treated separately."[96]

The 1973 war did serve to alert the nation to the Soviet chemical threat. Testimony to Congress by the Army stated that "intelligence from the October war in the Middle East highlighted the relative unpreparedness of U.S. troops to engage in chemical warfare." Specific reactions to this threat included accelerating developments of antidotes, decontamination capability, and scanning chemical detectors.[97] However, it is difficult to find extensive data showing that the United States responded in a manner similar to the drastic responses observed after the 9/11 attacks and the anthrax letters. In fact, the bureaucratic environment described in the previous section imposed serious headwinds on the program. Likewise, the training environment described in the frames section is not reflective of an urgent national response.

By the Army's own account, the extent of U.S. biological detection and warning research at the time was described simply as "exploratory in nature," with no urgency driving the program.[98] This thought process was also captured in a 1981 Air Force study on chemical warfare, which stated that the United States had "little commitment to chemical warfare," noting the influence of its "humanitarian view" in this aversion.[99] Another intelligence report acknowledged that the Soviets probably had an accurate evaluation of U.S. "deficiencies" in this area, but did not take the step to assume the Soviets might wish to exploit those deficiencies with an offensive program.[100]

As already cited, Mauroni documents the increase in funding subsequent to the Arab-Israeli War and the Sverdlovsk incident, which has been partially discussed in the frames section. Proportionally, the response favored chemical weapons, as would be expected from a chemical frame. However, it must be acknowledged that the timing of the two events, and corresponding increases in funding levels, are also indicative of a realist response to a changing external threat, although the relative proportionality, especially in light of the fact that biological defense was so far behind chemical defense at this time, suggests that the response was tempered by a chemical frame.

While it may be possible to argue that U.S. actions in the early 1970s were realist in nature, based on U.S. perception of a greater chemical threat, the argument does not hold for the 1980s. Available intelligence reports from the late 1980s clearly identified a significant Soviet biological weapons program. A realist-based response to this threat would be to try and address existing deficiencies to counter the program.

There is evidence that the threat was being taken more seriously by Congress, and there was concern the relevant treaties might not be working. A 1980 hearing on chemical and biological warfare reflected concern over reported use of Soviet chemical and toxic weapons, and the implications for nonproliferation efforts. The committee raised specific concerns over the "yellow rain" and Sverdlovsk incidents, and these questions elicited a telling response from (retired) Admiral Davies of the U.S. Arms Control and Disarmament Agency. Asked his opinion of the threat posed by the evidence of an anthrax release he responded, "I think they represent a need for further investigation. … But as to a threat … biological warfare, we concluded … was not a useful weapon."[101]

Opening statements from a 1984 hearing on chemical warfare reflected a similar concern over the emerging threat. The chairman stated that "until recently it was believed that the Geneva Protocol of 1925 and the Bacteriological Weapons convention of 1972 were working effectively. So powerful was the revulsion with chemical and biological arms that no nation … would use them. Unfortunately, recent events have cast these assumptions into question."[102]

This committee hearing is interesting in several ways. First, although it was a hearing on "Chemical Warfare," biological weapons were repeatedly associated with chemical weapons. Second, the committee placed more emphasis on the "yellow rain" accusations than the Sverdlovsk anthrax incident. Finally, this committee raised several questions regarding terrorist use of chemical and biological weapons—a new theme not observed in previous periods.

There is also some evidence that the chemical frame's influence over the perception of biological weapons began to change later in the 1980s. For example, in a 1989 Congressional hearing on "Chemical and Biological Weapons Proliferation" there were two instances where biological weapons were discussed as a separate weapons class. There was a specific reference to potential terrorist use of a biological agent, and also references to the unique aspects of biological weapons, such as the challenges presented by the fact that, unlike other "WMD" weapons, biological weapons can be grown from a small, easily transported sample.[103]

However, as repeatedly observed, the trend was to address the problem as a combined chemical/biological threat. Except for the two sections noted above, almost every other statement referencing biological weapons combined them with chemical weapons as a single category. Aside from these two specific sections, the general testimony contained forty-seven combined chemical/biological references, and chemical weapons were uniquely mentioned over four hundred times, while biological agents were mentioned only twenty-two times as a unique weapon. The testimony included items such as the subcommittee's "Chemical and Biological Weapons Policy," and under the "U.S. Chemical Weapons Control Proposals" section stated that "a number of bills have been introduced in both the House and Senate to further restrict the proliferation of chemical and biological weapons."[104]

These hearings do indicate a general increase in concern over the Soviet threat, but in most instances reflect the joint chemical/biological perspective. In fact, several of the hearings that discuss both chemical weapons and biological weapons are titled exclusively as hearings on chemical weapons.

The intelligence estimates and Congressional testimony from this period reflected a growing awareness of the threat posed by biological weapons. However, there were almost no organizational outputs reflecting this awareness. As documented in the organizational frames section, the doctrine, hardware, and training from this period were almost exclusively reflective of a combined chemical/biological threat. Had external threat exerted a greater influence, one would expect a greater emphasis on equipment dedicated to biological defense.

Conclusions—Realism

Without recounting all of the evidence presented in the organizational frames section, the most that can be said for the influence of external threat over this time period is that the nation was becoming concerned with an emerging biological threat, but subsequent actions continued to be executed through a chemical frame. More emphasis was placed on chemical defense relative to biological defense, especially in the 1970s, as would be predicted by the theory. However, as later threat assessments became more definitive regarding the existence of a Soviet biological weapons threat, there was no corresponding increase in biological defense. However, there was a drive to expand the chemical program, and a continued pattern of combining chemical and biological defensive programs.

Additionally, two possible predictions that would indicate an external threat influence are not observed. First, regardless of the threat level, chemical and biological weapons have vastly different characteristics, and are each worthy of their own program, yet there are numerous examples of a combined chemical/biological threat in all sources of data examined over this time period. Second, realism would predict that a low biological threat would result in a corresponding low incidence of references to biological weapons. However, biological weapons continue to receive significant attention, albeit as combined within references to NBC or CB threats or programs. The continued linkage of chemical agents and biological agents, as well as a (relative) lack of priority adjustment for biological agents is more indicative of behaviors associated with organizational frames than realism.

Conclusions—1971–1991

Over this period, several important historical events influenced the direction of the U.S. biological program. This period began with the program adjusting to President Nixon's unilateral renouncement of the use of biological weapons, which drastically altered the resources and prestige associated with the program. Other significant events included the 1973 Arab-Israeli war, the Vietnam War, defense drawdowns, Sverdlovsk, and a subsequent defense buildup in the 1980s.

Over this period, there is evidence of behaviors predicted by all three theories of interest. In the 1970s, retrenching and maintenance behaviors were apparent as the chemical program fought to remain relevant in spite of Army reorganization and budget cuts. When more money became available in the 1980s, there was imperialistic behavior, such as the public campaigning for binary chemical weapons.

There is also evidence supporting the realist prediction that chemical defense would be favored based on the perceived threat level. In the 1970s, the Soviet chemical threat was perceived as greater than the biological threat, and there was a similar pattern in hardware development and financial expenditures. However, with the accident at Sverdlovsk and the increasing perception of the Soviet biological threat in the 1980s, there was no corresponding increase in the biological defense program. Rather, most biological programs continued to be combined with chemical programs.

Finally, there is ample evidence of the continued influence of the chemical frame that had dominated the program since the World War II era. Behaviors such as combining of weapons classes, unequal allocation of resources, and production of similar outputs are evident over the entire time period. Also of note is that even when evidence of imperialism or rational choice decisions is present, the behaviors predicted by these theories still appear to have been executed through a chemical frame.

Therefore, in scoring this time period, the conclusion is that a chemical frame exerted the greatest influence over U.S. biological posture. While some observations are best explained by the influence of imperialism or external threat, there are more observations in support of the chemical frame. From these available data, organizational frames theory shows the most consistent pathway and has the greatest number of observed behaviors.

As a result of the frame, the United States entered the Gulf War with little capability to operate in a biological environment. What effort the United States had put into defense, detection, and training was skewed towards the chemical threat, or had treated the biological threat as an extension of the chemical threat. When the U.S. military faced a potential biological threat in Iraq, the best it could do was to implement an emergency vaccination program and dust off a discarded biological detection system for emergency deployment to the theater.

While the United States did not face a biological attack in Iraq, military leadership and Congress noted the deficiencies in this area. The resulting investigations and soul searching would result in significant changes in the program. Money, attention, and a new assessment of the threat in the 2000 time frame might be the catalyst to break the chemical frame and help create a more effective biological defensive capability.

Notes

1. Paul I. Bernstein, John P. Caves, Jr., and W. Seth Carus, *Countering Weapons of Mass Destruction: Looking Back, Looking Ahead* (Washington DC: National Defense University, 2009).

2. Albert J. Mauroni, *America's Struggle with Chemical-Biological Warfare* (Westport, CT: Praeger, 2000).

3. Ibid.

4. Don T. Parker, Dale O. Galloway, and J. Clifton Spendlove, *Defense Against Biological Attack, A General Assessment* (Dugway Proving Ground, UT: U.S. Army Test and Evaluation Command, 1975).

5. *The Biological Defense Protocol: The Biological Defense Preparedness of U.S. Army Forces* (Dugway Proving Ground, UT: U.S. Army Test and Evaluation Command, 1977).

6. An interesting side note is the overall priority in which this training is regarded. This manual reflects the relative significance of training when it states "NBC situations must be integrated in such a manner that they do not seriously impair primary training objectives."

7. Naval Schools Command, *NBC Defense Training Guide* (Treasure Island, CA: Damage Control School, 1972).

8 . *Field Manual 21-48: Planning and Conducting Chemical, Biological, Radiological (CBR), and Nuclear Defense Training* (Washington, DC: Department of the Army, 1973).

9 . J. McMahon, "Memorandum for The Director of Central Intelligence," 7 November 1980, accessed 13 March 2012 from USSR General Staff Academy Lessons, Freedom of Information Act Electronic Reading Room, http://www.foia.cia.gov/docs/DOC_0001197566/DOC_0001197566.pdf; The expectation that Soviet forces would face a biological threat is similar to the view expressed by defectors such as Ken Alibeck. In part, they justified their program on the "knowledge" that the United States must be cheating on the treaty and maintaining a covert offensive biological program. Thus, the Soviets fully expected the United States to use biological weapons in a war.

10. Edward Bardill, "Nuclear, biological, and chemical operations: M114/94," 1983, accessed 12 September 2011 from Combined Arms Research Library, http://comarms.ipac.dynixasp.com/ipac20/ipac.jsp?&menu=search&aspect=subtab316&npp=25&ipp=20&spp=20&profile=carlcgsc&ri=2&source=~!comarms&index=BIB&term=41047&x=0&y=0&aspect=subtab316#focus.

11. The author of this work was actually an Army officer with Chemical Corps experience.

12 . K. Silvernall, *Handbook for Nuclear, Biological and Chemical Defense Training* (Maxwell AFB, AL: Air Command and Staff College, 1985).

13 . *Ordnance Subcourse Number 308: Decontamination* (U.S. Army Ordnance Center, 1976).

14. Michael Guhin, "Memorandum for Dr. Kissinger," 2 January 1970, accessed 30 October 2011 from Digital National Security Archive, https://www2.gwu.edu/~nsarchiv/NSAEBB/NSAEBB58/RNCBW17.pdf.

15. Zbigniew Brzezinksi, "Presidential Directive/NSC 28: U.S. Policy on Chemical Warfare Program and Bacteriological/Biological Research Program," 28 January 1978, accessed from Federation of American Scientists, https://fas.org/irp/offdocs/pd/pd28.pdf.

16. Combat Developments Command, "Improved CBR Defense Support System for the Army in the Field," 23 November 1971, accessed 11 August 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/index.jsp. This statement appears arbitrary and overly broad. Higher temperatures would increase the evaporation

rate of some chemical weapons; however, as biological weapons are living organisms, each has an ideal temperature range, and most will retain greater viability at lower temperatures.

17. Test and Evaluation Command, *Biological Defense Protocol* (see ch. 6, n. 5).

18. Nerve class chemical weapons often target cellular receptor sites. With biological weapons, cellular receptor sites are important for toxins and some viruses, but less important for many bacterial agents.

19. Defense Science Board, *Report on Chemical Warfare/Biological Defense* (Washington DC: Office of the Under Secretary of Defense for Research and Engineering, 1985).

20. Program Evaluation and Methodology Division, *PMED 86-11: Chemical Warfare—Progress and Problems in Defensive Capability* (Washington DC: U.S. General Accounting Office, 1986).

21. Interdepartmental Political-Military Group, "Annual Review of United States Chemical Warfare and Biological Research Programs as of 1 November 1970," 5 December 1970, accessed 7 May 2014, http://www.disabledveterans.org/wp-content/uploads/2013/12/710204-Annual-Review-of-US-Chemical-Warfare-and-Biological-Research-Program.pdf.

22. John Irwin to the President, memorandum, "Annual Review of U.S. Chemical Warfare and Biological Research Program," 4 February 1971.

23. Director of Defense Research and Engineering to Deputy Director, Research and Technology, memorandum, "Identification of Essential Jobs," 15 September 1970.

24. Chemical Systems Laboratory, *FY 1981 Historical Report* (Aberdeen Proving Ground, MD: U.S. Army Armament Munitions Chemical Command, 1981). While the name of this organization indicates "chemical," this organization was responsible for biological programs such as NBC remote detection, protective clothing, mathematical predictions of a biological attack, and the XM19 biological detection system.

25. Richard L. Dimmick and Ronald P. Hinkle, *1986 Advanced Planning Briefing for Industry* (Aberdeen Proving Ground, MD: U.S. Army Armament Munitions Chemical Command, 1986).

26. *Chemical-Biological Warfare—U.S. Policies and International Effects: Hearings Before the Subcommittee on National Security Policy and Scientific*

Developments of the Committee on Foreign Affairs, United States House of Representatives, 91st Cong. (1970).

27. *Military Posture: Hearings Before the Committee on Armed Services*, House of Representatives, 94th Cong. (March/April 1975).

28. *H.R 9745: Hearings Before Subcommittee No. 1 of the Committee on Armed Services*, United States House of Representatives, 93rd Cong. (3 October 1973).

29. *U.S. Chemical Warfare Policy: Hearings Before the Subcommittee on National Security Policy and Scientific Developments of the Committee on Foreign Affairs*, United States House of Representatives, 93rd Cong. (May 1974).

30. Tactical Air Command, *TAC ROC 38-70: All Purpose Chemical/Biological Agent Decontaminant* (Langley AFB, VA: U.S. Air Force, 1971).

31. J. Harstad, "Biological Decontamination from the Army's Point of View" (Symposium on Toxic Substance Control: Decontamination, U.S. Army Research and Development Command, 1980).

32. R. Gross, memorandum, "Meeting of the Evaluation Coordination Working Group for the C8 Emulsion," 23 December 1985, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

33. Decontamination Systems Division, "Program Overview," 1986, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

34. Army Science Board, *Final Report of the Ad Hoc Subgroup on Army Decontamination Program* (Washington, DC: Department of the Army, 1984).

35. Test and Evaluation Command, *Biological Defense Protocol* (see ch. 6, n. 5).

36. Joe Swisher, "Draft O&O Plan for the Chemical/Biological Agent Sampling Kit," December 23, 1988, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

37. Joe Swisher, memorandum, "Review of Draft Operational and Organizational Plan for the Chemical Biological Mass Spectrometer," 8 August 1990, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

38. John Palman, memorandum, "Integrated Logistics Support Management Team for the Biological/Chemical Detector," 22 September 1989, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

39. Jesse Floeck, U.S. Army Chemical School, "Independent Evaluation Report (IRE) for the High Technology Light Division Nuclear Biological and Chemical System," 1985, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

40. D. Mangrum, memorandum, "Change to the Required Operational Capability (ROC) for a Biological Detector and Warning System," 1 October 1981. This requirement reflects the one-size-fits-all approach for detectors and fails to take into account the vast differences in infectious doses, which can range from ten particles to five thousand particles, depending on the organism.

41. Swisher, "Review of Draft" (see ch. 6, n. 37).

42. Dimmick and Hinkle, *1986 Advanced Planning* (see ch. 6, n. 25).

43. Swisher, "Draft O&O Plan" (see ch. 6, n. 36).

44. Congressional Research Service, *Chemical and Biological Warfare: Issues and Developments During 1974* (Washington DC: Library of Congress, 1974).

45 . *A Limited Assessment of Ground Operations in a Chemical Warfare Environment at a Typical USAFE Base* (Quest Research Corporation, 1981).

46. Chemical Systems Laboratory, *Historical Report* (see ch. 6, n. 24).

47. Combat Developments Command, "Improved CBR Defense Support System for the Army in the Field," 23 November 1971, accessed 11 August 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/index.jsp. The reference to tactical employment is significant in that most military planners recognize that the slow action of biological weapons gives them minimal tactical benefit in the form of immediate battlefield effect. Chemical weapons act quickly and have a much greater tactical utility, thus the terminology of the threat implies a chemical bias.

48. Quest, *A Limited Assessment* (see ch. 6, n. 45).

49. Department of the Air Force, "NBC Weaponization Optimization Against Rear Area Targets," 11 March 1986, accessed 1 November 2011 from Defense Technical Information Center, http://www.dtic.mil.

50. Department of the Army, *Field Manual 100-5: Operations* (Washington, DC: U.S. Government Printing Office, 1971). This assumption is realistic in a chemical attack scenario, where casualties will appear in minutes even if no detectors are present—unlike a biological attack, which may go undetected for up to a week.

51. U.S. Army Combat Developments Command, *Field Manual 101-40: Armed Forces Doctrine for Chemical Warfare and Biological Defense* (Washington, DC: U.S. Government Printing Office, 1972).

52. The wording of this threat paragraph is interesting in that Soviet offensive and defensive chemical capabilities are specifically acknowledged, yet the paragraph only calls out Soviet nuclear and biological defense training. It is possible that the reference to a defensive biological posture suggests a belief that the Soviets did not have an active biological program, but including nuclear defense in the same sentence confounds this theory, as the Soviets clearly had an offensive nuclear capability at this point in time.

53. Department of the Army, *Field Manual 100-5: Operations of the Army Forces in the Field* (Washington, DC: U.S. Government Printing Office, 1968).

54. Department of the Army, *Field Manual 90-14: Rear Battle* (Washington, DC: U.S. Government Printing Office, 1985).

55. This statement is always true for chemical agents, but only true for biological weapons if the skin is broken.

56. Protective equipment from the 1980s was referred to as “MOPP Gear” (Mission Oriented Protective Posture).

57. Army, *Field Manual 90-14* (see ch. 6, n. 54).

58. Department of the Army, *Field Manual 90-12: Base Defense* (Washington, DC: U.S. Government Printing Office, 1989).

59. Department of the Army, *Field Manual 63-21: Main Support Battalion* (Washington, DC: U.S. Government Printing Office, 1990).

60. Department of the Army, *Field Manual 21-40: NBC Defense* (Washington, DC: U.S. Government Printing Office, 1977).

61. Dwight Oland, *Annual Report, the Surgeon General, United States Army, Fiscal Year 1975* (Washington, DC: Office of the Surgeon General, U.S. Army, 1979).

62. Parker et. al., *Defense Against Biological Attack* (see ch. 6, n. 4).

63. Congressional Research Service, *Chemical and Biological Warfare* (see ch. 6, n. 44).

64. Kendall Hoyt, *Long Shot: Vaccines for National Defense* (Cambridge, MA: Harvard University Press, 2012).

65. *GAO/NSIAD-96-103: Chemical and Biological Defense—Emphasis Remains Insufficient to Resolve Continuing Problems* (Washington, DC: U.S. General Accounting Office, 1996).

66. A portion of the evidence presented in this section, and in the realism section, includes testimony and policy based on chemical weapons, partly due to the lack of data and also on the assumption that the environment was extremely poor for imperialistic behavior. As chemical weapons had fewer restrictions than biological weapons, any imperialistic behavior would likely be observed in the chemical program before the biological program. The majority of the programs and polices of this period are presented in the joint chemical/biological frame of reference.

67. Matthew Holden, Jr., "'Imperialism' in Bureaucracy," *The American Political Science Review* 60, no. 4 (1966): 943–951.

68. Interdepartmental Political-Military Group, "Annual Review" (see ch. 6, n. 21).

69. Melvin Laird to the President, memorandum, "National Security Decision Memoranda 35 and 44," 6 July 1970, Nixon Presidential Materials, NSC Files, National Archives and Records Administration, College Park, MD.

70. John Stoner, *Overview of the Army's Chemical and Biological Material Program* (Fort Belvoir, VA: Defense Technical Information Center, 1973). These notes actually come from a briefing by the Chief Chemical officer to the Chief of Staff of the Army.

71. Henry Kissinger, "National Security Study Memorandum 157: Review of United States Position on Chemical Weapons Prohibitions," 28 July 1972, http://fas.org/irp/offdocs/nssm-nixon/nssm_157.pdf.

72. National Security Council, "Analytical Summary NSSM 157 Response," December 1973.

73. National Security Council, "Addendum to the NSSM 157 Study: U.S. Position on Chemical Weapon Prohibition," 9 March 1973, accessed 13 March 2012 from Digital National Security Archive.

74. Congressional Research Service, *Chemical and Biological Warfare* (see ch. 6, n. 44).

75. National Security Council, "Addendum" (see ch. 6, n. 73).

76. Gerald Ford, *Executive Order 11850*, "Renunciation of certain uses in war of chemical herbicides and riot control agents," 8 April 1975, accessed 12 March 2012 from National Archives, http://www.archives.gov/federal-register/codification/executive-order/11850.html.

77. Zbigniew Brzezinksi, memorandum, "Presidential Directive NSC 15: Chemical Warfare," 16 June 1977, accessed from Federation of American Scientists, http://fas.org/irp/offdocs/pd/pd15.pdf.

78. H. Miley and G. Brown, memorandum of agreement, "Joint USAMC/AFSC Administration of Air Force and Army Chemical and Biological RDT&E Programs," 24 March 1971.

79. *DoD Directive 5160.5: Responsibilities for Research, Development, Test and Evaluation on Chemical Weapons and Chemical Biological Defense, 30 March 1976* (Washington DC: Department of Defense, 1976).

80. *U.S. Army Activity in the U.S. Biological Warfare Programs* (Washington, DC: Department of the Army, 1977).

81. J. Wickham, *Chemical Warfare: Deterrence Through Strength*, (Washington DC: Department of the Army, 1984); Binary weapons represented a new technology, and were the source of significant debate within the government. Approval to develop these weapons would also include significant funding.

82. Strategic Plans Branch, "AMCCOM Strategic Long Range Plan," November 1984, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

83. Director of Central Intelligence, "Soviet Capabilities and Intentions with Respect to Biological Warfare," 26 August 1964, accessed 31 October 2011 from Digital National Security Archives.

84. Director of Central Intelligence, *National Intelligence Estimate 11-11-69: Soviet Chemical and Biological Warfare Capabilities* (Washington, DC: Central Intelligence Agency, 1969).

85. Central Intelligence Agency, Directorate of Plans, "Intelligence Information Report: Warsaw Pact," 6 November 1970, accessed 1 November 2001 from Freedom of Information Act Electronic Reading Room, http://www.foia.cia.gov/docs/DOC_0001199065/DOC_0001199065.pdf.

86. National Foreign Assessment Center, “Soviet Civil Defense Against Chemical and Biological Warfare,” May 1978, accessed 1 November 2011 from Freedom of Information Act Electronic Reading Room, http://www.foia.cia.gov/docs/DOC_0000498569/DOC_0000498569.pdf. This finding in itself reflects a chemical frame on the part of the analyst.

87. Defense Intelligence Agency, “USSR: Biological Warfare,” 25 March 1980, accessed from Digital National Security Archive.

88. Director of Central Intelligence, “Use of Toxins and Other Lethal Chemicals in Southeast Asia and Afghanistan,” February 1982, accessed 13 March 2012 from Freedom of Information Act Electronic Reading Room, http://www.foia.cia.gov/docs/DOC_0000284013/DOC_0000284013.pdf.

89. Director of Central Intelligence, “Implications of Soviet Use of Chemical and Toxin Weapons for U.S. Security Interests,” 15 September 1983, accessed 29 October 2011 from Freedom of Information Act Electronic Reading Room, http://www.foia.cia.gov/brows_docs_full.asp?doc_no0000273395. The report also shows a potential chemical frame, noting that detection, protection, and decontamination of toxins is similar to “traditional chemical agents.”

90. Director of Central Intelligence, “New Directions in Soviet BCW Agent Development,” 28 February 1984, accessed 1 November 2011 from Freedom of Information Act Electronic Reading Room, http://www.foia.cia.gov/docs/DOC_0001106197/DOC_0001106197.pdf.

91. Defense Intelligence Agency, “Soviet Biological Warfare Threat,” 1986, accessed 31 October 2011, from Digital National Security Archive.

92. Director of Central Intelligence, “Chemical and Biological Weapons: The Poor Man’s Atomic Bomb,” December 1988, accessed from Freedom of Information Act Electronic Reading Room, http://www.foia.cia.gov.

93. Interdepartmental Political-Military Group, “Annual Review” (see ch. 6, n. 21).

94. House of Representatives, *Chemical-Biological Warfare* (see ch. 6, n. 26).

95. The BWC is generally regarded as unverifiable. The United States has been critical of verification protocols, and President Bush pulled out of verification discussions in 2001—a stance repeated by President Obama in 2010.

96. Michael Guhin to National Security Advisor Henry Kissinger, memorandum, “Conventions Banning Biological Weapons and Toxins,” 17 September 1971, National

Security Council, Box 816, Folder 11, Nixon Presidential Materials, NSC Files, National Archives and Records Administration, College Park, MD.

97. *Military Posture*, hearing (see ch. 6, n. 27).

98. Army, *Field Manual 21-40* (see ch. 6, n. 60).

99. Quest, "A Limited Assessment" (see ch. 6, n. 45).

100. National Foreign Assessment Center, "Soviet Civil Defense" (see ch. 6, n. 86).

101. *Strategic Implications of Chemical and Biological Warfare: Hearing Before the Subcommittees on International Security and Scientific Affairs and on Asian and Pacific Affairs of the Committee on Foreign Affairs*, House of Representatives, 96th Cong. (24 April 1980).

102. *Chemical Warfare: Arms Control and Nonproliferation: Joint Hearing Before the Committee on Foreign Relations and the Subcommittee on Energy, Nuclear Proliferation and Government Processes of the Committee on Governmental Affairs,* United States Senate, 98th Cong. (1984).

103. Biological agents are unique due to the ability to use a small sample (in theory, a single cell) to grow liters of agent for weaponization, unlike chemical weapons, which cannot multiply in this way and must be transported in significant amounts. Therefore, covert trafficking of a biological agent is much easier than with chemical agents or nuclear devices.

104 . *Chemical and Biological Weapons Proliferation: Hearing Before the Subcommittee on International Finance and Monetary Policy of the Committee on Banking, Housing, and Urban Affairs,* United States Senate, 101st Congress (1989).

CHAPTER 7

U.N. Sanctions, Terrorism, and Anthrax in the Mail (1991–Present)

> The proliferation of weapons of mass destruction and the means of delivering them continues to pose an unusual and extraordinary threat to the national security, foreign policy, and economy of the United States; therefore, the national emergency first declared on November 14, 1994, and extended in each subsequent year, must continue.
>
> —President Barack Obama, 2010[1]

Historical Setting

The United States entered the present period in a bit of a panic, having just fought an enemy with known chemical and possible biological capabilities, while possessing less than ideal protective and detection capabilities. The military realized it had an inadequate supply of protective clothing, and was forced to pull equipment from other theaters to fill the gaps. Military members arrived in theater requiring crash courses in chemical and biological defense. By the time the United States initiated its ground action, forces were judged capable of operating in a contaminated environment, but serious concerns had been raised. The best the military could do to provide biological detection was to dust off a mothballed prototype system developed in the early 1980s.

Biological weapons received considerable attention in the news after the war, as the United States and the United Nations uncovered the extent of Iraq's biological program. Biological weapons remained in the news for the next ten years, as U.N. Inspectors, Iraq, and the United States battled over attempts to execute the biological weapons inspection program within Iraq. President Clinton went so far as to initiate several bombing campaigns of Iraq, due in part to continuing confrontations between U.N. inspectors and the Iraqi military, including strikes on a Sudanese pharmaceutical plant over fears of possible chemical weapons production.

Also influencing this period was the emergence of several defectors from the former Soviet Union, who revealed extensive details of the Soviet biological weapons program. They provided evidence of Soviet treaty violations, as well as evidence of a mature and operational state-level biological program. From their accounts, the United States had drastically underestimated the Soviet threat, which went so far as to include biological ICBM's capable of delivering weaponized anthrax and smallpox to any target within the United States.

Just as the United States was becoming aware of the extent of the Soviet biological weapons program, the Soviet Union collapsed, with immediate implications for non-proliferation of nuclear, biological, and chemical weapons. For example, the Ukraine was suddenly the third largest nuclear power in the world. With the loss of Soviet control and money, the United States was extremely concerned over the security of the weapons. Likewise, many Soviet biological facilities were left with skeleton crews, and security forces went unpaid paid for months at a time. For the United States, the possibility that a foreign government or terrorist group would be able to buy or steal one of these weapons was a very real concern.

Adding to the fear of a rogue biological weapons threat has been the explosion in scientific advances in the biotechnology field. Cloning, genetic sequencing, and artificially constructed viruses, which were all once viewed as science fiction, have become commonplace in the scientific literature. Genetic techniques once taught in graduate school are now available as mail order kits for high school biology labs.

In 1995, the Japanese cult Aum Shinrikyo attacked the Tokyo subway with homemade nerve agent sarin, killing thirteen people. Subsequent investigation of the group found that in addition to several nerve agent attacks, it had attempted to grow and release anthrax from its Tokyo headquarters. Luckily, they used the vaccine strain of anthrax for the attacks, and the sarin they produced was of low purity—otherwise the group could have inflicted many more casualties. Nonetheless, these revelations served as watershed events for the nation. A terrorist group had crossed the chemical and biological line, using weapons previously regarded as a threat only on the state level.

The Tokyo attack was followed by a series of international terrorist attacks on U.S. facilities, culminating with the 9/11 attacks, which drastically changed how the United States viewed the terrorist threat. These attacks demonstrated that dedicated international terrorist groups using low-tech unconventional means had the capability to cause horrific damage. Almost immediately following the 9/11 attacks, anthrax was delivered through the mail, and suddenly the idea of terrorists releasing a biological weapon within a U.S. city seemed a distinct possibility.

After the 9/11 attacks, the United States invaded Afghanistan in an attempt to root out the al-Qaeda leadership. Soon there were reports of U.S. forces discovering evidence that al-Qaeda had conducted basic research into chemical weapons, as well as biological weapons. After the United States invaded Afghanistan, it invaded Iraq for the second time. One of the reasons given was that Iraq was continuing to develop biological and other weapons, in violation of multiple U.N. resolutions. Secretary of State Powell went before the U.N. to provide evidence of alleged mobile Iraqi biological production facilities. The subsequent failure to find biological weapons and analysis of the intelligence that led to this failure has been the subject of many books and endless debate, but the reality is that prior to the invasion the United States "knew" that the Iraqis possessed biological weapons, and would likely use them in the Second Gulf War.

The backdrop for this entire time period was the presence of rogue states such as North Korea, Iran, and Libya, which were suspected of developing any combination of nuclear, chemical, and biological weapons. Such states are still regarded as proliferation threats today, and are the target of sanctions and non-proliferation initiatives designed to forestall their efforts.

As of the writing of this work, U.S. forces have left Iraq, and are all but out of Afghanistan. At the moment, the international community is debating a nuclear treaty with Iran, while North Korea continues to make claims of advances in its nuclear program. In the Middle East, known Syrian chemical weapons have been destroyed, while ISIS controls a significant amount of territory. Domestically, the U.S. biological defense program (along with all counterproliferation programs) has grown to a massive scale, orders of magnitude larger than it was in the early 1970s. In addition to military programs, the United States has initiated multiple federal and state biological defense programs as well.

This brief history of the last twenty years reflects an international environment conducive to policy decisions based on an increasing external threat. For twenty years, the United States has been observing an increasingly sophisticated terrorist threat, an explosion in biotechnology, and a general realization that the 1975 treaty did nothing to contain biological weapons. It seems that every three to five years another significant event took place that made the likelihood of a biological event seem even greater. In fact, the Graham/Talent commission, writing in 2008, stated that "it is more likely than not that a weapon of mass destruction will be use in a terrorist attack somewhere in the world by the end of 2013."[2]

Likewise, and perhaps as a result of external threat, the bureaucratic environment has been fertile for imperialism, especially after 2001. The United States has spent massive amounts of money, not only on biological defense, but also on chemical and nuclear defense. While the United States was spending less than $10 million per year for medical countermeasures in the early 1970s, that amount ballooned to $600 million in the mid-2000s. The massive amount of money and prestige associated with biological defense makes it a tempting colonization target for any organization with an advertised biodefense capability and an advocate in the correct position.

However, the U.S. biological defense program is also burdened with the presence of a chemical frame that has been influencing its direction for the last forty years. Several generations of military officers, politicians, and researchers have learned and worked under this frame. As seen in previous periods, direction from the top regarding a frame does not necessarily mean the frame will be broken. With such a long history, it would be difficult to remove the frame entirely from the defense community.

For this period, the evidence indicates that all three factors have exerted an influence over defense posture. The United States has clearly implemented a national policy based on external threat. The money and resources available due to this response have resulted in an explosion of organizations taking on some aspect of responsibility for biological defense. These organizations are using the external threat as justification for their imperialistic behaviors. However, there is evidence that some of the organizational outputs reflect a chemical frame, which is troubling in that even though the nation may think it is taking appropriate action, if the outputs of the program are not effective against the biological threat, it will have wasted a substantial amount of resources. Even more troubling is that if the frame continues to influence the program, future military forces may find themselves in the same situation encountered in the First Gulf War.

Organizational Frames and Biodefense, 1991–Present

The conclusion from the previous two time periods was that a chemical frame played a significant role in U.S. biological posture from the end of World War II through the Gulf War. Having been a major part of the decision making process for over forty years, there is reason to believe the chemical frame is so strongly entrenched that it will continue to exert influence during this period as well.

The evidence will show that entering this time the chemical frame was exerting considerable influence over U.S. posture. However, later in this period the behaviors indicative of the frames model become less apparent. This move away from a chemical frame is most evident in government policy, military doctrine, and general testimony, while the area of hardware development seems to be the slowest to emerge from the influence of the frame.[3]

Frames in Training

Historical events over this time period, such as the chemical and biological defensive scramble in the Gulf War, the realization of the existence of Iraqi and Soviet biological programs, the 9/11 attacks, and the anthrax attacks all increased Congressional interest in chemical defense and biological defense. Based on a perceived vulnerability to chemical agents and biological agents in the First Gulf War, there was a push from Congress to increase capabilities, and in particular to increase training efforts. While the nation’s approach to biological training will also be addressed in the realism section, it is important to highlight behaviors indicative of a chemical frame in this section as well.

An excellent example of how the DoD viewed chemical and biological weapons as a single class is captured in the DoD response to a 2000 GAO report on training. Acknowledging the GAO finding that current training was inadequate, the DoD responded that "the Joint staff and CINCs will continue to develop a counter-CBW operational concept. … This concept will serve as the basis for refining doctrine to reflect all aspects of counter-CBW operations."[4] Not only does this position capture the combined chemical/biological threat behavior predicted by the model, but also a directive from such a high organizational level instructing development of a combined chemical/biological operational concept could "lock in" that frame of reference for subordinate staffs responsible for developing the concept.

In a 2001 report on medical readiness, the GAO found an overall lack of chemical or biological awareness in the military medical community, but noted the level of biological awareness was lower than that of chemical awareness. It found the Army had finally incorporated chemical casualties into medical casualty/logistics estimates, but had not incorporated biological warfare scenarios. The same report also showed that chemical scenarios had begun to be included in medical unit training, but biological scenarios had only been "piloted" at that point. The GAO also noted that no official direction had been issued to include biological scenarios in training "even though biological warfare scenarios are different than those for chemical warfare."[5]

A subsequent GAO study in 2005 found that training was somewhat improved, but still noted a general lack of NBC training at combat training centers. The report showed that when training did take place, it was executed through a chemical frame. Examining several training events, the authors noted that training included three to seven chemical attacks per rotation, usually incorporated as an overt bomb, aerial spray, or artillery attack. They also noted far fewer biological attacks, and when they were included the attack scenario was usually biological contamination of drinking water. The report did cite one area that showed an increase in biological emphasis: a 2004 Marine NBC course allocated two of seventeen classroom hours to biodefense.[6]

As late as 2007, Army training guidance continued to reflect a combined chemical/biological threat. The title of the document—*React to a Chemical or Biological (C/B) hazard/attack*—reflects this bias, and it is also evident throughout the training tasks, which prescribed chemical-centric performance steps and attack scenarios. For example, soldiers were to identify a C/B hazard by a "Chemical Alarm," or by observing symptoms of "C/B" poisoning such as "difficulty breathing, coughing, wheezing, vomiting, or eye irritation."[7] While such guidance is realistic for a chemical attack, the training made no reference to the fact that biological symptoms would not appear until days after the attack.

Frames in Speech

In the previous historical periods, Congressional testimony has demonstrated the close association between chemical weapons and biological weapons in the minds of government officials. Generally, biological weapons appeared to be included by default in discussions of chemical weapons, or as an afterthought of another possible route of attack, but were not regarded as a serious threat on their own.

The perception of biological agents observed during this period shows a striking contrast with previous testimony, indicating a weakening of the chemical frame. While there have still been references to combined threats, and repeated use of the terms WMD or CBRN, the close chemical/biological association seen in previous periods has exhibited a gradual but steady weakening. Ironically, in the most recent testimony, the roles of biological weapons and chemical weapons have been almost reversed, as chemical agents have begun to appear almost as an afterthought to the biological threat.

In 1993, testimony regarding proliferation did not necessarily use the chemical/biological association, but referred to generic "WMD" threats when assessing the international threat environment. However, when the discussion turned to specific countries or proliferation scenarios, references were unique to the type of weapon, separate from the general WMD category. Interestingly, one recommended course of action was to create a one-stop, combined "WMD" threat center to collect and process intelligence.[8]

Over the subsequent years, testimony has reflected varying levels of influence from a chemical frame, with a general pattern of decreased influence. In 2001 testimony, Dr. Anna Johnson-Winegar did a good job of addressing biological-specific challenges and solutions. However, the frame did creep in, as evidenced by references to "DoD's chemical and biological detection equipment," and "operations in chemical and biological environments."[9]

The frame exerted still greater influence over testimony in 2003, with an even stronger chemical/biological association than previous testimony. For example, the statement was made that "the Chemical Biological Defense Program's initiatives over the last decade have significantly improved our ability to protect Service members from the effects of chemical and biological weapons," and that "efforts have resulted in improvements in the whole family of chemical and biological defense systems," and a reference was also made to a "chemical and biological (CB) installation protection equipment suite."[10]

While the chemical frame is evident in this testimony, there are some specific references to dedicated biological detection equipment. These statements reflect an attitude not previously observed in Congressional testimony. One telling statement reflects an appreciation of the difficulty in biological detection, pointing out that "not only are there high levels of biological aerosols naturally present, but detection systems need to identify the various biological species and strains, the particle size, whether they are pathogenic, and whether they remain viable after being released into the atmosphere."

Testimony in 2008 is interesting in that it represents a dual view of the chemical/biological relationship, reflecting a general pattern observed in other areas examined over this time period. The civilian component of the testimony showed a distinction between weapons classes, and made references to biological attacks, threats, and technology, with no reference to chemical agents. The military representative did make specific references to biological weapons in some scenarios, but when discussing general threat, the reference was much more likely to combine chemical and biological weapons. For example, he referenced "new chemical and biological detectors," a "chemical and biological event," "chemical and biological medical systems technologies," and "all-hazards decontamination."[11]

Some of the most recent testimony has continued to reflect the move away from a chemical frame. The title of one hearing—*National Strategy for Countering Biological Threats: Diplomacy and International Programs*—is in itself significant in that the biological threat is being identified as a unique and separate weapon.[12] This theme continued in the actual the testimony. Whereas most previous testimony contained some references to a combined chemical/biological threat, it appears witnesses in this hearing were acutely aware of the differences in the weapons, and took steps to identify issues with previous references.

This awareness is reflected in statements such as "I have often said that the use of the term WMD is misleading, because it lumps into one category mustard gas and hydrogen bombs along with all chemical, radiological, and biological and nuclear threats" and "I want to stress a key point that informs the rest of our commission's analysis. That is that nuclear weapons and biological weapons are very different. … If we apply some of the lessons that we have drawn from the nuclear area to the biological area, we will make some big mistakes."[13]

Testimony in this hearing was biological-specific, addressing concepts such as international disease surveillance and the importance of drugs and vaccination for biological agents, noting "why weaponize pathogens to populations [that] can be effectively immunized or treated." This testimony is also notable in that it addressed characteristics of biological agents not previously exploited in defense planning. Specifically, it recognized that the relatively slow action of biological agents provides a treatment option not available to other "WMD" class weapons.[14] Speaking on behalf of the Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism, Rademaker stated the position "that the United States needs to take advantage of that window to make sure that we have measures in place that will minimize the consequences of a bio attack."

However, it is still possible to find references that indicate the chemical frame has exerted some influence. A troubling comment from one committee member regarding the "underwear bomber" reflects a combining of the chemical/biological threat, and general confusion over what constitutes a chemical weapon versus an explosive/kinetic weapon: "Our most recent attack from a chemical/biological weapon shows the sophistication and change of tactics of terrorists … who would have thought that a mere mixing of a chemical in one's under garments could blow a plane out of the sky?"

Records from two other 2010 sessions also reflect the considerable weakening of the chemical frame. Testimony on government preparedness made some references to a combined “WMD” threat; however, it made many more references to biological-specific threats and attack scenarios than observed in previous periods.[15] A hearing on emerging threats is significant in that it almost completely reversed the chemical frame observed in the previous time periods. This testimony still used the combined chemical/biological/nuclear “WMD” term, but there were more references to specific biological attacks or technology than to chemical events. Even more importantly, not one biological reference was combined with a reference to a chemical agent.

The continuing change in focus is reflected in Congressional testimony from the director of the Chemical Biological Defense Program regarding the 2011 budget. Some of the testimony shows evidence of imperialistic behavior, and will be discussed in the next section. Significantly for this section, the main focus of the testimony was on countering the biological threat through drug development and disease surveillance. This testimony reflects a decoupling of the chemical/biological threat, as it recognized the unique role of medical countermeasures in biological defense. It also emphasized the large number of collaborating agencies, indicating increased imperialistic influence—something not observed in previous periods.[16]

Written Frames

When examining documents such as annual reports, charters, after-action reports, and modernization strategies, it is possible to find behaviors predicted by the chemical frame model, such as combining threats, subsuming threats, and giving unequal attention. As in other areas, while there is evidence of the chemical frame, it is also possible to detect a gradual shift away from the frame.

Sources early in this period almost always combined the chemical and biological threat as one entity. The 1992 report summarizing U.S. performance in the Gulf War made repeated references to “CW/BW” defensive equipment, protection, and training.[17] Also in 1992, a regulation was published creating a committee to evaluate material for “nuclear survivability and NBC contamination survivability matters.” Although the committee was clearly charged with NBC survivability, its official name was the “Nuclear and Chemical Survivability Committee.”[18] The *Army*

NBC Modernization Plan, published in 1992, combined threats and solutions in stating that "contamination avoidance is the cornerstone of NBC defense," despite an acknowledged lack of biological detection capability. The plan also stated that "successful NBC protection is founded in the chemical infrastructure and protective equipment located in all Army units."[19]

The 1997 science plan began to reveal a crack in the chemical frame, as it showed an interest in biological-specific defense issues. The plan included three specific biological technology demonstrations designed to improve defense against biological weapons. At the same time, the plan included several combined experiments. It is not surprising that two of the areas that were combined, protective clothing and decontamination, have shown some of the strongest historical evidence of the chemical frame.[20]

While the frame may have been weakening, it was still exerting influence. A 1998 NBC defense report to Congress continued the behavior of combining chemical and biological weapons as a single threat. There was a distinct nuclear section in the threat portion of the report, yet chemical and biological weapons were regarded as one threat for the purposes of issues such as national weapons programs, delivery systems, and attack scenarios.[21] In some cases, there were actually conscious efforts to combine the weapons classes. In 2002, the Counterproliferation Program Review Committee actually combined a unique "Bio Point Detection Roadmap" published in a previous report by re-designating it a "Chem-Bio Point Detection Roadmap."[22]

The combined chemical/biological view continues to exist in more recent government reports, particularly within "the" chemical/biological defense program. The 2005 CBDP annual report was based on a combined threat, as evidenced by references such as "the unique characteristics of the various CB weapons," and "effectively mitigate the effects of a CB attack."[23] This combined threat was still evident in 2010, as the CBDP annual report discussed acquisition of "CB defensive equipment," "CB sensor components," and "CB point identification," and made repeated references to the encompassing "CBRN threat."[24]

As in previous periods, academic writings by military officers and NCO's that address issues relating to biological weapons show a stronger prevalence of the chemical frame than observed in other written documents, perhaps reflective of a stronger frame within military leadership. This is also significant in that if the frame still exists within today's emerging leaders, it may continue to influence the military for the next ten to twenty years.

Writing in 1991, Doesburg produced a thesis on the future of the Chemical Corps. Reflected in his work is the familiar behavior of combining chemical and biological weapons as one threat. Specifically, when addressing the "NBC" threat, he identified the unique nature of nuclear weapons, segregating them for separate discussions, while referring to chemical and biological weapons as one combined class. There is also the behavior of combining requirements for hardware, discussing incorporating multiple detection missions and threats within combined "NBC" detection devices.[25]

A 2005 paper titled *Chemical and Biological Warfare: A Moral Dilemma* demonstrates an extreme example of chemical weapons and biological weapons being viewed as one category. The thesis statement stated the paper was about the Chemical Weapons Convention, retaliation, and elimination of chemical weapons, making no reference to biological weapons. The paper then included an almost obligatory paragraph on the basics of biological weapons, yet made no reference to biological agents in any of its subsequent arguments. Perhaps the most troubling aspect of the combined view is that it leads to false statements. Thirty-five years after President Nixon's biological declarations, do these military members still believe the United States has biological weapons? These misperceptions are expressed in statements such as "our nation's leaders have decided the time has come to dispose of our nation's vast stockpile of chemical and biological weapons," or "the U.S. unleashed 10,000 tons of chemical and biological agents on the North Vietnamese" and "how do we dispose of the remaining 91 percent of chemical and biological weapons by the 2007 deadline?"[26]

The combining of weapons is also observed in a 2007 thesis examining fixed site decontamination. This thesis continues to reflect the historic tendency to combine chemical and biological decontamination within the same frame of reference. In this case, chemical and biological weapons are also combined with radiological and nuclear weapons as a single decontamination problem. An additional point highlighted in the thesis is that the other services rely on the Army for heavy decontamination capabilities, making the Army's frame of reference the default for all the services.[27]

As argued in previous sections, the existence of contrarian views to a frame is expected, and serves as an indicator that others take issue with the status quo. At least one military paper has advocated a non-frames view on consequence management, arguing that "organizations are driving their actions based upon misperceptions gleaned from the 1996 sarin attack in Tokyo." The author made several points that the combined category of weapons as observed with "WMD" policy results in universal doctrine and policy that are at best impractical, and at worst impossible to implement because of the differing physical realities of the various agents. For instance, he argued that the quick action of chemical weapons makes it unrealistic to assume a military unit would be able to respond in time to provide any protection to a local community.[28]

While it is possible to identify many examples of the chemical frame, there is also important evidence that the chemical frame has been challenged in recent years. In 2005, the Air Force held a workshop in an attempt to identify the "85% solution" for defense against biological weapons. The workshop was needed to combat the perceived belief that the military was unwilling to accept any solution less than 100% effective. The workshop produced over fifty suggestions on how to improve biological defense. Among the "Tier-1" solutions was to "develop C-BW CONOPS," when the report explicitly stated "doctrine for BW should be de-linked from other CBRNE doctrine since it is significantly different."[29] The Air Force has adopted this recommendation in implementing a biological-specific concept of operations in 2008.[30] The Air Force also adopted other recommendations, such as developing biological-specific decision tools, while recommendations such as increased training have not received substantial support.

There is also evidence that that the organizational culture of the Chemical Corps may be changing. In 2006, Brigadier General Spoehr, Chief of the Chemical Corps, gave a briefing in which he stated "we lack a common lexicon in our Corps, are we exactly sure what we mean when we use terms like: WMD, NBC, CBRN, Full Spectrum Hazards, SSE, HAZMAT, WMD Elimination, Technical Escort…?" In the same briefing, he proposed changing position descriptions from NBC or chemical to reflect CBRN terminology. For instance, a "Chemical Operations Specialist" was to become a "CBRN specialist."[31]

Frames in Hardware

The data presented so far in this section indicate that behaviors associated with a chemical frame were strongly present early in this period, but have been fading over the last ten years. However, compared to statements and reports, hardware and doctrine take much longer to develop and change. Therefore, even if the frames model were being broken in this period, it would take much longer to become evident in these areas.

The available evidence supports this conclusion, as it is still possible to find numerous examples of hardware developed against joint threats, and of biological defensive hardware mirroring chemical hardware requirements—specifically, the combining of chemical and biological agents/threats in the development of sensors, employment concepts, and decontamination capabilities. In instances where requirements are not explicitly combined, it is possible to observe operational requirements that are more similar than would be expected given the differences in the agents. This finding is important for U.S. biodefense posture in that, if good policies are executed poorly, the United States will still be left with substandard defensive capabilities.

In the early 1990s, equipment was almost always referred to as NBC or C/B equipment. The DoD report assessing U.S. performance in the Gulf War made almost exclusive use of the term "Chemical/Biological" when referencing defensive equipment, protection, and decontamination materials.[32] Likewise, in the Army's 1992 *NBC Modernization Plan*, current capabilities, threat, and operating environment were almost exclusively described relative to an "NBC" environment. When the WMD threat was broken out, there was still an overriding tendency to use combined "chemical/biological" references, as when describing long range plans for "individual CB detection," and "long range, real-time, detection, warning and identification system for Bio/Chem. hazards." The hardware described in the vision section for Fiscal Years 2003–2008 shows a chemical bias, or a combined threat bias, with four chemical-unique systems and five combined chemical/biological systems, but only one biological-unique program.[33]

Although there is a preponderance of chemical or chemical/biological sensors, there have always been some programs specific to biological agents. However, as seen in previous periods, the operational requirements for biological systems are similar to operational parameters for chemical sensors. The requirements for the Joint Biological Point Detection System in 1996 reflected another biological point detector of a similar construct to chemical detectors. The specifications for the systems called for detection, warning, sample collection, and identification capabilities within the same system. Specific performance parameters for the system called for detecting one agent particle per liter of air, and given a detection event, the system was to provide genus/species level identification within ten minutes.[34]

A concept study for the Biological Integrated Detection System (BIDS) in 1993 was somewhat unique in that the operational requirements for this system appeared to be less influenced by the rapid alert/warning requirements seen in chemical sensors and most biological sensors under development at this time. For this system, the requirement was to provide "rapid warning," specifically "at least fast enough to warn of impending casualties" and "if possible provide advanced warning for some personnel, and warning to others to minimize their dose." In this case, the removal of specific time requirements allowed developers flexibility in designing detection capabilities to meet faster requirements for toxins (acting in minutes/hours) versus bacteria or viruses (acting in days/weeks).[35]

However, by the time the BIDS system was under development in 1998, the flexible time requirements had been replaced by a near real-time detection requirement. Specifically, the system was now required to detect and identify 5–25 particles per liter of air in 15–30 minutes, simultaneously detect eight different agents, and also detect chemicals "at or below human response levels."[36] The point bears repeating that the 15–30 minute time warnings are of almost no use to a base commander. Only warnings within seconds can prevent exposure among personnel—a warning provided thirty minutes after the cloud passes means most of the base has already been exposed.

In 1994, Congress mandated that biological (and chemical) programs previously dispersed among the services be consolidated under one joint

DoD program, which is currently known as the Chemical Biological Defense Program (CBDP). Starting in 1995, the program issued annual reports to Congress that included a section listing all major existing and developmental programs. The table below summarizes the number of major research programs reported each year to Congress from 1995–2007.[37]

Chemical and Biological RTDE Programs 1995–2007*

Category	Chemical	Chemical Biological	Biological	"Real-time" Biological Detection	Standoff Biological Detection
All	**50**	**100**	**66**	**33**	**22**
CBDP Decontamination	1	38	0	-	-
CBDP Hardware	45	35	44	29	14
DARPA	0	10	11	1	0
DTO	4	17	11	3	8

** Source: CBDP reports to Congress 1995–2007*

In the table, programs are scored as either dedicated to chemical agents, dedicated to biological agents, or designed to address both. The bulk of the programs are under the control of the CBDP, and these were scored as either decontamination or hardware. Biological detection was further broken out as real-time (designed to detect in time to alert forces to don protective gear) or standoff (designed to detect biological agents at a distance from the location of the sensor). This breakout was included to show the relative lack of interest in a third possibility of biological detection—so-called "detect to treat," where identification takes hours and the goal is to facilitate medical treatment. Two alternative programs, the Defense Advanced Research Projects Agency (DARPA) and the Defense Technology Office (DTO), also produced similar equipment over this time period, and their programs are included as examples of nontraditional military-funded research.

Looking at the various totals, it is possible to draw several conclusions regarding the defense program.[38] One important observation is that the total number of biological projects is higher than the number of chemical projects, reflecting a level of biological independence not observed in previous periods, and possibly indicating a weakening of the chemical frame in some areas.

Also of interest is the continued combined approach in the decontamination effort. The decontamination program has historically shown a strong chemical frame influence. As seen in the table, these behaviors have persisted in this period, with no dedicated biological decontamination program. Program descriptions from this period support this observation. A decontaminant effective "against all probable threat chemical and biological agents, to include toxins" was requested in 1991.[39] Similar requirements were reflected in the parameters for the Sensitive Equipment Decontamination System, which was to "decontaminate chemical and biological warfare agents," and the Sorbent Decontamination System, which was required to "effectively decontaminate all CB warfare agents from contaminated surfaces."[40]

As with other areas, there are some indicators that, even in the decontamination arena, the frame might be weakening. In 2010 the Joint Program Manger—Decontamination's acquisition of a "Family of Decontamination Systems" addressed the possibility of a multiple decontaminant solution. This program was to incorporate "a family of decontaminants and decontamination application systems under a single entity."[41] Interestingly, the program description has now changed and seeks to provide "General Purpose Decontaminants" with "thorough chemical and biological decontamination capabilities."[42]

There is also evidence that the Air Force may be breaking the chemical frame associated with the decontamination effort. Included in the survivability testing for the latest generation of fighter aircraft was a test dedicated to biological decontamination. Writing about the tests, the authors recognized that "biological threats and agents are living organisms that can be neutralized through a proven process such as VHP. Unlike chemical threats, biological contamination does not have to be physically removed from the asset once an organism is killed."[43] However, at the same time, they continued to combine chemical and biological as one threat, therefore attributing capabilities to biological weapons that do not exist. Referencing material hardness, they stated materials must have the "ability to resist degradation by CB agents. Materials … must be capable of withstanding exposure to a contaminated environment."[44] The Air Force has also recently conducted JBADS (Joint Biological Aircraft Decontamination System), a biological-specific aircraft decontamination demonstration that focused solely on the ability to inactivate biological contamination from large frame aircraft.

The table also captures programs outside of the traditional DoD research and acquisition programs. The two additional agencies, DARPA and the DTO, were created to focus on forward-looking, "high risk" research. These programs present an opportunity to break from legacy thinking and explore "non-traditional" solutions. Interestingly, in this case there is a large bias towards combined or biological-unique programs, and relatively little effort directed towards chemical programs. Such a contrast is consistent with organizational frames theory in that organizations outside of the frame would adopt strategies to address the problem, as they perceive it, which very well might be different from strategies pursued by organizations within the frame. This may also reflect imperialist behavior by these agencies, as they may be attempting to claim the biological mission space ignored by the traditional CBDP program.

A particular area of interest is biological detection programs. As already discussed, detection parameters for chemical agents and biological agents continue to mirror each other. The table also confirms that almost all of the traditional biological detection programs are based on real-time or standoff detection systems, continuing the established pattern of producing biological detectors with operational characteristics similar to chemical detectors. There is a more recent program, JBREWS/JBTDS, which seems to break the pattern. This program (currently still in development) is based on a dispersed detection model rather than the traditional low-density point sensor detection strategy. Also of note is that DARPA detection projects do not follow the same trend, and seem to break from a chemical frame by examining alternative biological detection methods.

Over this period, three additional biological detection systems were developed, and are currently utilized by organizations outside the CBDP. These systems—JBAIDS (DoD medical community), BASIS (NNSA/DOE), and BioWatch (DHS)—were developed outside the traditional CBDP and are all based on technology utilizing a long sample/collection step, followed by a PCR-identification step. Compared to the near real-time sensors developed by the CBDP, these systems take hours to days to complete a detection cycle. The long detection time is offset by a high degree of sensitivity and specificity not available in sensors developed by the CBDP. The fact that these three systems were developed and deployed outside the traditional DoD program supports the contrasting internal/external behavior predicted by the organizational frames model. The successful employment of alternative sensors by outside organizations also supports behaviors predicted by the bureaucratic politics model.

But, just when it is possible put forth an argument that the frame may be weakening, it continues to show its strength, as evidenced in two current research programs. A 2012 *Request For Information* from the Transformational Medical Technologies Office looked for technology to "identify and characterize biowarfare agents and infectious disease agents," but also included that a "secondary objective is to identify biological toxins and chemical agents."[45] The frame is also present in the Chemical Biological Agent Resistance Test program. While including "biological" in the title, this program has nothing to do with biological agents, but rather seeks to improve testing protocols for "chemical warfare agents, toxic chemicals and toxic industrial materials."[46] While biodefense hardware may be slowly emerging from the chemical frame, there is clear evidence that the chemical frame is still influencing perceptions within the biodefense program.

The Case of Protective Clothing

A final area of hardware to examine is protective clothing. Combining data from each time period for one specific item allows a mini-observation over the entire period of biological defense. The pattern observed with protective clothing mirrors the overall pattern of the defensive program. The initial development of protective biological clothing reflects the influence of external threat, but a chemical frame dominates subsequent development. However, its history also reflects a battle of frames versus non-frames thinking, as the guidance regarding appropriate protection is schizophrenic, confusing, and at times directly contradicts itself.

There is a solid logistical and financial argument in favor of combined protective equipment. A single suit reduces development and acquisition costs, reduces logistical requirements, and does not rely on an accurate intelligence assessment of the enemy's capabilities. However, a combined suit comes with its own set of costs. Many studies have documented the loss of mission effectiveness associated with protective equipment (decreased tactile sensitivity, heat stress, claustrophobia, etc.). The current materials used for chemical protection also come with a shelf life and service life, meaning that combined suits are required in larger numbers than would be needed for a biological-only threat scenario.[47] While there is no argument as to the need for cutaneous protection against chemical weapons, it is questionable whether the same protection is needed for biological agents, especially when balanced against the loss of effectiveness and the heat stress associated with the protective garments.

The need for biological protective clothing was identified in World War II, and the initial efforts reflect a realist response to a new threat. Assuming the threat would be in the form of an aerosol or powder, physical filtering of agents was of prime concern to defensive planners. They first looked at chemical protective equipment, which was readily available, to see if it offered protection against biological agents. The results of these experiments were mixed. Assessment of the issued chemical clothing showed it had no additional filtering capability over standard uniform fabrics.[48] Assessments of gas masks in 1944 indicated that hoods were needed to augment masks, but were not available.[49]

Other assessments did find some benefit in using chemical gear for protection against biological agents. Evaluation of available chemical masks indicated they provided two hours of protection. While chemical protective clothing did not filter biological agents, it was found to possess a degree of bactericidal capability. While the overall finding of the report was that fully effective biological protection was not available, the presence of chemical clothing in theater, combined with its bactericidal properties, led researchers to "conclude that the chemically impregnated clothing should be worn in case BW breaks out."[50] This is not to say that alternative protective methods were not explored. A 1943 report suggested that in an emergency "a surprisingly effective mask can be devised from a stocking filled with dried grass using crank case oil with rancid butter as a wetting agent."[51]

After the war, development of protective clothing generally showed the influence of a chemical frame, although the frame was periodically challenged by contradictory assessments of the threat posed by biological agents. In 1949, the Air Force was concerned over the heat stress induced by chemical protective clothing and expressed interest in permeable fabrics for biological protection.[52] In 1953, the Air Surgeon went so far as to state that only ordinary over-clothes, with no special protection, were required for individuals handling biological munitions.[53] A similar recommendation was included in Chemical Corps training documents, which stated intact skin and normal clothing provided adequate biological detection.[54]

This is contrary to the opinion expressed by the Chief of the Chemical Corps, who acknowledged intact skin as adequate protection, yet still recommended several layers of clothing, or an impermeable layer, for biological protection.[55] This attitude was also reflected in a Chemical Corps program description claiming that "present items of clothing are unsatisfactory in one or more respects as protection for body surfaces against biological agents."[56]

As chemical weapons and biological weapons began to be viewed as a single threat, protective equipment followed the same pattern. The idea of combined chemical and biological protection within the same overgarment became the standard. A Chemical Corps annual summary from 1957 reflected the concern with new V-series chemical agents and the need for increased protective value in the suits.[57] Although the chemical threat was a valid concern, focusing on it had caused biological protection to become over-engineered. While this approach might have had logistical advantages, it also resulted in over-protection against biological agents, which negatively impacted physical performance.

Yet despite contradictory policy directions regarding the amount of protection required for a biological agent, the military's default course of action was continued development of combined protective gear, as observed in program descriptions. In 1971, protective garments were described as "preventing the entry of such agent into the respiratory system, decreasing the cutaneous and percutaneous hazards," while making no distinction between the threat posed by chemical agents or biological agents.[58]

Likewise, in 1985, the *Mission Requirements for Chemical and Biological Protective Equipment Master Plan* continued the combined approach, making continued references to "CW/BW" agents, and stating that "defense consists largely of preventing harmful agents from contacting personnel and material." It also listed identical characteristics when describing the types of threats posed by chemical agents and biological agents, identifying both as "vapor," "aerosol (droplet, solid particle, dust liquid suspension)," or "re-aerosolization." This plan also reinforced the worry over an agent breaking through barrier material, which is primarily a concern for chemical agents.[59]

The 1997 science plan addressed protective clothing, again utilizing a combined weapons view to define the threat environment. The report acknowledged the physical burden associated with protective clothing and recommended development of advanced lightweight *chemical* protection, but described the actual plan as being to "develop and demonstrate materials for a new generation of lightweight *chemical/biological (CB)* protective clothing ensembles" (emphasis added).[60]

Such combined descriptions exist today, as the most recent protective clothing is still described relative to a combined threat scenario. Testimony describing the new Joint Service Lightweight Integrated Suit Technology (JLIST) overgarment states it is intended to offer "extended protection in a chemical or biological weapon environment."[61] Likewise, testimony describing future protective clothing called for "embedding a level of chemical, biological and radiological protection into our forces' standard combat uniform."[62]

The testimony regarding the JLIST suit also highlights another instance where the frame may have influenced development of protective equipment. As described in the 1998 report to Congress, research on the JLIST suit described a lightweight suit for chemical and biological protection, combined with a second overgarment designed for chemical agents, with no biological protective requirement.[63] This approach would have reflected an appreciation of unique biological and chemical protective requirements. However, by 2008 this approach was not mentioned in testimony, and today the suit is described as a single outer shell that provides protection against "chemical and biological agents, radioactive fallout particles, and battlefield contaminants." As observed before, the capabilities are described relative to a combined threat in references such as "24 hours of protection against CB agents" and "provides complete ocular, percutaneous and respiratory protection against CB agents when worn with CB protective gloves and masks."[64]

While the separate JLIST approach did not go forward, there is some evidence that the military does appreciate that different protection is required for the biological threat. The military has conducted experiments to determine the level of biological protection offered by commercially available protective masks, such as the N95 and P100 filters.[65] Test results were encouraging, but further study was recommended.

While the protective equipment program reflects a relatively consistent combined chemical/biological approach, written guidance on the appropriate response is less consistent, and often contradictory. While full protective gear is generally recognized as the appropriate response to a biological attack, the military has never seemed to develop a fully consistent doctrine. Some examples of contradictory statements have already been cited. Similar contradictory guidance is also codified in published military doctrine.

For example, *FM 3-100: NBC Operations* from 1985 stated full protection is required for a biological attack, while *FM 3-4: NBC Protection,* also published in 1985, as well as *FM 21-40: NBC Defense* (1977) and *FM 3-11.4* (2003) all stated that clothing and a respirator offer adequate protection. The confusion continued in 2000 with *Joint Publication 3-11*, which actually argued that regular clothing offers more protection against nuclear effects than against biological weapons, stating "ordinary clothing can provide some protection against thermal effects of a nuclear detonation. More sophisticated protection is required against biological and chemical agents."[66] This contradictory guidance can lead to confusion, which can be deadly if it results in personnel taking inappropriate action in the face of a threat.

Frames in Doctrine

As observed in previous time periods, military doctrine for this period exhibits many instances of combining chemical and biological (as well as radiological and nuclear) weapons within the same policy or doctrine. For this period, the influence of the chemical frame seems to decrease over time, and there is greater awareness of the unique nature of biological agents.

FM 3-7: NBC Field Handbook, published in 1994, is generally more consistent with a strong chemical frame influence. For example, there are separate threat matrices for nuclear weapons, yet chemical and biological weapons are combined within the same table. The decontamination section uses a combined threat, and describes procedures geared towards chemical contamination. Finally, it dedicates nineteen pages to nuclear weapons, sixteen to chemical weapons, and only eight to biological weapons.[67]

Air Force Doctrine Document 2-1.8: Counter Nuclear, Biological and Chemical Operations, published in 2000, shows how combining weapons classes can result in statements that are physically impossible. For example, there is reference to NBC weapons delivered by "infected humans or animals," or NBC weapons delivered by "helicopters equipped with sprayers that spread aerosol over a wide area."[68]

Army *FM 3-11.4: Multiservice Tactics, Techniques and Procedures for Nuclear, Biological and Chemical (NBC) Protection,* published in 2003, shows a chemical-centric bias when discussing the fundamentals of NBC weapons. When discussing the physical impact of threat agents, the references used are indicative of a chemical frame. Specifically mentioned was the length of exposure to an agent correlating to a relative level of incapacitation, and the body's ability to detoxify agents, combined with exposure frequency.[69] Using specific terminology such as "fallout" for radiological weapons, but more general terms like "gas" for both chemical and biological agents, and making statements such as "a downwind vapor hazard of a non-persistent CB agent" reflects a chemical-dominated vocabulary and results in false statements regarding biological agents. The manual does acknowledge that the basic duty uniform can provide protection against biological agents (and some chemical agents).[70]

FM 3-11.3, published in 2006, deals with CBRN contamination avoidance. This publication follows the trend of a reduced chemical frame observed in more recent publications. While the chemical frame is not as obvious, there is still evidence of a chemical (or CBRN) frame. In the general chapters, the threat, procedures, policies, and actions are all described in reference to a "CBRN" threat, and when biological weapons are not addressed in the CBRN context, they are always combined as a chemical/biological weapon. There are also specific examples of the chemical frame in the formatting used for incident forms and messages. Nuclear incidents have unique forms, while chemical and biological incidents are combined within the same paperwork. There are also examples of a combined threat resulting in unrealistic scenarios, as when the manual describes "CBRN" contamination affecting electronics.[71]

Yet there are indications that the chemical frame is not exerting total influence over the document. Whereas documents in previous periods referred to defensive equipment as "chemical" equipment or gear, this publication refers to "protective gear." The manual also contains separate chapters for each weapon class that do a good job of describing the unique nature of each weapon. While documents in previous periods also had distinct weapons chapters, the biological chapter in this manual shows less of the chemical-centric wording and doctrine found in manuals from previous periods.[72]

Also published in 2006 was a field manual that prescribed procedures for conducting decontamination operations. While it is a relatively recent publication, it still reflects a strong legacy of the chemical frame, with the background, threat, and hazards all described in terms of "CBRN" contamination. Likewise, there is no differentiation between types of contamination or appropriate decontaminating procedures, and when the CBRN reference is broken, as in specific decontamination actions, it is split as radiological or chemical/biological.[73]

Two versions of *Joint Publication 3-11: Joint Doctrine for Operation in Nuclear, Biological and Chemical (NBC) Environments* are available to review. Compared to the most recent 2008 version, the 2000 publication is less detailed, and focuses more on planning and staff responsibilities. As observed in other documents, the 2000 version almost always referenced nuclear weapons, biological agents, and chemical agents as one combined NBC threat. It did acknowledge the limited biological detection capability of the United States, yet many of the statements on maneuver and defense were written with the apparent assumption that a biological agent would be detected and identified in time to allow commanders to factor biological contamination into decisions.[74]

The 2008 revision generally shows less chemical frame influence, but it still contains some statements that reflect the presence of a chemical frame. For example, it uses a combined weapons view when discussing detection requirements, protective clothing, onset of medical effects, and planning assumptions.[75]

However, this more recent publication did improve upon the 2000 version, as there are many instances where chemical and biological weapons are discussed as unique weapons classes. For example, the weapons are split when addressing areas such as decontamination, physical effects, and protective equipment. However, in some cases statements influenced by a chemical frame contradict non-frame statements within the same section. One example is medical considerations, where the "immediate impacts" section breaks out each weapon class and does a good job of describing the unique aspects of each weapon, yet the final part of the section combines all weapons into one CBRN class that discusses mass casualties within hours of an event—an unlikely scenario for a biological weapon attack.

One of the most recent relevant publications is *ATTP 3-11.16: Multi-Service Tactics, Techniques and Procedures for Chemical, Biological, Radiological and Nuclear Aspects of Command and Control,* published in 2010. This publication continues to exhibit the trend of a reduced chemical frame, but still contains some statements indicative of the frame. For example, there are still examples of combining threats and effects of different weapons (now including nuclear and radiological), such as making reference to the covert release of a CBRN weapon, assuming the same infrastructure will be present for any "CBRN" weapon, describing liquid "CBRN" contamination as soaking through protective covers, and making general statements about CBRN weapon impact on medical operations. Perhaps one of the strongest indicators is guidance to use the enemy's possession of chemical defensive equipment as an indicator that an enemy is "trained and equipped to conduct BW operations."[76]

At the same time, this manual does break out some aspects of biological agents and biodefense that have historically been combined in previous guidance. For example, there is reference to distinct biological surveillance capabilities, operated by biological platoons with CBRN specialists (rather than chemical NCO's). Instead of referencing biological detection or identification, the reference to biological surveillance indicates an acknowledgement that instantaneous detection is not presently possible. The distinct nature of biological protection is also acknowledged, as there is guidance for protection based solely on a duty uniform and mask.[77]

A final piece of "doctrine" to be discussed is official guidance that reinforces the combined approach associated with the chemical frame. This approach was actually codified into law in 1993 by *50 U.S. Code Section 1522*, which directed the DoD to develop a combined "chemical and biological defense program" within one office under the Secretary of Defense. The DoD continues to reinforce this association whenever it issues guidance written relative to the chemical frame. For example, 2008 *DoD Instruction 3150.09* addressed "the Chemical, Biological, Radiological and Nuclear (CBRN) Survivability Policy."[78] Also published in 2008 was *DoD Directive 5160.05*, which prescribed "Roles and Responsibilities Associated with the Chemical and Biological (CBD) Program (CBDP)." [79]As long as legislation and directives prescribe the terminology, the frame may never be completely broken.

Contrasting the terminology used in DoD directives is *House Resolution 5498: The WMD Prevention and Preparedness Act of 2010.* The language of this legislation is important in highlighting the evolution of the way biological weapons are perceived. While testimony and deliberations in previous periods showed a heavy bias towards unique chemical or chemical/biological references, this document contains sixteen references to a CBR threat, seventy-five references to a biological threat or weapon, and zero references to a chemical threat or weapon. It almost seems as if the frame had been reversed, with chemical agents now an afterthought, and biological agents the threat of choice.[80]

Conclusions—Frames

The available evidence shows many behaviors indicative of a chemical frame over this period of analysis. The tendency to combine hardware solutions, combine threats, develop combined doctrine, and to subsume biological agents under chemical agents is readily observable in all areas examined.

However, there is also evidence that the influence of the chemical frame is waning over this time period. This trend is most evident in areas such as policy, perceptions, and doctrine, where biological agents continue to gain separation from chemical agents. In these sources of data, specific discussion of biological weapons is much more likely, as is highlighting and addressing their unique nature versus chemical agents. However, this trend is less evident in areas such as hardware development, as biological defense is still often combined with chemical defense, or is based on requirements tailored to address the chemical threat.

In areas where the frame still exists, it seems strongest in military-dominated organizations, particularly in the areas of detection and decontamination. If the frame continues in these areas, while fading within the national leadership, a serious disconnect may emerge. If the trend to separate biological agents continues in the areas of policy, doctrine, and research, the nation will be on course to substantially improve its biodefense posture. However, if the hardware does not change to reflect national policy, the military may find itself in a situation similar to the one faced in the First Gulf War.

Bureaucratic Politics and Biodefense, 1991–Present

While the evidence given thus far shows that many behaviors associated with the chemical frame are present in this period, it also points out that in general these behaviors are not as strong as in previous time periods. There are also instances where biological agents have totally broken from their association with chemical agents. With the weakening of the chemical frame and the large influx of resources during this period, it is possible that imperialism or external threat may be exerting a greater influence.

The rapid rise of the terrorist threat, combined with a renewed concern over biological weapons, resulted in Congressional decisions to allocate greater resources to counter these threats. Under these conditions, bureaucratic politics would predict that organizations would exhibit imperialistic behavior, embracing the new threat as an avenue to greater resources and power. The multitude of government agencies now competing for biological defense resources provides the strongest evidence that bureaucratic politics has played an important role in influencing U.S. biodefense posture over this time period. In fact, looking at the multiple government agencies today taking on responsibility in some way for biological defense, it is difficult to believe that the Chemical

Corps originally accepted the biological mission somewhat reluctantly, and other agencies actively avoided it.

While strong evidence for imperialism influencing this period will be presented, it is also important to contrast the level of imperialistic behavior observed during this period with previous periods. This contrast in behavior serves to further support the significance of the imperialistic behaviors within this time period.

Multiple Agencies

The imperialistic model predicts that multiple agencies will attempt to take on responsibility for the "new" biological threat in order to claim the associated resources. As it is government agencies responding to the threat, their ability to exhibit imperialistic behavior is somewhat limited by legislative restrictions on their areas of responsibility and financial resources. Yet despite these constraints, it is possible to identify nearly one hundred agencies with some responsibility for biological defense by the end of this period.[81]

After the Gulf War, Congress took several steps to address the state of the defensive program. In 1993, Congress established the DoD Chemical Biological Defense Program in an effort to coordinate and integrate all defense programs across the military, from R&D through procurement. The DoD subsequently initiated an additional stand-alone R&D program in biological defense within the Defense Advanced Research Projects Agency (DARPA) in Fiscal Year 1997, and in October 1998 designated the Defense Threat Reduction Agency (DTRA) to administer the Chemical and Biological Defense Program.

Reflected in a GAO report is the sense that by 1999 many other agencies had begun to take roles in biological defense. This particular report shows three other government agencies—the Department of Energy (DOE), the Technical Support Working Group (TSWG) and DARPA—involved in the same areas of defensive research covered by the CBDP.[82] The GAO also projected that by 2001 the DOE and DARPA would be receiving as much funding for nonmedical basic research, applied research, and prototype development, as would the DoD.[83]

Another organization to enter the biological mission area was the department of Health and Human Services (HHS). Sensing an opportunity, HHS strongly advocated for a role in the biodefense mission, placing the bioterrorism threat on par with AIDS, malaria, and tuberculosis. As a result of their efforts, the HHS budget increased from $300 million in 2001 to $3 billion in 2002—in direct contrast to the DoD, which actually returned money allocated for biological detection work in 2001.[84]

Presently, the number of agencies with some responsibility for biological weapons has exploded compared to the handful of agencies with responsibility in earlier periods. For example, the Chemical, Biological, Radiological & Nuclear Defense Information Analysis Center has published a web page listing eighty-five organizations as having a role in CBRN defense. Removing international agencies, duplicates, and tangential organizations such as publishing offices or museums still leaves over twenty large government organizations that have some role in CBRN defense.[85]

Imperialism in Missions

The development and employment of biological detection hardware over the last ten years also reflects the influx of new organizations into the biological defense mission. Whereas in previous periods the majority of biological defense hardware development was done by the DoD, the BASIS sensors utilized in the Salt Lake City Olympics and the Biowatch sensors employed in U.S. cities were developed by the DOE/DHS. Additionally, the medical community, rather than the traditional CBDP, developed the JBAIDS system utilized within the DoD. Congress is even taking a role in expanding the number of organizations involved in biological detection. For example, *House Resolution 5498* directs the secretary of Health and Human Services to assess, and possibly implement, "screening capabilities for biological agents, pandemic influenza, and other infectious diseases."[86]

In addition to hardware development, organizations claiming to be "CBRN experts" have also increased. In his 2010 testimony to Congress, the Director of DTRA highlighted the CBRN reachback capability as a unique and important service that DTRA/STRATCOM provides to the DoD and federal government.[87] However, as with most other mission areas in this period, several other agencies have also created similar capabilities.

FM 3-11.3, published four years prior, lists nine other DoD agencies that also provided CBRN reachback capabilities.[88]

The counter-WMD mission is another area providing evidence for imperialistic behavior. In the mid-2000s the DoD established eight mission areas for combating weapons of mass destruction. When viewed together, these mission areas form a continuum of possible actions, starting with security cooperation and ending with consequence management.[89] While it is good to have a comprehensive and integrated strategy, this wide range of missions has resulted in almost every combatant command and service having some responsibility for at least one C-WMD mission area, whether it is detecting, surveillance, destruction, interdiction, protection, or remediation. This desire for military organizations to embrace the biological (C-CBRN) mission has not been observed in previous periods of analysis. It is important to note, however, that while these actions are imperialistic, the mission is still a counter-WMD mission and not a biological or chemical-specific mission, reflecting a chemical frame influence.[90]

In addition to new agencies taking on responsibility for biological defense, established agencies have also taken measures to expand existing missions, or to create new capabilities in order to obtain a greater portion of the increased funds. Several of these attempts reflect the interaction between external threat and imperialistic expansion.

In 1992, the Army was attempting to modernize its WMD plan, while at the same time it faced a potential chemical weapons treaty that would directly impact its operational mission. In the plan, the Army hedged its bets, emphasizing its chemical expertise, which would directly contribute to treaty verification. Specifically, the Army listed six future technology developments and three programs that would allow it to expand its mission by contributing to future treaty compliance and verification missions.[91]

This period also shows the military embracing the biological threat (free from a chemical reference) to justify biological detection systems. In the justification section, operational documents from the mid-1990s cite the failure to create meaningful treaties, and an increase in number to thirteen nations pursuing biological weapons, as justification for development of new systems.[92] At face value, these arguments would support the realist behavior of a state responding to an external threat.

However, as will be discussed in the next section, numerous audits found deficiencies in the military's biological training and readiness over the same period. Therefore, these arguments may be more indicative of an agency embracing the threat for the associated resources, while failing to give enough validity to the threat to actually increase readiness.

A 1994 interview with retired General Ross, Army Materiel Command (AMC), reflected imperialistic actions his agency took regarding a rational choice input to consolidate AMC's authority. Facing increased Congressional concern over the vulnerabilities exposed in the first Gulf War, and a series of Base Realignment and Closure Committee (BRAC) decisions, there was high-level pressure within Congress to fix the problem.[93] General Ross related how AMC developed an "Alternative Azimuth to BRAC-91" which was briefed through the DoD and Congress, and resulted in the consolidation of the previously "fragmented" program under the new Chemical Biological Defense Command. Also related in the interview was the effort to create *Public Law 103-160*, designating the Army as the executive agent for chemical and biological programs within the Department of Defense.[94]

The 1996 annual report from the Army's Chemical and Biological Defense Command provides strong evidence of attempts to colonize new areas. The report contained six strategic goals for the command. Only two goals (ranked fourth and fifth) dealt with NBC technology or material development. The goals ranked first and third dealt with handling or remediating existing chemical sites. The second listed goal emphasized a new domestic mission for the organization to "become the DoD's premiere response force—the Public's Emergency Response Center—for CB events." The final goal was for the organization to implement quality management practices, such as ISO 9000/14000 standards. In this report, the organization seemed less concerned with technology and hardware development (despite documented deficiencies), and more concerned with staking a claim to the remediation and public response missions.[95]

The Command's move to expand into public emergency response is also an excellent example of how an organization can use an external threat scenario to support a new mission. In their 1996 report, the Command referenced the Domestic Preparedness mission:

> An area driven by national interest and public concern is domestic preparedness against terrorists using CB agents. CBDCOM was designated as the DoD program Director for Domestic Preparedness because of our expertise and experience in chemical and biological defense. We developed a strategy to execute this new mission, consistent with the language of the draft Nunn-Lugar II legislation.[96]

The 2006 briefing by the Chief of the Chemical Corps, previously cited as moving away from the chemical frame, also included imperialistic behaviors. For example, regarding the Army establishing protection as a wartime function, he stated that the Chemical Corps was "well positioned for this change." He also talked of the Corps including defense of the homeland in its mission, and of "the desire to move to full spectrum capabilities to advise and protect against the complete range of hazards: peacetime/wartime/ CONUS/OCONUS."[97]

While legislation gives the CBDP almost monopolistic responsibility for biological defense, it still makes overt efforts to obtain more funding and greater responsibility. The DTRA/CBDP budget testimony from 2010 provides many examples. While the emphasis on medical countermeasures and drug development, manufacturing, and evaluation has already been discussed as a break from the organizational frame, it can also be considered an area of expansion not observed in previous time periods.[98] Another area of expansion is the inclusion of civilian and homeland defense as important consumers of equipment developed for military users.[99]

In the same testimony, the Director of DTRA/USSTRATCOM Center for CWMD also made statements indicative of imperialistic behavior. When questioned regarding equipment survivability relative to chemical or biological weapons, he responded by highlighting DTRA's work on Electro Magnetic Pulse. His testimony also focused extensively on the most recent Quadrennial Defense Review's assessment of the spread of WMD, and highlighted all potential areas that could be addressed by DTRA. Another strong indicator of the organization's mindset is the emphasis placed on its ability to spend money and meet obligation/expenditure goals, highlighting the importance of bureaucratic policies in the function of the agency. [100]

Confusion in the Program

A possible outcome of strong (and successful) imperialistic behavior is the existence of many organizations having responsibility for the mission, with no evidence of an overarching authority responsible for shepherding the program. The interview with General Ross cited above points out the "fragmented" state of the program in the early 1990s, and the corresponding actions taken to consolidate it under his authority.[101] The fragmentation noted in the 1990s continued through the 2000s, as the number of programs drastically increased.

Evidence of this situation is noted in a 2000 GAO report on integration of the DoD's defensive programs, which included a finding that the "DOD's organizational structure may be too diffused to facilitate efficient and effective management and integration of the Department's counter proliferation effort." The report also stated that "there is no one overarching joint counterproliferation doctrine document to provide a centralized picture of how DOD should respond in an NBC environment," and that the "DOD has not created a single, integrated master, or management, plan to guide, oversee, and integrate its department wide counter proliferation efforts."[102]

Testimony in 2010 reflected that the coordination problem had yet to be fully resolved, saying that "some have noted that while there are many agencies in departments that have resources dedicated to prevention and mitigating damage and harm to the public, there is still a large gap in interagency and inter-governmental communications and co-ordinations."[103] A similar sentiment was reflected in the 2009 *National Strategy for Countering Biological Threats,* which stated "efforts targeted to prevent such threats have received comparatively limited policy focus or substantive guidance at the national level."[104] One area in particular that has shown a considerable amount of fragmentation and confusion is medical countermeasures.

Medical Countermeasures

Responsibility spread among multiple agencies, and the resulting confusion, is particularly evident in the current medical countermeasures program. Several reports have cited organizational and bureaucratic issues as hampering U.S. efforts to develop medical countermeasures.

The medical countermeasures program received considerable attention after the First Gulf War. While evidence from previous periods showed a general lack of drive to develop countermeasures, following the war the program underwent considerable organizational changes and received a large increase in funding. By the mid-2000s, individual components of the program were receiving hundreds of millions of dollars per year, and the total program budget topped one billion dollars.

The increased interest and allocation of resources are indicative of the nation making a rational choice response to the increase in perceived external threat posed by biological weapons. Examination of the program and its questionable success rate also reveals some behaviors associated with a chemical frame, but for the most part, the issue appears to be a fragmented and complicated bureaucratic program, which would be associated with imperialism.

There was a change in attitude after the war regarding countermeasures. While previous periods tended to place a low priority on medical capabilities as a means of defense against a biological attack, this attitude changed after the Gulf War. The change is reflected in professional writings, with statements such as “defense against biological warfare is almost exclusively a medical problem,” and assertions that biological attacks were becoming regarded as “similar to normal disease outbreaks,” except for the severity. Massive prophylaxis was now envisioned as a valid response to a biological attack.[105] In contrast to the 1970s, recent literature does not debate whether medical countermeasures are appropriate, but rather how to optimize their employment.[106] In 2009, the President even issued an Executive Order directing the Post Office to develop procedures to distribute countermeasures in the event of a biological attack.[107]

While the attitude toward medical countermeasures has changed, indicative of an external threat influence, the actual development of countermeasures has not kept pace with the changes in policy. Organizationally significant changes were made in response to the issues identified in the Gulf War. In 1993, Congress centralized chemical defense and biological defense into one program. As part of this reorganization, vaccine procurement was moved from USAMRIID to the Joint Development Office, which as Hoyt states was "disastrous," as it removed those who understood vaccine research from the program. Subsequently, operational capacities were moved to the Center for Health Promotion and Preventative Medicine in Aberdeen, Maryland, which resulted in the vaccine program competing with (and losing to) occupational health and environmental issues.[108] Approximately ten years after the implementation of these changes, a series of reports were issued showing the United States was still concerned over the pace of countermeasure development. This concern was further heightened in response to the second Gulf War and the anthrax mail attacks.

Written in 2000, the "Top report" highlighted the lack of progress in the DoD vaccine acquisition program. The report reflected the belief that medical countermeasures are a valid form of defense, stating that "vaccines are the lowest risk, most effective protection; they enable force projection and are superior to antibiotics or other treatments." However, the report assessed the DoD's program as "insufficient" and judged that "it will fail."[109]

The report identified many bureaucratic issues hindering the program. For example, it noted that eleven organizations had some responsibility for vaccine production, but that decision-making authority was located in "organizations that lack the requisite level of medical and technical expertise," and that the government acquisition program was not flexible enough to take a candidate vaccine to market. While most of the observations were bureaucratic in nature, there is also a hint of frame influence, as the lack of appropriate scientific knowledge among program officials was also noted.

Another report in 2004 reached many of the same conclusions, noting the need for vaccines, and contradicting some of the arguments made in the 1970s, stating that "the potential for new bioengineered pathogens does not eliminate the need for countermeasures against more familiar biological threats."[110] As with the Top report, this report took issue with the bureaucratic construct of the program, noting that "the DoD effort is in practice fragmented among multiple chains of command and burdened by organizational complexity." They noted that research was directed by

DTRA, that the Joint Program Office ran advanced development/acquisition, and that program requirements originated with the JCS. As with the Top report, they also indicated issues with the qualifications of program managers, noting "a lack of understanding of the level of experience, expertise and leadership … necessary to shepherd candidate vaccines and drugs through the long and difficult research, development and licensure process."

Despite reports critical of the organizational fragmentation, the situation has become worse. In addition to the DoD's Transformational Medical Technologies Initiative and Chemical Biological Medical Systems programs, other agencies involved in some aspect of medical countermeasures include DARPA, the National Institute of Health, the Department of Health and Human Services, and the Centers for Disease Control. Additionally, the DoD has lost the lead in vaccine development, as in 2004 funding for medical countermeasures development given to outside agencies was five times the amount received by the DoD.[111]

While bureaucratic factors are prevalent within the countermeasures program, it is still possible to find behavior influenced by frames. As already noted, several reports took issue with the knowledge of program managers, possibly indicating the DoD regarded countermeasures as just another acquisition program. A medical systems briefing from 2007 also evidenced the continuing chemical frame by presenting the program from a combined chemical/biological standpoint.[112] For example, the briefing made references to developing "pre-treatments and therapeutics for protection against chemical and biological agents and radiological exposure," and programs to "develop, assess and validate diagnostic assays for Chemical and Biological Agents."[113]

In addition to organizational issues, financial issues have also hampered the program. The Joellenbeck report faulted confusion in the DoD acquisition process, noting that in the first ten years, the DoD changed acquisition strategies three times. The initial plan was for a government-owned/contractor-operated facility. This strategy was replaced with plans for a contractor-owned/contractor-operated facility, which was subsequently changed to a prime systems contract acquisition strategy.

In an attempt to address issues with countermeasure development, Congress initiated another bureaucratic solution by creating the BioShield program in 2004. However, as created, the program reflected a lack of understanding of the development process. While the program provided initial research funding and established a guaranteed market for approved vaccines, it failed to provide funding for the intermediate years of testing and trials required to receive FDA approval, creating a "valley of death" in funding.

As Hoyt notes, by the 1990s the major pharmaceutical companies had become less interested in developing vaccines for the DoD, and the BioShield program was not structured in a way that would entice them to devote resources to developing vaccines. As a result, the program received little to no interest from the major pharmaceutical companies. The only companies that did participate in the program were small startup biotechnology companies lacking the capabilities to bring candidate vaccines through licensure.

In 2006, a second program, the Biomedical Advanced Research and Development Authority, was created in an attempt to provide incremental funding for vaccines under development in an attempt to help companies through the "valley." Again, this program failed to interest the large pharmaceutical companies, and a subsequent series of bureaucratic decisions shifted money to other development programs, which undercut and underfunded the DoD effort.

Hoyt's summary of the current state of the vaccine program is that "the combination of push and pull programs currently in place will not bridge the valley of death because they reinforce the balkanized structure for research that grew in the 1980s and 1990s."[114] As a result of a lack of understanding, a fragmented program, and repeated reorganization, the United States finds itself essentially with the same countermeasures it possessed at the end of the First Gulf War.

Conclusions—Imperialism

The substantial increase in the number of organizations involved in the biological defense mission is perhaps the greatest evidence for the influence of imperialism in the current time period. The previous periods were marked by austerity in the defensive program, and a general lack of interest by organizations. Today, however, not only has there been a substantial increase in the number of military organizations participating in biological defense, many other federal and state organizations are involved as well.

The emergence of imperialistic behaviors is not unexpected. The increased national concern over weapons of mass destruction, combined with the rise of the international terrorist threat during this time period has resulted in increased Congressional interest and resources dedicated to WMD, and to biological weapons in particular. This increased interest and increased funding started after the first Gulf War, accelerated in the late 1990s and exploded in the early 2000s. While it is possible to trace the increases in funding to external threats, the fight over the resources has shaped the current program into a structure predicted by imperialism.

Therefore, based on the prevalence of these behaviors, and the ability to define a logical process, it is possible to state that imperialism played a critical role in guiding defensive strategy over this time. The evidence also indicates that the influence of this behavior has been most evident over the later parts of this period.

The emergence of a significant imperialistic influence within the program has several implications for the health of U.S. defensive posture. Colonization of the mission area by new agencies can result in innovation, which injects new ideas to compete with the existing program. This can also force legacy organizations to reassess their programs as they attempt to fend off the new competition. These behaviors can serve to break existing frames and inject new solutions into the defensive program. However, unchecked imperialistic behaviors can also result in tangled, inefficient, and leaderless programs that are unable to effectively advance new defensive capabilities.

Realism and Biodefense, 1991–Present

External threat has previously played a dominant role in the development of U.S. posture, as observed in actions taken by the United States in World War II. Subsequent time periods do not reflect a similar level of influence, as the chemical frame has dominated decision-making. Observing U.S. actions in the present time period reveals the return of a strong rational actor response to the changing external threat environment. It is possible to find many actions taken by the United States over this period that are consistent with realist behavior. Notably, this is the first period when a national policy was written exclusively to address the biological threat. This is compelling evidence, at least in the rhetoric, that the chemical frame influencing policy in previous periods is no longer present at the highest levels of the U.S. government. Instead, the behavior observed over this period reflects a desire for action from the highest level of government (with the allocation of appropriate resources) specifically directed at biological agents. However, this behavior is not as clear within those organizations tasked to implement guidance, possibly indicating the influence of other behaviors beyond those focused exclusively on external threat.

As was observed with imperialism, it is not only the behaviors observed over this period, but also the contrast with previous periods that highlights the strong influence of external threat during this time.

Evolving Threat Perceptions

Over the last twenty years, the United States has faced a series of events regarding biological weapons that caused a notable adjustment in how the United States viewed the threat. Revelations as to the degree and sophistication of the Soviet program, combined with the discovery of the Iraqi weapons program, reaffirmed the threat posed by states armed with biological weapons. At the same time, the United States was becoming increasingly concerned with terrorism. This fear, combined with the crumbling infrastructure and failing security within the Soviet Union, made it possible to imagine a terrorist group stealing or buying material from the old Soviet program and using it against the United States.

In 1995, the Aum Shinrikyo cult attacked the Tokyo subway with a chemical nerve agent, raising the specter of non-state WMD terrorism. This was followed by a series of international terrorist attacks against the United States—the 9/11 attacks on the homeland, closely followed by the anthrax mail attacks. Two years later, the United States was involved in another war with Iraq, in part due to fears of its biological weapons program. By the early 2000s, it could be argued that the combined terrorism/WMD threat was perceived as the top threat facing the state.

An interesting point raised by Bernstein is that these threats, first faced by President Clinton, and then by subsequent Presidents, were not amenable to diplomacy or treaty solutions.[115] He notes three such challenges faced by President Clinton: loose nuclear weapons, rogue states with WMD, and WMD terrorism. With no diplomatic solution, and a national self-assessment that the state was vulnerable to these threats, the only viable option was to increase defensive capabilities, as predicted by a rational actor model.

The evolution in national policy regarding biological weapons during this time is consistent with a growing external threat. The trend observed in this period begins with the United States viewing the biological weapons threat as part of the general "WMD terrorism" threat. The perception of the biological threat evolved as subsequent policies began to reference biological agents as serious and unique threats to the state, separate from references to "CB," "WMD," or "CBRN" weapons. This event is important, as for the first time in over fifty years, senior U.S. officials consistently discussed biological weapons without reference to chemical weapons—a serious blow to the existence of the chemical frame observed in earlier periods.

The rise of biological agents as an area of concern began with their inclusion in the "WMD" threat, which gained more attention in the early 1990s. *Presidential Decision Directive 39*, published in June 1995, was a counterterrorism policy that included WMD, declaring "the United States shall give the highest priority to developing effective capabilities to detect, prevent, defeat and manage the consequences of nuclear, biological or chemical (NBC) materials or weapons use by terrorists." And that "the acquisition of weapons of mass destruction by a terrorist group, through theft or manufacture, is unacceptable."[116]

In 1999, President Clinton expanded the emphasis on biodefense, calling for increased training and increased efforts to develop and stockpile medical countermeasures. President Clinton also took an important step by recruiting the National Institute of Health into the national biodefense effort. As quoted by the Secretary of Health and Human Services at the time, this was "the first time in American history where the public health system has been integrated directly into the national security system."[117]

This move is telling regarding the external threat in that it demonstrates the significance attributed to the emerging biological threat. It also represents a bureaucratic move in expanding the number of organizations involved in biodefense. Finally, it impacts the chemical frame in a negative manner, as the HHS was involved specifically to address the biological threat, representing a break in the combined weapons view.

The national concern over WMD continued to grow within the DoD as well. In 1997, the Secretary of Defense stated, "I believe the proliferation of weapons of mass destruction presents the greatest threat that the world has ever known. We are finding more and more countries who are acquiring technology … and are developing chemical weapons and biological weapons. ... So I think that is perhaps the greatest threat that any of us will face in the coming years."[118] The following year, Secretary Cohen appeared on national television with a five-pound bag of sugar, which he used as a prop to describe how many casualties an attack utilizing a similar amount of anthrax would cause.

In 2000, the Secretary of Defense described the WMD threat as "the greatest and most complex challenge facing the Department of Defense." And the U.S. National Military Strategy assessed that "the continued proliferation of weapons of mass destruction, particularly chemical and biological weapons, has made their use by an adversary increasingly likely in both a major theater war and smaller scale contingencies."[119]

In 2004, top officials continued to worry about the "WMD" threat, but in a notable policy shift, biological agents were now regarded as a unique threat, separate from chemical agents. In 2004, President Bush issued *Biodefense for the 21st Century*, a national strategy dedicated solely to the threat from biological agents. In this strategy, the biological threat was regarded as a unique and significant threat to the security of the United States. The strategy specifically stated that "biological weapons in the possession of hostile states or terrorists pose unique and grave threats to the safety and security of the United States and our allies."[120]

Subsequent hearings and documents continued to reference biological agents as a distinct class of weapons, and placed the threat from biological agents on the same scale as the threat from nuclear weapons. The Graham/Talent Commission, which was formed to assess the WMD threat facing the nation, emphasized this point, writing that "while the mandate of the Commission was to examine the full sweep of the challenges posed by … all forms of WMD … we concluded early in our deliberations this report should focus solely on the two types of WMD categories which have the greatest potential to kill massive numbers: biological and nuclear weapons."[121]

The Graham/Talent Commission's findings were repeated in Congressional testimony, highlighting the threat assessment that "their initial report found biological weapons are more likely to be acquired and used by terrorist groups than nuclear weapons … it is more likely than not that a weapon of mass destruction would be used in a terrorist attack somewhere in the world by the end of 2013."[122] Also reflecting the elevated status of biological weapons is Congressional testimony where an Assistant Secretary of Defense said that the two things keeping him up at night were the thought of a nuclear device smuggled into an American city, or a possible anthrax attack.[123]

The recognition of the unique biological threat continues with the current administration. The most recent national biodefense policy, the *National Strategy for Countering Biological Threats,* published in 2009, again referenced a unique biological threat and stated the threat of "biological weapons and their use or proliferation by States or non-State actors present a significant challenge to our national security."[124]

Presidential Responses

In addition to simple rhetoric highlighting the biological threat, it is possible to identify actions taken by the state that reflect rational choice consistent with realism. Presidential guidance over this period clearly directs a national response to the threat, while at the same time following the pattern of moving from a combined biological/chemical/WMD frame to a biological-only frame.

In 1995, the threat from "WMD" was acknowledged, but only addressed within a general counter-terrorism strategy. Acknowledging the risk of "nuclear, biological or chemical materials," the *U.S. Policy on Counterterrorism* directs action, stating that "there is no higher priority than preventing the acquisition of this capability or removing this capability from terrorist groups potentially opposed to the U.S."[125]

The 2004 guidance issued by President Bush also prescribed actions to be taken in light of the biological threat. This document directed national action, prescribing four pillars for the biodefense program: "Threat Awareness, Prevention and Protection, Surveillance and

Detection, and Response and Recovery." The guidance listed many specific hardware and policy advances put in place to protect the nation, and specifically directed the DoD to "continue to ensure that United States military forces can operate effectively in the face of biological weapons attacks, and that our troops and our critical domestic and overseas installations are effectively protected against such threats."[126]

Presently, while biological weapons are still viewed as distinct entities within Presidential policy, it is possible to detect a shift in the perception of the threat and directed actions. In 2009, President Obama published his strategy for biological defense. While continuing to acknowledge a real threat from these weapons, and retaining previous Presidential directives, the 2009 guidance had a three-pronged strategy to reduce biological threats:

> (1) Improving global access to the life sciences to combat infectious disease regardless of its cause
>
> (2) Establishing and reinforcing norms against the misuse of the life sciences
>
> (3) Instituting a suite of coordinated activities that collectively will help influence, identify, inhibit, and/or interdict those who seek to misuse the life sciences

Within the "Roles and Responsibilities of the Federal Government" section, there were six specific federal responsibilities. None of the responsibilities listed included a specific mandate to develop hardware or defensive capabilities. The directive most applicable to this area gave the federal government responsibility for "conducting the full range of preparation to ensure an effective response in the event of a biological incident."[127]

As Koblentz notes, this latest Presidential guidance reflects a shift from pure biodefense to biosecurity. This policy moves from a strategy based on a defensive bunker mentality to one incorporating ideas such as third-world medical improvements, increased laboratory security, and achieving a comprehensive biosecurity environment.[128] It also demonstrates how breaking the chemical frame and addressing biological agents as unique weapons results in approaches that never would have been considered under the influence of a chemical frame.[129]

Allocation of Resources

In order to implement government-directed actions, realism predicts the state will respond with additional resources to address the threat. Consistent with official statements regarding the biological threat, financial expenditures demonstrate an increase in allocation to biological defense over this time period. As predicted by realism, the budget increases were most substantial after the 9/11 and anthrax mail attacks. However, even before these events, there were significant increases in funding, most likely a result of the post-Gulf War capabilities assessment.[130]

The highest level of funding observed in the previous historical period was $360 million for chemical and biological defense combined. Long-range Army planning published in 1992 projected a similar amount, predicting a relatively constant funding level of $300–$400 million per year for Fiscal Year 1994 through Fiscal Year 2008.[131]

The 1998 program report to Congress showed an upward trend in funding, reflecting an actual budget $100 million greater than predicted in 1992. It also showed a projected increase in future funding, predicting a total of nearly $800 million in 2003—double the projections from 1992.[132] The program's budget actually grew faster than predicted, reaching $800 million in 2000—three years earlier than expected—and was set at $836 million for 2001.[133]

The rate of allocations rapidly accelerated in 2002, as the defense budget increased sharply, a behavior predicted by realism, as the state responded to the 2001 threats. The 2002 report to Congress, reflecting the President's 2003 budget, showed research funding alone at $550 million in 2002, with a projected increase to $932 million in 2003. Corresponding total program budgets for 2002 and 2003 were $903 million and $1.3 billion, respectively.[134] The trend in increased funding for defense continues, as reflected in hearings on the 2011 defense budget, with DTRA/CBDP expecting to receive an eighteen percent increase. The Chemical Biological Defense Program alone was requesting $370 million for procurement, $812 million for advanced research and development, and $396 million for Science and Technology efforts, for a total budget of $1.6 billion.[135]

The DOD Response through Training

While a nation can exhibit a rational actor response to a changing external threat by creating new polices and increasing budgets, these actions are meaningless if they do not produce effective defensive outputs. As already discussed, the military has perhaps the strongest history of a chemical frame, and the data presented in the frames section provides evidence that a chemical frame is still exerting a level of influence over the biodefense program. While there is evidence that the frame is weakening in areas such as decontamination, detection, and protection, the changes in outputs are neither as swift nor as definite as would be expected by a purely rational-actor response. Another area that should change in response to external threat is training. While training deficiencies have been identified, and changes directed, the training program has yet to fully address the new threat environment.

After the Gulf War, the DoD knew it had a problem with biological training. The 1992 report reviewing the conduct of the Armed Forces in the First Gulf War stated that U.S. "CW/BW defensive readiness at the outset of the crisis was quite low," noting that only "after intensive preparation in theater" were forces at a level capable of conducting combat operations. The report also noted a need to pull protective clothing from worldwide reserves due to greater than planned usage. Specific to biological capacities, the report found "BW defense should be emphasized more fully in DOD programs. Inadequacies exist in detectors, vaccines, and protective equipment."[136]

Also in 1992, the Army addressed the growing importance of NBC defense relative to strategic changes imposed by treaties, stating that "NBC defense will become a key element of NBC warfare deterrence as NBC retaliatory capabilities are reduced or eliminated to satisfy treaty requirements."[137] The report specifically cited proliferation in the third world as a future source of NBC threat and, among other responses, recommended increased resources, training, and integration of WMD into war games as keys to modernization. These suggestions are accompanied by a request of additional funds, demonstrating an imperialistic response to a changing external threat.[138]

Despite this highlighting of training deficiencies, the issue persisted. A 1996 GAO report reflected a continued lack of priority given to biological training:

> Today, chemical and biological defense activities at all levels (from the Joint Staff to individual Army and Marine units) tend to continue to receive a lower level of emphasis than other high-priority activities, such as performing traditional operational mission tasks. This lower emphasis is seen in the funding, staffing, monitoring, and mission priority given to chemical and biological defense activities. Army officials contend that increased operational deployments coupled with reduced forces and budgetary constraints force commanders to make decisions regarding which aspects of operational preparedness to emphasize and those for which they are willing to accept increased risk. Thus, many commanders have accepted a level of chemical and biological defense unpreparedness and believe the resources currently devoted to this area are appropriate, given other threats and current budgetary constraints. Activities to equip, train, and otherwise prepare U.S. forces to operate in a contaminated environment have therefore received insufficient attention to resolve many continuing problems.[139]

Four years later, the GAO again noted that the military was slow to implement biological training into normal operations. Despite official planning guidance in 1998 and 1999 directing that "the NBC threat will be given a high priority in defense planning," and that major exercises should "routinely include activities to assess and enhance preparations for sustained operation in chemical and biological warfare environments."[140]

In a separate report from 2000, the GAO found "that Marine Corps, Army, and Air Force commanders were not integrating chemical and biological defense into unit exercises and the training was not always realistic in terms of how units would operate in war," and that "the Army's combat training centers were restricting the simulated use of chemical weapons against the units being trained because the units were not proficient in chemical and biological defense."[141] The same GAO report looked at personnel levels for "chemical specialists" for a sample of units and found that only the Air Force had 100% manning for officer positions (1 of 1), while the Army and Marines were between 75–88% manned. For enlisted, the Army had one unit manned at 100%, while the manning for other units and services was between 67–90%.

A follow-up study on Army/Marine training in 2005 showed that while chemical and biological events were being incorporated in training centers, only five percent of soldiers were required to spend more than eighteen hours in protective gear.[142] The GAO also found that many units were failing to perform required protective measures.[143] In 2007, the DoD was required by Congress to report on NBC training and education. Some of the issues identified in the report include a "lag" in doctrine and education, confusion over WMD mission areas, variation of requirements between services, and issues with medical NBC training.[144]

The GAO conducted another study of military training in 2007, and again identified issues, noting that "most Army units tasked with providing chemical and biological defense support are not adequately staffed, equipped or trained to perform their missions." The report also noted "a misalignment between the high priority DOD places on chemical and biological defense and the current low level of preparedness characterizing Army chemical companies."[145] This last statement could not provide a better summary of the external threat/chemical frame dynamic at play over this time period. It also shows that in spite of high-level emphasis, the operational-level military forces have been slow to fully embrace the threat.

Conclusions—External Threat

This historical period saw perhaps some of the most significant changes in the external threat since the late 1940s. Over this period, the United States fought an enemy who had a biological program, confirmed the existence of the Soviet biological program, and suffered a series of terrorist attacks, including one employing a biological agent. These events combined to elevate the threat from biological agents to a level previously reserved only for nuclear weapons.

Faced with such a change in threat, realism would predict that the state would take action to defend itself. The actions taken in the areas of national policy, national response, and the budget are all consistent with a rational actor's reactions to an increase in perceived threat, indicating that external threat exerted considerable influence over the nation's biological defense doctrine over this period. However, in the programs responsible for executing national policy, the response has not been as swift or as definite. This lag in execution indicates that a chemical frame is still influencing the actual implementation of national policy.

However, of most importance over this period is the emergence of an official national policy regarding biological defense, separate from any reference to a chemical threat. This change in the chemical agent /biological agent relationship is consistent with the relationship proposed under the realism theory hypothesis. Therefore, it is possible to state that external threat exerted a significant influence on biodefense doctrine over the later parts of this period of analysis. If this approach continues, and the program breaks from the remnants of the chemical frame, the nation will be pursuing a defensive strategy tailored to the unique threats posed by biological agents for the first time since the Second World War, which hopefully will result in improved defensive capabilities.

Conclusions—1991–Present

In every previous period, it has been possible to identify one factor dominating the development of U.S. biological posture. Since the end of World War II, the chemical frame has exerted the most influence over the program. While the frame is observable again in this period, the non-frame behaviors seem fundamentally different, and more influential. Driving this perception is perhaps the national recognition that biological weapons are a unique class with specific defensive requirements.

This time period is unique due to developments in technology, evolving state threats, and the rise of international terrorism. Based on these events, it is possible to develop an explanation of this period where all three theories of interest play a substantial role in influencing the development of U.S. biodefense policy.

For this period, a rational actor based assessment of the evolving WMD/biological/terrorist external threat precipitated change in the U.S. program. As the state attempted to protect itself against this new threat, it placed greater emphasis on biological defense, providing more prestige and resources for the mission area. Associated with this heightened awareness of the biological threat was a substantial increase in resources dedicated to biological defense. At the same time, official statements and testimony were breaking the chemical frame, referring to biodefense and biological weapons specifically, where similar data from previous periods showed a strong chemical agent/biological agent association.

The influx of new resources has provided fertile conditions for organizations to exhibit imperialistic behaviors. Sensing the new national emphasis on biological defense, new agencies were created, and existing agencies expanded capabilities in order to compete for the resources associated with developing new defensive capabilities.

A significant observation in the newer defensive organizations is that they are devoted to defense against biological agents, independent of chemical agents. This is not unexpected, as some of these new agencies had no prior exposure to the chemical frame, and would have no reason to associate chemical weapons with biological weapons. It can be argued that the large number of new organizations entering the biodefense mission area has diluted the effect of the chemical frame, resulting in a new direction in biological defense over the last several years of this time period. However, as the nation takes significant steps to improve biological defense, such steps still must be taken with caution. Perhaps the best summary of the danger associated with the massive influx of resources is captured in fifty-year-old testimony: "If the country pours enough money into research it will inevitably support the trivial and the mediocre."[146]

Despite the infusion of new agencies into biodefense, many of the individuals within the established defensive agencies have been involved in biological defense work for many years, and have been shaped by the strong chemical frame present in previous periods. As many of these individuals are responsible for managing the execution of the defensive programs, the legacy chemical frame still exerts a strong influence over this period. It is still possible to find a strong chemical agent/biological agent relationship, particularly in the outputs from the traditional military-centric defense organizations. Unfortunately, the frame is still strongest in the organizations responsible for the production of hardware and doctrine. Therefore, despite national policy, the United States has yet to fully execute a frame-free biodefense program.

Therefore, it is possible to argue that for this time period, all three theories are making a significant contribution to doctrine development. Whereas with the previous three periods of analysis it was possible to identify one theory as most influential, and to demonstrate one logical pathway, this period may be exhibiting equifinality. There is evidence that the historically close relationship between biological agents and chemical agents is weakening, which is allowing external threat and imperialism to exert influence. While there is still strong evidence for the close relationship within some organizations, the weakening of this relationship may foreshadow the demise of the chemical frame. As this frame is most evident in military-centric organizations, such as the CBDP, it will be important to see if the frame continues to weaken, or if a new event or change in policy allows it to reestablish itself. If the frame continues to weaken, the U.S. biodefense posture stands to see a marked increase in technologies and capabilities directed at the specifics of the biological threat.

Note

1. Barack Obama, *Communication from the President of the United States*, "Continuation of the National Emergency with Respect to the Proliferation of Weapons of Mass Destruction," 18 November 2010 (Washington DC: U.S. Government Printing Office, 2010).

2. Bob Graham and Jim Talent, *World at Risk: The Report of the Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism* (New York: Vintage Books, 2008).

3. While this period saw the decline of a chemical frame, it was also the rise of the combined "CBRN" frame. While these weapons have been combined in the past (e.g., NBC, WMD), there was a higher prevalence of a combined chemical/biological reference in the previous two periods. While the combined C/B category seems less apparent in this period, there are more CBRN references, which may be a direct reflection of the

increased congressional awareness (and resources) allocated to CBRN threats, indicating a shift in frames influenced by bureaucratic politics.

4. *GAO-01-27: Units Better Equipped, but Training and Readiness Reporting Problems Remain* (Washington DC: U.S. General Accounting Office, 2000).

5. *GAO-02-38: Chemical and Biological Defense: DoD Needs to Clarify Expectations for Medical Readiness* (Washington DC: U.S. General Accounting Office, 2001).

6. *GAO-05-8: Army and Marine Corps Need to Establish Minimum Training Tasks and Improve Reporting for Combat Training Centers* (Washington DC: United States Government Accountability Office, 2005). Interestingly, this course inverts the previous chemical frame in that there is a distinct biological component, while all chemical components are combined with the biological threat.

7. United States Army, "Individual Training," 5 September 2007, accessed 31 January 2012 from United States Army Training Support Center, https://rdl.train.army.mil/soldierPortal/atia/adlsc/view/public/8417-1/cctsp/031-c-1019/031-c-1019.htm.

8. *Proliferation Threats of the 1990's: Hearing, 24 February 1993, Before the Committee on Governmental Affairs*, U.S. Senate, 103rd Cong. (1993)(statement of R. James Woolsey, Director of Central Intelligence).

9. *Biological Terrorism—Department of Defense Research and Development: Hearing Before the Science Committee*, U.S. House of Representatives, 107th Cong. (2001) (statement of Dr. Anna Johnson-Winegar, Deputy Assistant to the Secretary of Defense for Chemical and Biological Defense).

10. *Countering the Terrorist use of WMD: Hearing, 19 March 2003, Before the Subcommittee on Terrorism, Unconventional Threats and Capabilities of the Committee on Armed Services*, U.S. House of Representatives, 108th Cong. (2003) (statement of Dr. Dale Klein, Assistant Secretary of Defense for Nuclear, Chemical and Biological Defense Programs).

11. *Technologies to Combat Weapons of Mass Destruction: Hearing, 18 March 2008, Before the Subcommittee on Emerging Threats and Capabilities of the Committee on Armed Services*, U.S. Senate, 110th Cong. (2008).

12. In 1970, the same committee was having hearings on "chemical-biological warfare."

13 . *National Strategy for Countering Biological Threats—Diplomacy and International Programs: Hearing, March 18, 2010, Before the Subcommittee on Terrorism, Nonproliferation, and Trade of the Committee on Foreign Affairs*, U.S. House of Representatives, 111th Cong. (2010).

14. Designing a strategy based on the "window of opportunity" unique to biological weapons is not observed in previous periods of analysis. While doctrine acknowledges the slower action of biological agents, the prevailing defensive strategies are to detect and mask up, or to wait for casualties—both of which are influenced by the chemical frame.

15. *Government Preparedness and Response to a Terrorist Attack Using Weapons of Mass Destruction: Hearing, 4 August 2010, Before the Subcommittee on Terrorism, Technology and Homeland Security of the Committee on the Judiciary*, U.S. Senate, 111th Cong. (2010).

16. *Budget Request for the Defense Threat Reduction Agency and Chemical Biological Defense Program and Counterproliferation Initiatives: Hearing, 14 April 2010, Before the Subcommittee on Terrorism, Unconventional Threats and Capabilities of the Committee on Armed Services*, U.S. House of Representatives, 111th Cong. (2010) (statement of Brigadier General Jess A. Scarbrough, Joint Program Executive Officer for Chemical and Biological Defense).

17. Department of Defense, "Conduct of the Persian Gulf War," April 1992, accessed 25 November 2011 from National Defense University, http://www.ndu.edu/library/epubs/cpgw.pdf.

18. Secretary of the Army, *Army Regulation 15-41: Nuclear and Chemical Survivability Committee* (Washington DC: Department of the Army, 1992).

19. *NBC Modernization Plan* (Washington, DC: Department of the Army, 1992).

20. *Nuclear/Biological/Chemical (NBC) Defense Annual Report to Congress* (Washington DC: Department of Defense, 1997).

21. *Nuclear/Biological/Chemical Defense Annual Report to Congress* (Washington DC: Department of Defense, 1998).

22. Counterproliferation Program Review Committee, "Integrated Chemical and Biological Defense, Research, Development and Acquisition Plan: Chemical & Biological Point Detection and Decontamination," April 2002, accessed 16 July 2011 from Defense Technical Information Center, http://www.dtic.mil/dtic/tr/fulltext/u2/a423302.pdf.

23 . *Chemical and Biological Defense Program Annual Report to Congress* (Washington DC: Department of Defense, 2005).

24. Chemical and Biological Defense Program, *2010 Portfolio* (Aberdeen Proving Ground, MD: Department of Defense, 2010).

25. John C. Doesburg, *The Chemical Corps in Transition: Visioning for the Future* (Carlisle Barracks, PA: U.S. Army War College, 1991).

26 . Ken Hodge, Alonzo Alarcon, Edmond Hackett, and Douglas Emmons, "Chemical and Biological Warfare: A Moral Dilemma," 18 March 2005, accessed 6 February 2012, from U.S. Army Sergeant Majors Academy Digital Library, http://cgsc.contentdm.oclc.org/cdm/singleitem/collection/p15040coll2/id/5138.

27 . Alissa R. Ackley, *Chemical, Biological, Radiological and Nuclear Consequence Management: Ways to Improve Fixed-Site Decontamination* (Newport, R.I.: Naval War College, 2007).

28. Mark A. Lee, "Seeing the Elephant—Consequence Management Policy for the Department of Defense," May 2001, accessed 6 February 2012 from Combined Arms Research Library, http://cgsc.contentdm.oclc.org/cdm/singleitem/collection/p4013coll3/id/308.

29. Tasha L. Pravecek and Jim A. Davis, *Bio-Defense Now: 56 Suggestions for Immediate Improvements* (Maxwell AFB, AL: USAF Counterproliferation Center, 2005).

30. The Air Force has effectively broken the doctrinal WMD frame, developing distinct operating plans for chemical, radiological, and biological environments.

31. Thomas Spoehr, briefing slides, visit to Fort Hood, TX, 27 September 2006, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD. Such a change could be frames driven, or could be imperialistic, as Congress has generally added funding to counter CBRN programs.

32. Department of Defense, "Conduct of the Persian Gulf War" (see ch. 7, n. 17).

33. Secretary of the Army, *Army Regulation 15-41* (see ch. 7, n. 18).

34. P. Short, memorandum, "Final Operating Requirements (ORD) for a Joint Biological Point Detection System," 20 September 1996, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD. As already discussed, a ten-minute reaction time will still result in exposure of personnel half a mile to over one mile downwind of the sensor.

35. *Biological Integrated Detection System (BIDS) Concept Definition* (Columbus, OH: Battelle, 1993).

36. Department of Defense, *Nuclear/Biological/Chemical Defense* (see ch. 7, n. 21).

37. The reports from 2008 to present are in a new format, and do not allow direct comparison of programs. Some are multi-year programs, and are counted multiple times in the totals.

38. The table does not include items listed as individual protection or collective protection.

39. J. Palman, memorandum, "Plan for Logistic Support, Decontaminating Agent: Multipurpose (DAM)," 11 February 1991, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

40. Department of Defense, *Nuclear/Biological/Chemical Defense* (see ch. 7, n. 21).

41. "JPM Decontamination," 12 January 2010, accessed 15 December 2011 from Joint Program Executive Office for Chemical and Biological Defense, http://www.jpeocbd.osd.mil/packs/Default.aspx?pg=140&title=Decontamination.

42. "Decontamination Family of Systems Fact Sheet," 11 March 2012, accessed from Joint Program Executive Office for Chemical and Biological Defense, https://jacks.jpeocbd.army.mil/Jacks/Public/FactSheetProvider.ashx?productId=380.

43. "VHP" stands for vaporous hydrogen peroxide.

44. Will Stewart and Hugh Griffis, "Systems Engineering Approach to Chemical/Biological Design," *Aircraft Survivability* (Fall 2006): 6-13. Material degradation from chemical weapons is a concern to the Air Force, as agents such as VX and mustard can weaken metals and degrade aircraft components. Biological weapons, however, pose no such material hazard.

45. JPM-Transformational Medical Technologies, "Development of Handheld Pathogen Identification and Characterization System (TMT-Response Systems)," 18 January 2012, accessed 25 January 2012, http://www.jpmtmt.mil/resources/pdfs/2012-RFI-12-DTRA01.pdf.

46. JPM Contamination Avoidance, "Chemical Biological Agent Resistance Test (CBART) Fact Sheet," 7 March 2012, accessed 4 April 2012 from Joint Program Executive Office for Chemical and Biological Defense, https://jacks.jpeocbd.army.mil/Jacks/Public/FactSheetProvider.ashx?productId=383.

47. Protective suits are based in part on a layer of activated charcoal that absorbs and sequesters chemical agents. Once the suit is removed from the packaging, the charcoal will gradually lose its ability to protect the individual. Biological protection does not rely on the charcoal, so in theory a biological protective suit would have an infinite service life and shelf life.

48. E. B. Fred, meeting minutes, 31 December 1943, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

49. G. Gantz, memorandum, "A Discussion of Protective Clothing of Use Against BW Agents," 31 July 1944, Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington DC.

50. Ibid.

51. War Research Service, "Conference of Canadian C-1 Committee," 15 October 1943 Committees on Biological Warfare Collection, National Academy of Sciences Archives, Washington, DC.

52. Dorothy L. Miller, *History of Air Force Participation in Biological Warfare Program 1944-1951* (Wright-Patterson AFB: Air Materiel Command, 1952).

53. Dorothy L. Miller, *History of Air Force Participation in Biological Warfare Program 1951-1954* (Wright-Patterson AFB: Air Materiel Command, 1957).

54. U.S. Army Chemical Corps School, "Special Text 3-162: Military Application of Microbiology and Biological Agents," September 1960, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

55. William M. Creasy, "Presentation to the Secretary of Defense's Ad Hoc Committee on CEBAR," 24 February 1950, RG 218, Box 207, Chemical and Biological Warfare Collection, National Security Archive, Washington, DC.

56. *Project Card 4-11-05-05: Protective Clothing and Related Materials for Protection Against Biological Agents* (U.S. Army Chemical Corps, 1949).

57. U.S. Army Chemical Corps Historical Office, "Events and Problems, FY 1961–1962," June 1962, accessed 14 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1962_majoreventsandproblems.pdf.

58. "U.S. Army Test and Evaluation Command Materiel Test Procedure Background Document: Testing Chemical, Biological and Radiological Equipment," 1

November 1971, accessed 13 March 2012 from Homeland Security Digital Library, https://www.hsdl.org/?view&did=8942.

59. U.S. Army Research and Development Center, "Strawman for Mission Requirements for Chemical and Biological Individual Equipment Master Plan," 1985, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

60. *Defense Technology Objectives of the Joint Warfighting Science and Technology Plan* (Washington DC: Department of Defense, 1997).

61. *Countering the Terrorist use of WMD*, hearing (see ch. 7, n. 10).

62. *Technologies to Combat Weapons*, hearing (see ch. 7, n. 11).

63. Department of Defense, *Nuclear/Biological/Chemical Defense* (see ch. 7, n. 21). Yet the JLIST testimony previously cited referenced a chemical/biological threat.

64. Joint Program Management Office, "Joint Service Lightweight Integrated Suit Technology Fact Sheet," 11 March 2012, accessed 4 April 2012 from Joint Program Executive Office for Chemical and Biological Defense, https://jacks.jpeocbd.army.mil/jacks/Public/FactSheetProvider.ashx?productId=333.

65. Aaron Richardson, Jonathan Eshbaugh, Kent Hofacre, and Paul Gardner, *Respirator Filter Efficiency Testing against Particulate and Biological Aerosols under Moderate to High Flow Rates* (Columbus, OH: Battelle, 2006).

66. *Joint Publication 3-11: Joint Doctrine for Operation in Nuclear, Biological and Chemical (NBC) Environments* (Washington DC: Joint Chiefs of Staff, 2000).

67. Department of the Army, *Field Manual 3-7: NBC Field Handbook* (Washington DC: U.S. Government Printing Office, 1994).

68. Secretary of the Air Force, *Counter Nuclear, Biological and Chemical Operations: Air Force Doctrine Document 2-1.8* (Washington DC: U.S. Air Force, 2000). "Infectious spread" is a term only applicable to a subset of biological agents that are transmissible; one cannot utilize an "infected" individual as a delivery method for a chemical or nuclear weapon. Aerosol is a valid delivery method for chemical or biological agents, but makes no sense in reference to a nuclear weapon.

69. Time and concentration of agent are greater concerns for chemical weapons, as there is a graduated physiological response to agent concentration (pinpoint pupils →

death), whereas biological weapons have more of a binary manifestation (sick/not sick). The body is also able to detoxify/remove chemical agents over time.

70. Department of the Army, *Field Manual 3-11.4: Multiservice Tactics, Techniques and Procedures for Nuclear, Biological and Chemical (NBC) Protection* (Washington DC: U.S. Government Printing Office, 2003).

71. While such damage is expected from chemical and nuclear weapons, biological agents are not usually associated with physical damage to equipment.

72. U.S. Army Chemical School, *Field Manual 3-11.3: Multiservice Tactics, Techniques and Procedures for Chemical, Biological, Radiological and Nuclear Contamination Avoidance* (Washington DC: U.S. Government Printing Office, 2006).

73. U.S. Army Training and Doctrine Command, *Field Manual 3-11.5: Multiservice Tactics, Techniques and Procedures for Chemical, Biological, Radiological and Nuclear Decontamination* (Washington DC: U.S. Government Printing Office, 2006).

74. *Joint Publication 3-11* (see ch. 7, n. 66).

75. *Joint Publication 3-11: Operations in Chemical, Biological, Radiological and Nuclear (CBRN) Environments* (Washington DC: Joint Chiefs of Staff, 2008). In this document, radiological and nuclear weapons are also often combined within the same CBRN weapon class, further complicating any attempt to understand the different actions of these distinctly different weapons.

76. The statement regarding infrastructure was made in reference to the Intelligence, Surveillance and Reconnaissance (ISR) mission, describing infrastructure such as weapon storage, transport, filling stations, etc.

77. Department of the Army, *ATTP 3-11.36*, “Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological and Nuclear Aspects of Command and Control,” July 2010, accessed from Federation of American Scientists, http://fas.org/irp/doddir/army/attp3-11-36.pdf.

78. John J. Young, Jr., *DoD Instruction 3150.09*, “The Chemical, Biological, Radiological and Nuclear (CBRN) Survivability Policy,” 17 September 2008, http://cryptome.org/dodi-3150-09.pdf.

79. Gordon England, *DoD Directive 5160.05*, “Roles and Responsibilities Associated with the Chemical and Biological Defense (CBD) Program (CBDP),” 9 October 2008, http://www.dtic.mil/whs/directives/corres/pdf/516005p.pdf.

80. *WMD Prevention and Preparedness Act of 2010, H.R. 5498*, 111th Cong. (2010).

81. Agencies claiming responsibility for NBC or CBRN defense are included as being involved in biological defense.

82. Of note is that every area of research within the DoD is replicated by at least one other agency.

83. *GAO/NSAID 99-160: Coordination of Nonmedical Chemical and Biological R&D Programs* (Washington DC: U.S. General Accounting Office, 1999).

84. Frank L. Smith, "A Casualty of Kinetic Warfare: Military Research, Development and Acquisition for Biodefense," *Security Studies* 20, no. 4 (2011): 663-696.

85. "CBRN Defense Agencies and Organizations," accessed 26 November 2011 from Chemical, Biological, Radiological, and Nuclear Defense Information Analysis Center, https://www.cbrniac.apgea.army.mil/Products/Links/Website/Pages/CBRNAgencies.aspx. This list is also incomplete, as the author has personal knowledge of several organizations not included.

86. *WMD Prevention* (see ch. 7, n. 80).

87. *Budget Request for the Defense Threat Reduction Agency and Chemical Biological Defense Program and Counterproliferation Initiatives: Hearing Before the Committee on Armed Services*, House of Representatives, 111th Cong. (2010). Reachback consists of experts on standby to provide advice to forces in the field should they encounter situations beyond their training.

88. U.S. Army Chemical School, *Field Manual 3-11.3* (see ch. 7, n. 72).

89. *Joint Publication 3-40: Combating Weapons of Mass Destruction* (Washington DC: Joint Chiefs of Staff, 2009).

90. The Air Force's distinct counter-BW concept of operations may be one of the only biological-distinct strategies that could fall under this argument.

91. *NBC Modernization Plan* (see ch. 7, n. 19).

92. B. Saunders, memorandum, "Operational Requirements Document (ORD) for the Long-Range Biological Standoff Detection System," 12 January 1995, U.S. Army

Research, Development and Engineering Command Archives, Aberdeen, MD; Short, memorandum, (see ch. 7, n. 34).

93. A BRAC is a Congressional committee formed to evaluate existing military bases with the objective of recommending consolidations and closures in order to reduce military expenditures.

94. Gen. Jimmy D. Ross (former Commander, Army Materiel Command), interview by Robert Darius and Herbert Leventhal, 4 March 1994, U.S. Army Research, Development and Engineering Command Archives, Aberdeen, MD.

95. *FY 1996 Annual Report* (Aberdeen Proving Ground, MD: U.S. Army Chemical and Biological Defense Command, 1996).

96. Note the CB reference, implying a chemical frame influence over the proposed program.

97. Thomas Spoehr, briefing slides (see ch. 7, n. 31).

98. The program may also be attempting to defend against competition from outside organizations such as HHS, DARPA, and CDC.

99. Scarbrough, *Budget Request*, hearing (see ch. 7, n. 16).

100. *Budget Request* (see ch. 7, n. 86). Money budgeted by Congress is typically valid for two years, during which time it must be utilized. There are defined metrics on how fast the money must be obligated and expended, and failure to meet the spending rate can result in additional scrutiny, or possibly loss of current or future money.

101. Ross, interview (see ch. 7, n. 94).

102. *GAO/NSIAD-00-97: DoD's Actions to Combat Weapons Use Should be More Integrated and Focused* (Washington DC: U.S. General Accounting Office, 2000). Of note in this report is that the GAO took issue with the fragmentation of the program, yet offered a frames-based solution calling for a strategy and written guidance to address the "WMD" threat.

103. *National Strategy*, hearing (see ch. 7, n. 13).

104. Barack Obama, *Executive Order 13527*, "Establishing Federal Capability for the Timely Provision of Countermeasures Following a Biological Attack" (Washington DC: U.S. Government Printing Office, 2009).

105. Dan Crozier, "The Biological Warfare Problem," *Journal of Occupational Medicine* 11, no. 10 (1996): 509-512.

106. Cleto DiGiovanni, Barbara Reynolds, Robert Harwell, Elliott B. Stonecipher, and Frederick M. Burkle, "Community Reaction to Bioterrorism: Prospective Study of Simulated Outbreak," *Emerging Infectious Disease* 9, no. 6 (2003): 708-715.

107 . Barack Obama, *National Strategy for Countering Biological Threats* (Washington DC: The National Security Council, 2009).

108. Kendall Hoyt, *Long Shot: Vaccines for National Defense* (Cambridge, MA: Harvard University Press, 2012).

109 . Franklin H. Top, Jr., "Department of Defense Acquisition of Vaccine Production: Report to the Deputy Secretary of Defense by the Independent Panel of Experts," December 2000, https://www.hsdl.org/?view&did=459558.

110. Lois M. Joellenbeck, Jane S. Durch, and Leslie Z. Benet, eds., *Giving Full Measure to Countermeasures* (Washington DC: The National Academies Press, 2004).

111. Ibid.

112. This briefing is presented by the CBDP, which has retained the strongest chemical frame influence among government organizations.

113. David Williams and Calvin Carpenter, *Medical Systems: Advanced Planning Briefing to Industry* (Washington, DC: Joint Program Executive Office, 2007).

114. Hoyt, *Long Shot* (see chap. 7, n. 108).

115. Paul I. Bernstein, John P. Caves, Jr., and W. Seth Carus, *Countering Weapons of Mass Destruction: Looking Back, Looking Ahead* (Washington DC: National Defense University, 2009).

116. William J. Clinton, "PDD 39: U.S. Policy on Counterterrorism," 21 June 1995, accessed 22 November 2011 from Federation of American Scientists, http://www.fas.org/irp/offdocs/pdd39.htm. President Clinton issued no Presidential Directives specifically addressing biological weapons (as opposed to "WMD") such as those later produced by Presidents Bush and Obama.

117. Susan Wright, "Taking Biodefense too far," December 2004, accessed 20 March 2012 from Bulletin of the Atomic Scientists, http://martin-senate-va-2012.

ucarems.org/essays-memos-notes/By-Other-Authors---not-Dr-Martin/takingbiodefense-toofar-susan_wright.pdf.

118. *GAO-01-27* (see ch. 7, n. 4).

119. *GAO/NSIAD-00-97* (see ch. 7, n. 102).

120. George W. Bush, "Biodefense for the 21st Century," 28 April 2004, accessed 23 November 2011 from Federation of American Scientists, http://www.fas.org/irp/offdocs/nspd/hspd-10.html.

121. Graham and Talent, *World at Risk* (see ch. 7, n. 2).

122. *National Strategy*, hearing (see ch. 7, n. 13).

123. *Budget Request*, hearing (see ch. 7, n. 87)

124. Obama, *Executive Order 13527* (see ch. 7, n. 104).

125. Clinton, "PDD 39" (see ch. 7, n. 116).

126. Bush, "Biodefense for the 21st Century" (see ch. 7, n. 120).

127. Obama, *National Strategy* (see ch. 7, n. 107).

128. Gregory Koblentz, "From Biodefense to Biosecurity: The Obama Administration's Strategy for Countering Biological Threats," *International Affairs* 88, no.1 (2012): 131-148.

129. The current strategy does represent a shift in views regarding international relations—a policy that does not fit with Waltz's view of realism.

130. Due to the multiple organizations and combined chemical/biological programs, it is difficult to present a breakout of funds allocated to chemical versus biological. The significance of this data is in the relative amount of money spent during this period in relation to other periods.

131. *NBC Modernization Plan* (see ch. 7, n. 19). These funding amounts did not include protective equipment and medical items.

132. Department of Defense, *Nuclear/Biological/Chemical Defense* (see ch. 7, n. 21).

133. *GAO-01-27* (see ch. 7, n. 4).

134. *Chemical and Biological Defense Program Annual Report to Congress, Vol. 1* (Washington DC: Department of Defense, 2002).

135. *Budget Request*, hearing (see ch. 7, n. 87).

136. Department of Defense, "Conduct of the Persian Gulf War" (see ch. 7, n. 17).

137. The combined NBC reference highlights the inaccuracies associated with a combined frame. The U.S. had not had a retaliatory biological capability since 1969, yet taken at face value, this statement implies such capabilities existed in 1992.

138. *NBC Modernization Plan* (see ch. 7, n. 19).

139. *GAO/NSIAD-96-103: Chemical and Biological Defense: Emphasis Remains Insufficient to Resolve Continuing Problems* (Washington, DC: U.S. General Accounting Office, 1996).

140. *GAO/NSIAD-00-97* (see ch. 7, n. 102).

141. *GAO-01-27* (see ch. 7. n. 4).

142. Regulations allow commanders to tailor the nature of training conducted for individual units as well as at training centers. As many of these units were preparing for combat deployments in areas with low chemical or biological threats, commanders may have chosen to focus on more immediate threats facing their units.

143. *GAO-05-8* (see ch. 7, n. 6).

144. Deena S. Disraelly, et al., *Nuclear, Chemical and Biological Education and Training: A Review Across the Services and Joint Community* (Alexandria, VA: Institute for Defense Analysis, 2007).

145. *GAO-07-143: Management Actions are Needed to Close the Gap Between Army Chemical Unit Preparedness and Stated National Priorities* (Washington, DC: U.S. Government Accountability Office, 2007).

146. Vannevar Bush, "Vannevar Bush Speaks," *Science* 142, no. 3600 (1963): 1623.

CHAPTER 8

Results

> You keep using that word. I do not think it means what you think it means.
>
> —Inigo Montoya, *The Princess Bride*

The last four chapters analyzed the seventy-year history of the U.S. biological program for evidence that external factors were influencing the U.S. biodefense program. The available evidence revealed the presence of behaviors associated with organizational frames, bureaucratic politics, and realism. Analysis of these behaviors indicates a complex interaction between the behaviors themselves and their ultimate impact on U.S. biological posture. While it appears a chemical frame played the most significant role in shaping U.S. posture, the story is not that simple.

Findings

While each theory has contributed to the current U.S. biodefense posture, a chemical frame has had the greatest influence. External threat exerted a strong influence early in the program, and in the last twenty years, but played a substantially less important role in the intermediate years. Imperialistic behavior was observed at a low level prior to the mid-1990s, at which point its influence increased considerably. The shift in the biological program's character after the Second World War indicates a chemical frame existed within the Chemical Corps before it received prime responsibility for the biological mission. The chemical frame has proved to be extremely strong and resilient, as it was the dominant factor from the end of World War II to the First Gulf War. While today external threat and imperialism are beginning to exert greater influence over the program, it is still possible to observe behaviors associated with the chemical frame.

How the Current U.S. Biodefense Posture was Formed

It is not unexpected that external threat exerted considerable influence over the initial formation of the U.S. biological program. The program was developed in direct response to the feared use of biological weapons by enemy states in a global war. During this period, research on biological agents was conducted by organizations composed of civilian biological experts, created for the sole purpose of understanding the potential of biological agents. While the Chemical Corps was also involved in this research, the majority of the work was biological-specific, and separated from chemical weapons. This period is a classic example of a state perceiving a threat to its security and responding with appropriate interest and dedication of resources.

As the biological program grew in size and capabilities, it was handed off to the military. At this point in time, the biological weapons program became subject to a chemical frame when the military, and in particular the Chemical Corps, became the primary organization of responsibility. The chemical frame was in existence even before the Corps was given responsibility for biological weapons. The frame was likely established in the inter-war period, when the Corps focused solely on developing the offensive and defensive aspects of chemical warfare.

The chemical frame exerted significant influence over the development of the U.S. biological program from the late 1940s through the 1990s. During this period, there was an overwhelming presence of behaviors predicted by the organizational frames model. Military doctrine over this period almost always referred to a combined chemical and biological threat when addressing enemy capabilities, attack scenarios and defensive measures. Tellingly, when the combined threat was described, it was almost always dominated by terms relating to the way a chemical weapon would affect the battle, ignoring the unique aspects of the biological threat. Likewise, official statements and reports demonstrated a similar trend in combining chemical agents and biological agents as a single threat or weapon type. As a result, most of the biological equipment and doctrine produced during this period was sub-optimal, failing to address the unique challenges and characteristics of a biological attack.

This is not to imply that the chemical frame dominated every aspect of those forty years. There were many events highlighting the influence of alternative behaviors, such as President Nixon's decision to end the program, the Air Force's large area coverage weapons, the debate over the offensive use of the weapons, and the debate to eliminate the Chemical Corps. However, while the other theories exerted temporary influence, the chemical frame was always present and always influencing the program. The presence of the combined view with offensive weapons, defensive hardware, and doctrine shows the strength of the frame.

The end of the Cold War, the First Gulf War, the discovery of state biological weapons programs, the use of chemical agents and biological agents in terrorist attacks, and the rise of international terrorist groups caused a series of shocks to the strategic outlook of the United States. Exhibiting behavior consistent with realism, the United States assessed that it was facing an increased biological threat, and that it was unprepared. The country responded by changing national policy and allocating substantial resources to address the threat. Biological agents are currently the subject of dedicated Presidential directives, separate from chemical agents, and are viewed with a level of significance not observed since the Second World War.

As a result of this elevated threat level, a considerable amount of national attention and resources have been allocated to biological defense. The resources and prestige currently associated with biological weapons present a prime target for organizations wishing to expand. Not unexpectedly, a significant increase in imperialistic behavior has been apparent in the last twenty years, with many military organizations claiming part of the mission space, and an increase in the total number of government organizations involved in the defensive program.

While external threat influenced the national response, which created an environment conducive to organizational imperialism, it is individuals who ultimately execute research and development programs. Many of today's leaders, especially within the DoD, entered the program years ago and learned their trade under the influence of the chemical frame. It is at this individual level where organizational frames can have the greatest impact. Even though the state and the organization may feel they are taking appropriate measures to address a threat, it is the individual who interprets guidance and executes the response. So, even as the other factors grow in influence, if organizational frame behavior persists within the program, it will blunt the influence of the other factors.

Findings of Note

This work examines seventy years of history in an attempt to understand the present state of the U.S. program. Some of the observations put forth in this work, while significant, are not unexpected. For example, the fact that external threat influenced U.S. actions during a world war, or that new organizations flocked to expanding resources in 2001, is not surprising. The identification of these events confirms that the assumptions, theory selection, and experimental design of this work are appropriate.

Of greater interest are findings that were not readily predictable at the onset of this study. Findings of substantial change, or of inaction, that do not fit the predicted pattern offer the best chance to understand why the U.S. biological posture exists in the state we find it today.

One such finding is that senior civilian leadership twice broke the chemical frame. Although under different circumstances, Presidents Nixon and Bush both came to view biological agents as separate from chemical agents. Their actions showed that the frame is not inevitable, and when individuals outside the frame examine the issue they find that the prevailing frame-dominated view may not be the best approach.

It is also important to note that the chemical frame seems weakest when the nation views itself in the greatest crisis, such as during World War II, and after the anthrax attacks. This observation may indicate that when the nation is actually serious about making significant advances in the program, it appreciates that the combined weapon view is not optimal. Yet, when the nation's attention turns to other matters, the influence of the chemical frame returns. This dynamic indicates that of the theories examined, realism and frames may be the least compatible. While they may be able to simultaneously exist at lower levels of influence, when one set of behaviors reaches a critical level of influence, the other theory fades to the background.

Another unexpected finding is the current lack of concern with chemical agents within civilian agencies. While it may be expected for non-military organizations with less exposure to the frame to have less interest in chemical agents, it is not that simple. As the evidence shows, the combined chemical/biological or WMD association has existed in almost all areas of the government at some point. At the genesis of many current non-military biodefense programs, the threat to the nation was still regarded predominantly as WMD or CBRN, as it is today. Any government agency would have been repeatedly exposed to this frame of reference in testimony, guidance, reference material, and contact with personnel within the traditional program. Yet today, the civilian agencies involved with "WMD" defense are almost exclusively focused on biological agents. This may be an imperialistic stance to secure resources, but also demonstrates that objective assessment of the weapons can result in programs dedicated specifically to one weapon type.

The resilience of the chemical frame is another surprise. At various points within the history of the program, some agencies were able to break or resist the frame. However, that situation was never permanent, and it has always been possible to find the frame somewhere within the traditional defense organizations. Even after written guidance from the White House to the contrary, the chemical frame persisted. The frame emerged at the end of the Second World War, and continues to influence the trajectory of the program to this day. While the frame does show signs of weakening, and may have even disappeared in some areas of the program, it can still be found within the traditional defensive programs.

The existence of the frame is concerning in that the defensive program seems to be banging its head against the wall trying to find solutions to problems it has made unnecessarily difficult. Perhaps the most striking evidence of this is the decontamination program. The United States is still struggling to develop the capability to decontaminate agents developed in the First World War.[1] The requirements expressed in the previously cited Tactical Air Command decontamination requirements document from the 1970s could just as easily be ascribed to today's programs. Despite years of effort, it seems the frame has prevented anyone in authority from stepping back and assessing why the program has not produced the desired results.

The detection area demonstrates the second strongest bastion of the chemical frame. Again, despite technical limitations, the program has insisted on a real-time detection capability. In reality, any detection system taking more than ten minutes to alarm will do little to protect the vast majority of a military base, yet the rapid response paradigm dominates the development program. This is in contrast to the three slower, but more reliable biological detection systems deployed by agencies not associated with the traditional program.

The general lack of imperialistic behavior, while not a total surprise, is still somewhat unexpected. These data show that imperialism did not exert a significant level of influence over the program until the late 1990s. It can be argued that, compared to major weapon systems and the nuclear threat, biological agents did not represent a compelling target for colonizing behavior. However, there were several periods where organizations were forced to defend their existence, and only made a token attempt to emphasize biological defense. Combined with the fact that biological defense was generally lacking in effectiveness, it is surprising that the program was not subject to a hostile takeover attempt by another service.

It is also interesting to note the interaction of imperialism with other behaviors. While organizational frames and rational choice are not compatible, imperialism appears compatible with either of the other theories. There are many examples of imperialistic organizations using external threat to justify additional resources. Another interesting trend is that prior to the 1990s, most imperialistic behaviors were executed relative to the organization's inherent frame. For example, when the Army sought new funds in the 1980s, it lobbied for binary chemical weapons—a comfortable option, well within the chemical frame. This may indicate that as a general rule, imperialism is most likely to be observed in newer organizations without an established frame, and when older organizations attempt imperialistic behavior, any associated frames will overshadow the attempt.

One final data point of interest is the medical countermeasures program, particularly in the 1970s. While this area has not been the major focus of this work, the available data from this period are of interest, as it appears that none of the behaviors associated with the three theories exerted a significant influence over the program during this time. There is no evidence that national leadership was directing any serious attention to this area, nor is there evidence that other agencies were attempting to take over the program. One could argue that the lack of confidence in medical countermeasures grew from a chemical frame, but even this evidence is not as strong as that observed in other areas of the defensive program. A more extensive investigation into this area of defense may reveal a program showing a lack of influence by any of the three theories of interest, and may be indicative of another organizational behavior.

These unexpected findings are important, as they provide opportunities to reflect on how the program could have been changed. In particular, the findings relative to the chemical frame highlight its strength, and illustrate how insidiously the chemical frame has impacted the program. The fact that there are internal and external program assessments critical of the program in every time period indicates that the country was never truly comfortable with the state of the biological program. However, investigators never appeared to question whether it was the chemical/biological relationship that was causing the problem. Had this question been examined, it is quite possible the United States would be in a better defensive position today.

A Pattern of Observed Behaviors

From these findings, it is possible to draw some conclusions as to when and where different behaviors are likely to exert the greatest influence. From the data, it appears that realism and organizational frames are incompatible, and that the threat environment and age of the organization may predict which theory will dominate, as shown in the following table.

Predominant Behaviors by Threat and Organizational Age

Age of Organization	Low/Stable Threat	High/Changing Threat
Old	Organizational Frame (Cold War)	Realism **or** Organizational Frames (Current, Nixon)
New	Bureaucratic Politics (Least likely)	Realism **and** Bureaucratic Politics (WW II, Current)

Most of the time periods covered in this analysis fall within the old/stable category. From the end of the Second World War to the 1990s, the United States faced the Soviets in the Cold War. While there were occasional flare-ups and proxy battles, the Soviet Union was a known and relatively stable threat. The United States had an established program, and an organization dedicated to the biological problem. As far as the nation was concerned, it was addressing the threat.

In this type of environment, a nation will show little interest in established programs addressing what it perceives as lower-level threats. Likewise, without a major event or outside assessment, the nation will assume the situation is under control, existing programs will receive little high-level direction, and the parent organizations will be relatively free to execute their programs as they see fit. It is easy to imagine that such an environment would result in existing frames dominating the direction of the program.

The environment least likely to be observed is the stable threat/new organization combination. This threat environment is reflective of the Cold War, as just discussed, and very few "new" biodefense organizations came into existence during this time period.[2] A nation is unlikely to expend resources to create a new organization to address an existing low-level threat that is already being addressed by an established organization. Given the stable threat environment, and lacking any gross negligence within the program, there is no compelling rational choice reason to add an additional program. Nor is it likely that a chemical frame would influence the government to create a redundant organization. So by default, any new program would be created not due to lack of existing ability, but as the result of an arbitrary government decision. Such decisions are not usually made without some form of lobbying, either from existing organizations or outside constituencies.

The creation of a new organization in response to a substantial change in threat is consistent with behavior predicted by realism theory. For example, the civilian organizations created in World War II, and also the new governmental organizations that have entered the biodefense arena in the last ten years.

A national assessment that existing programs are misaligned with a rising threat will result in a rational choice to allocate more resources and possibly create new organizations in an attempt to alleviate the threat. It would be logical to expect that an organization created in direct response to a new external threat would focus closely on that threat. The newness of the organization and severity of the threat would create an environment where the "old way" of doing things, associated with a frame, would not be acceptable or expected. It would be expected that the additional resources available in this type of environment would encourage imperialistic behavior, as well as behaviors predicted by realism. It is possible to see these behaviors today in organization such as the HHS and DHS as they compete with the DoD to address the biodefense threat.

The final combination of an old organization in a rising threat environment brings to mind the Chinese curse: "May you live in interesting times." In this scenario, the national assessment of vulnerability has changed, and in the case of biodefense, the old organization addressed the threat through an inappropriate frame. The drastic changes imposed by President Nixon and the realization that the United States was unprepared to face the Iraqi threat in the Gulf War are two examples of established organizations struggling to adapt to drastic changes in the threat environment.

In this scenario, the nation realizes that existing measures are inadequate, and that something drastic must be done. One possible solution is to create new organizations that would likely be influenced by external threat and imperialism, as already discussed. Another possible solution is to rely on existing organizations to address the changing threat. This creates some tension, as the existing organization may have failed to adequately anticipate the threat, and is quite possibly operating under the influence of a frame.

This scenario also highlights the tension between external threat and a frame. Increasing funding to a frame-dominated organization would only produce more of the same pre-event products already proven inadequate. For the organization to break from the frame and address the external threat as it truly exists, considerable external pressure must be added. The historical analysis shows that it may require Cabinet or Presidential involvement with the problem before the frame is broken. The record also shows that as national attention turns to other areas (and the program enters the old/stable environment), existing frames tend to again emerge as the dominant influence.

The evidence suggests that in their true forms, the respective behaviors associated with frames and realism are incompatible. While both factors are influencing the program today, the influence is at different organizational levels. The highest levels of government are primarily concerned with the external threat, and produce outputs reflecting this concern. However, the organizations executing the program still reflect the influence of a chemical frame, as evidenced in the hardware. If the influence of external threat reaches a tipping point within the executing organizations, they will begin to address the biological threat based on the true nature of biological weapons, separate from chemical-based assumptions. Such an environment is inhospitable to the chemical frame.

Alternative Explanations

This work has concluded that the deficits in the U.S. biological program are in large part contributable to the existence of an organizational frame. There are alternative explanations that could account for this deficit as well.

Biology was too Hard

It is possible that the deficiencies in biological defense are a reflection of the significant scientific challenges associated with developing effective biological defense capabilities. Scientific advances in the last twenty to thirty years have produced identification techniques and allowed hardware and software developments that represent a quantum leap over the capabilities available in earlier periods of analysis. It is obvious today that the researchers trying to develop real-time biological detection systems with 1950s technology were facing an impossible task. Therefore, it should be of no surprise that biological defenses have lagged behind chemical defenses over the years.

While this argument is valid, it actually provides even more support in favor of a chemical frame. The focus of this analysis is not the technology, but the view of the threat, and the development of requirements based on that view. The history of biological detection devices demonstrates a constant quest to achieve real-time detection, as would be expected when the threat is viewed through a chemical frame. Yet this standard is not an absolutely critical factor, given the slower action of biological agents. What is not observed is any attempt to develop a detection strategy based on technology available at the time.

Detection and identification systems based on separate collection and identification could have been developed and fielded many years prior to Portal Shield.[3] However, such a system would not have provided "real-time" detection. It would have required a dedicated laboratory capability, and would have taken hours to days to function. Such a system would have only worked in combination with a robust medical capability, either in vaccine or drug development, to prevent widespread casualties. These operational characteristics are foreign to the detection of chemical agents, and this is arguably one reason such a system was not proposed.

Biological Agents were Never Really a Threat

It is also possible to argue that relative to massive Soviet conventional forces, nuclear-armed enemies, and enemies with established chemical capabilities, biological weapons were a relatively insignificant threat. It would then be logical to combine biological defense within similar requirements imposed by chemical defense, allowing a relatively low-level threat to be addressed with minimal additional resources. Such an argument is valid, and would be reflective of a rational choice associated with realism. However, there are two factors that contradict this assumption: the nature of the threat, and the nature of the biological agent/chemical agent relationship.

Looking at the modern history of biological weapons, there are at most only twenty years where the United States or its allies did not have a biological weapons program, or where the United States did not have concrete evidence it faced an adversary who possessed biological weapons. Entering World War II, the British had a biological program, and by the end of the war, the United States did as well. The United States maintained an offensive program through 1969. From 1970 to 1990, the United States could not point to a "known" biological program. However, by the mid-1980s, based on intelligence estimates and events such as Sverdlovsk, it was becoming increasingly accepted as fact that the Soviets had a clandestine program. By the end of the first Gulf War, the United States had firsthand knowledge of two state biological weapons programs. In 2001, the United States was subject to an actual attack that utilized weaponized anthrax. Taken together, it is possible to state that biological weapons were a tangible threat to the United States for a majority of the time since the early 1940s.

Also, the relative level of the threat should not have influenced how the United States viewed biological agents relative to chemical agents. Even though the level of the biological threat may have been lower than that from chemical agents, it does not change the physical nature of the two weapons. In fact, if biological agents posed no serious threat, then relatively simple, and less costly, biological-specific protective measures could have been developed to address the minimal threat that did exist. Yet, nearly all doctrine and policy produced by the Unites States prior to the 2000s refers to a combined chemical/biological threat, unnecessarily complicating the issue (and inadvertently and artificially elevating the status of biological weapons) if biological weapons were not in fact a threat.

Inappropriate Experimental Design

It is also possible the three theories are not mutually exclusive and create an issue of equifinality, which is a concern with the congruence/process tracing method described by George and Bennett. On one level this is correct—external threat drives state action, imperialism can drive inter-departmental actions, while frames work within organizations. However, it is the perception of biological weapons relative to chemical agents, and the resulting U.S. posture that is of most concern for this analysis. Each theory predicts a unique and mutually exclusive view of biological agents and the corresponding threat. Carried to their logical conclusion, each distinct view of the biological threat will produce a biological agent/chemical agent relationship specific to each theory.

A realist-based approach will view the threat relative to all external threats facing the state. Compared to nuclear and conventional threats, biological weapons were arguably of minor concern. Realism predicts a posture based on distinct threats, tailored to address each threat with the appropriate level of resources. Yet we consistently see chemical agents, biological agents, and nuclear weapons given the same degree of prestige, as they are often regarded as a single "WMD" threat or referred to as

"NBC" weapons. Even when nuclear weapons are treated separately, the majority of the references are to chemical/biological agents.

An organization with imperialistic intentions would view disparate threats as an opportunity for organizations to expand into underdeveloped areas. The theory also predicts that organizations looking to expand will highlight the unique aspects of biological weapons as a strategy to support their proposals for new programs. In fact, imperialism predicts overselling of the biological threat as a means to support new programs. Yet we still see a consistent combining of the threat, either as chemical/biological or as nuclear/chemical/biological.

An organization under the influence of a frame views the threat as real and makes every effort to respond accordingly. However, it is the viewing of biological agents through the chemical lens that produces the output unique to this theory. In this case, the weapons are seen as so similar that when attempts are made to address a biological threat, the resulting effort is accomplished in a manner that would be more effective against a chemical agent.

Incorrect Theories

It is possible that the three theories included in this work are in fact not appropriate, and an alternative theory would be better at predicting the behavior of U.S. biological defense doctrine. Posen addresses the same issue in his analysis. He acknowledges that it is difficult to select the most likely alternative theories, so he ultimately selected two of the most widely accepted theories to compete against each other.

To conduct this analysis, three logically competing theories were chosen from the literature. While there are academic and historical precedents for the selection of these three theories, they in no way comprise a comprehensive list of international relations and organizational theories that could impact biodefense doctrine. In order to conduct this work in a realistic manner, a limit needed to be placed on the number of theories examined. Therefore, the conclusions are only valid relative to these three particular theories. There is the distinct possibility that an alternative theory may provide a better explanation than the three used in this analysis, but that argument will rely upon future work.

Wrong Data Used

A final argument is that the data examined was insufficient, or not appropriate to support these conclusions. Admittedly, there are at least two potential issues with data collection for this topic: classification and volume.

Classification of data in this area is a factor that cannot be circumvented. There is a valid security concern that detailed knowledge of weapons capabilities or vulnerabilities can result in harm to the country. While it is possible to request declassification or Freedom of Information access for specific documents, it is a tedious process, and is not guaranteed to provide the data of interest. Therefore, this analysis is limited to data that is available to the public. Due to the nature of declassification, the older the document, the more likely it is to be publically available. This also creates a bias where there is a greater amount of data from earlier historical periods.

A second issue is the sheer volume of possible data—the archives contain hundreds if not thousands of feet of documents. Every effort was made to utilize the most relevant data, but it was not possible to examine every committee meeting, transcript, or decision document.

However, within the sources analyzed, the described behaviors were consistent regardless of volume or source. Given the ubiquity of these behaviors in the data examined, there is no reason to expect the same pattern would not be present in sources of data not included in this analysis.

Conclusions

This analysis selected three prominent theories that logically could have impacted the development of the United States' biological program. Based on the presence of unique behaviors predicted by each of the theories, it is possible to observe factors associated with each theory influencing the U.S. biological program at different points in the program's history.

Given the prevalence of these behaviors, it is evident that the U.S. biological program was created under the strong influence of an external threat. After the end of World War II, and throughout the first Gulf War, a chemical frame was the dominant influence over doctrine development. In the post-Gulf War/international terrorist period, it is possible to find a significant presence of behaviors associated with all three theories, each exerting the bulk of their influence on separate areas of the program.

Yet it is the presence of a chemical frame at the level of the executing organizations that has had the greatest historical influence over U.S. biological posture. The majority of the hardware, doctrine, and training, as well as the general perception within the military, reflects the presence of a chemical frame. The repeated association of chemical weapons with biological weapons has unnecessarily complicated the issue, and severely hampered the ability of the United States to achieve its true potential in biological defense. The repeated examples of the chemical frame being identified and partially broken, followed by the eventual return of the frame, stand out as perhaps the most telling observation from this work.

There are limitations to these findings, and while several challenges can be raised, they are subject to debate and can be resolved with additional research. There are two challenges that were unavoidable, and that place a limit on the conclusions that can be drawn from this work. The lack of access to classified information places an inevitable bias into data selection. Also, due to the need to limit the problem, only three theories were examined. In the future, additional theories or additional data may prove to contradict these findings.

These challenges notwithstanding, this work indicates that a chemical frame exerted considerable influence during a majority of the U.S. biological program's existence. The implications of this dominance will be expanded upon in the next chapter.

Notes

1. A previous point bears repeating: both chemical agents and biological agents can be and are routinely inactivated. It is the additional requirement to address all possible agents while in a field environment, without harming equipment, that makes the problem much more challenging.

2. Although the Army moved the mission from the Chemical Corps to Air Materiel Command, this was a re-organization and did not represent the creation of a new organization competing with the original organization.

3. While the DoD fielded a previously shelved detection system for Desert Storm, it was never standardized as an equipment item. Portal Shield, fielded in the mid-1990s, was the first significant biological detection system employed on a large scale. It is a point/real time detection system based on antibody detection technology.

CHAPTER 9

Significance and Recommendations

> Since leaving Moscow I have encountered an alarming level of ignorance about biological weapons.
>
> —Ken Alibek, *Biohazard*[1]

The results of this historical analysis show that behaviors associated with all three theories have contributed to the current state of U.S. biodefense posture, but that a chemical frame has exerted the greatest influence. Recognizing that external factors are influencing the program is the first step in understanding why the United States struggles in this area. Interpreting the impact and developing alternative strategies is the second step.

Significance—Impacts on the Program

The current U.S. biological defense posture is less than optimal, and three factors have been discussed that have contributed in some way to this condition. It has been shown that a chemical frame had the greatest impact, but each factor has had some role in determining the current U.S. biodefense posture. Given that these factors influenced the program, why should one care, and how should they be addressed if the program is to improve?

Impacts of Imperialism

Is imperialism an issue? By some measures, the presence of imperialistic behaviors has had a negative impact on the program. The best example of this impact may be the current vaccine development program, which has many participants, but little success. The negative influence of imperialistic behavior is manifested when organizations allow self-interest to affect decision-making. As a result, doctrinal decisions may not be optimal based on threat and cost, but are altered to include factors representing the best interest of organizations involved within the decision process. It would be reasonable to expect an increase in fragmentation and in the cost of the overall program as the influence of this theory increases.

However, especially in the presence of a frame, imperialistic behavior can have a positive effect on the program. One issue identified with the U.S. program is that under the influence of a chemical frame, it focused on established solutions, with little innovation. Imperialism can serve to counter organizational frames when outside organizations compete with established ones for resources. This represents an opportunity for individuals outside the frame to address the program and bring unique solutions to the table, while forcing established organizations to reassess their polices in response to new competition.

The employment of the BioWatch, BASIS, and JBAIDS biological detection systems provides evidence in support of this theory. These systems are based on an extended filtration/collection step, followed by a highly specific identification step. The traditional DoD defense program did not develop these systems, nor has it historically dedicated considerable resources to this type of detection strategy.[2] Yet these systems that were developed by organizations "new" to the biodefense program are the ones currently employed within many U.S. cities, government facilities, and even military bases.

For good or bad, a convenient characteristic of imperialism is that it is relatively easy to identify. While bureaucratic behaviors may be joked about, or just chalked up to "that's how the government works," strong leadership with a clear mandate can streamline and consolidate programs. Imperialistic organizations can resist culture change for a time if they have a powerful enough constituency, but at some point, if the nation wants it badly enough, the bureaucratic structure can be changed.

Impact of Rational Choice

Is realism/rational choice an issue? Decisions based on rational choice are not inherently good or bad. Ideally, they are a logical response to a threat, balanced against other threats and available resources. One would hope that there is some degree of rational choice behind every U.S. defensive decision. The nation cannot fund every possible defensive program, so choices must be made. Ideally, the rational choice is based on external threat, and can serve to break an organizational frame by injecting the real world into programs and decisions.

The weakness of rational choice is that it is based on human judgment, and the accuracy of the perceived threat. In some cases, such as Iraq, the United States had firsthand knowledge of the extent of their program after the war, and even maintained an inspection program. Even then, the United States overestimated the threat in the following years, eventually going to war, in part over the perceived Iraqi refusal to end its NBC programs. Conversely, the Soviet Union ran a sophisticated and successful clandestine biological program for years, which the United States never accurately characterized.

In addition to good intelligence, rational choice also relies on a rational decision maker. Deciding to ignore a threat based on its relative magnitude is acceptable; deciding to ignore a threat because you champion a technology to address a different threat is not. Likewise, a decision to ignore a threat because one finds it personally immoral does not protect the nation from an amoral world.

A doctrine based on realism should focus solely on the perceived threat to the state, and should allocate resources to counter the most pressing threats. The historical data does show realistic behaviors such as allocating greater resources to chemical weapons based upon Soviet threat. However, a program based on external threat would not produce the combining of threats, or the constant submission of one threat relative to another.

While rational actor behaviors are not always exerting influence over the biodefense program, when present, they serve as a rudder, providing guidance and direction. Realism-based behaviors are most evident in historical periods showing the greatest flux in external threat, while relatively stable periods show other behaviors having greater influence. Rational choice serves as a check on organizational or bureaucratic forces.

Unchecked, these forces can produce a doctrine based on politics or individual preference, and can ultimately result in doctrine and hardware that are ill suited to address the threats encountered in the next conflict or attack.

Therefore, a doctrine based on external threat is not an issue with a degraded defensive capability. When working perfectly, rational choice will fine-tune the national defense to fit the threat facing the nation. It is the institutional weakness in knowledge and decision-making that can result in a threat/defense mismatch. If deficiencies are identified, reallocation of resources and effort can be implemented to correct the situation.

Impact of a Chemical Frame

Is the chemical frame an issue? There is a valid argument to be made for treating biological and chemical weapons as a combined threat. In the area of collective and individual protection, the United States has pursued a strategy of developing barrier materials and filters that offer protection against both chemical and biological agents. These combined programs offer a considerable logistical advantage by reducing the amount of material needed in a theater of combat. Combined protection also simplifies the commander's operational environment by reducing information requirements and simplifying decisions made in response to an unconventional attack.

Combined chemical/biological doctrine and training also offers advantages to military forces. Operational forces train for many different and evolving threats, with a limited amount of time and resources. Biological agents and chemical weapons are just two of many threats facing combat forces, and ones which are arguably much less likely to be encountered in today's combat missions than snipers or IED's. And as the method of employment is likely to be similar for both weapons (airborne), many of the defensive actions have similar components. Combining training can allow commanders to maximize training opportunities, while conserving resources.

Arguments can also be made to combine weapons classes when designing decontamination capabilities. Large-scale decontamination operations impose a serious logistical burden on the commander and require a substantial amount of equipment, along with large amounts of water and decontaminant. As with protective equipment, development and employment of universal decontamination capabilities reduces logistical requirements, and also lessens the need to rely on detection technology and intelligence capabilities to identify the nature of the threat to be faced by combat forces.

Finally, no one would argue that it is acceptable to risk exposure to a biological agent if it can be prevented. Faced with agents that are invisible and generally undetectable by human senses, the ultimate goal of any detection system is the ability to detect the presence of agents in time to allow effective protective measures. To achieve this goal, it is necessary to develop standoff detection systems, or point detection with real-time detect/alarm capabilities. Therefore, when the objective is to avoid exposure, the operational requirements for chemical sensors and biological sensors will be essentially identical.

These arguments all make perfect sense to an organization working under a chemical frame. If the frame inhibits the ability to appreciate the unique aspects of a new challenge or weapon, then the organization will continue to utilize established solutions to address the new problem. And as documented in the analysis section, there is ample evidence that the organizational chemical frame has had a significant impact on the development of U.S. biodefense doctrine.

Despite these arguments, the frame is still a significant issue. Examining these arguments again, focusing on the differences between biological agents and chemical agents (i.e., breaking the chemical frame), exposes critical shortcomings with the U.S. approach of combining the biological and chemical programs. The key to this point of view is to appreciate the different physical behaviors of the weapons, as discussed in Chapter Three. Persistent chemical agents are oily, thickened chemicals manufactured through an industrial process, and are not normally found in the environment.[3] Their physical composition results in their ability to penetrate and even degrade many materials over time.

While lethal and intimidating, biological weapons are ultimately only human manipulation and employment of naturally ubiquitous bacteria or viruses.[4] While agents may be delivered in wet or dry forms, they are particulates. The agents themselves do not have the ability to penetrate non-porous surfaces, nor to degrade materials. While the existence of the chemical frame influences all aspects of the program, from the design of protective boots to the wording of public law, it has had the most profound and detrimental impact on the hardware that serves as the cornerstone of biological defense.

Frames Impact on Protection

From outside the chemical frame, the arguments to combine chemical and biological systems take on different implications. Equipment designed to protect against both types of agents must be able to withstand the penetration and degradation risks associated with the most caustic chemical weapons, resulting in bulky, expensive materials that usually have a shelf life imposed by their need to absorb chemical agents.

However, protective barriers for biological agents face a less significant physical challenge from the agent, and can be constructed of materials that impose a far lesser physiological burden on the user. Intact skin is an effective barrier to almost all biological agents, and is easily augmented by impermeable barriers such as Tyvek® suits and surgical gloves. The previously cited Air Force study on the efficiency of N95 masks against biological agents indicates there is an awareness of the different protective requirements.

While there is an excellent logistical argument to be made for combined chemical/biological filters, most current filters that are effective against both biological agents and chemical agents combine two distinct filtration techniques. Current filter systems provide protection against chemical agents with absorbent materials that sequester the agent as air passes over the material. Filters need to be periodically replaced, as the absorbent materials "fill up" with chemical agent and stop offering protection.

Even if there is no chemical agent present, these materials will react with normal chemicals in the air, slowly losing their ability to scrub the air of chemical agents. This results in a limited operational life for opened filters, after which they must be replaced, even if they were never exposed to chemical agents. Increased protection time and protection against additional agents is obtained by adding more or different mixes of absorbent materials into the filter.

Filtration against biological agents is based on physical immobilization of the infectious particles on the filter material. Because biological filters work as physical barriers to the passage of particles, they do not have a shelf life based on the chemical properties of the sorbent material. The life of physical filters is determined by the amount of material caught within the filter. While this accumulation of material does not necessarily reduce the effectiveness of the filter, it does increase the resistance of the air passing through. At a certain point, resistance will begin to impact the operation of ventilation systems, or place increased strain on the user's ability to inspire.

For protective equipment, the military has incurred a cost as a result of the decision to develop material designed to face biological agents as well as chemical agents. Such equipment must meet protective standards dictated by the most extreme threat, resulting in over-protection against less demanding threats. A combined threat model also results in rigorous performance requirements, which can result in increased research costs, longer development periods, and ultimately more expensive material solutions.[5] The need to address the chemical threat imposes shelf life and service life constraints on filters and protective garments that are not applicable to a biological-only threat scenario, imposing additional financial and logistical costs. Of most importance to a commander are the loss of mission effectiveness and the heat stress placed on individuals wearing protective over garments that are drastically over-engineered relative to the biological threat.

Frames Impact on Decontamination

A second mission area that has been seriously impacted by the chemical frame is decontamination, which would not be an issue if it were only a concern in a laboratory environment. Many chemical and physical methods are routinely used to inactivate toxic materials, or to eliminate the ability of biological agents to cause infection. However, these techniques are often harmful to sensitive equipment, or impractical for use in a field environment. Operating under the combined threat model imposed by the chemical frame, the United States has yet to develop a universal, equipment-safe decontaminant.

To answer the decontamination challenge, the United States has consistently pursued a decontamination strategy that focuses on developing a joint chemical/biological decontamination capability. While this strategy may seek to maximize logistical effectiveness, it imposes significant physical challenges on any system. Reexamining this strategy relative to the distinctly different physical characteristics of the agents, a split decontamination strategy could offer powerful advantages.

Liquid chemical agents (rather than vaporous agents) present the main challenge to chemical decontamination, in large part due to their ability to penetrate surfaces such as paint. Once the agent has been absorbed into a surface, it can remain a low-level contact and vapor hazard for a considerable amount of time. Therefore, a successful chemical decontaminant must be able to reach and detoxify sequestered agent without damaging the structural integrity of the original equipment.

Compared to persistent liquid chemical agents, biological agents offer a stark contrast in decontamination requirements. As particles, biological agents do not penetrate surfaces. While they can settle into cracks and pores, they are not physically absorbed into other materials, as are chemical agents, thus presenting an easier decontamination target. Also, as a general rule, biological agents are more "fragile" than chemical agents, requiring less extreme decontamination capabilities. Hospitals and research laboratories routinely decontaminate equipment using heat, radiation, or chemicals such as alcohol, peroxide, or bleach.

The physical differences and decontamination requirements are recognized and addressed daily in the "regular" world. Every household has multiple cleaning products used to "decontaminate" surfaces in the home. There are commercial products to degrease car engines, remove tar, clean toilet bowls, and wash dishes. Each of these products is specifically designed to meet unique operational parameters, such as the environment, the cleaning challenge, the material to be cleaned, and health considerations.

No commercial company (in my opinion) would attempt to develop a product that addressed every cleaning requirement in a home, yet the military has consistently required its decontamination programs to address all agents in all environments.[6] As with other combined requirements, any all-encompassing solution must be substantially over-engineered for most of the threats in order to neutralize the most demanding agents. By insisting on a 100% solution for every conceivable situation, many 80% solutions have been rejected. Had several of these 80% solutions been combined within a larger program, there is a real possibility the United States would today possess an acceptable decontamination capability.

Frames Impact on Detection

Detection is the final area of hardware that shows the impact of the chemical frame. The actual research programs, fielded sensors, and detection capabilities have been discussed in previous sections. Looking at these capabilities from outside the chemical frame, it is possible to argue that the chemical frame has hindered the development of effective biological detection capabilities.

By their nature, chemical agents necessitate an almost instantaneous detection capability in order to avoid casualties. Prior to the development of mechanical detection capabilities, chemical detection consisted of observing soldiers or animals for the effects of chemical agents. Sentries watched for chemical effects on personnel and sounded "gas" alarms to alert troops downwind of the initial attack.

Technical solutions to chemical detection logically needed to respond faster than observable human physiological reactions if they were to be of any advantage in the battlefield. Therefore, the time to alarm, sensitivity, and standoff capability were important considerations driving the development of chemical detectors. With the available technology, and the relatively low level of background noise in the environment, current chemical detection capabilities are at least adequate to protect military forces.

As documented, the history of biological detection research shows a strong correlation to chemical detection. Requirements are similarly, if not identically, worded and in many cases the programs seek to combine biological detection with chemical detection. From within a chemical frame, these similarities make sense. The purpose of real-time detection is to prevent personnel from being exposed to an agent, either through avoidance, or by utilizing protective equipment. Further, no one would argue that it is acceptable to allow exposure to a biological agent if a detection capability existed, nor would anyone argue against research to develop real-time biological sensors. Yet in the case of biological weapons, instantaneous, low-density, fixed sensors are not the only possible solution, especially given the current state of detection technology.

The chemical frame has blinded the United States to a realistic appreciation of the differences between chemical agents and biological agents, and the resulting technical challenges these differences impose. Compared to chemical agents, biological detection faces a much greater challenge with environmental noise. Some strategies to account for the noise are greater sensitivity, larger samples, or more data points, all of which result in slower detection responses. Yet looking at the historical record, the United States has consistently imposed time limits on biological detection, ranging from five to thirty minutes.

These requirements have resulted in detectors that exist in a no man's land of attempts to produce useful warnings with low false alarm rates. Instead, current sensors produce high false alarm rates, while providing relatively little protective advantage to an installation. As time to detect and alarm becomes slower than "instantaneous," the usefulness of the detector decreases. A five-minute response time could easily result in exposure of personnel half a mile downwind from the detector, and a thirty-minute response time could result in a three-mile downwind exposure.[7] Put in perspective, a three-mile downwind exposure would essentially result in the exposure of the entire population of Kunsan Air Base before an alarm sounded.

To meet even these relatively slow time requirements, developers must use the most rapid detection technology suitable for a field environment. Currently, the best fieldable rapid detection technology is antibody-based detection, which is relatively insensitive, and prone to cross reactions with normal environmental organisms. To combat this issue, the developer can either rely on a greater detection signal, or accept a high false alarm rate. If the detector is fielded with a high false positive rate, it may result in units ignoring alarms or disabling the sensors. Steps taken to decrease the false alarm rate can negatively impact detector performance by increasing detection time, lowering sensitivity, or generating a greater false negative rate.

Given the lack of current technology capable of instantaneous biological detection in a highly complex environment, solutions not based on the chemical frame might offer increased capabilities. Given the slower action of biological agents, and the ability to combat some agents through medical countermeasures, it is possible to conceive of alternative detection strategies, such as long collection periods combined with highly sensitive (although slower) detectors, or networks of dispersed detectors.[8] Such strategies may not be able to prevent exposure to an agent, but combined with a strong medical capacity, they can offer a significant level of protection. Interestingly, agencies without a strong chemical frame, such as the medical community and civilian agencies, have adopted such strategies.

Why the Frame Has Persisted

The chemical frame has had a negative impact on the U.S. biodefense posture, yet it has persisted. Even Presidential guidance aimed directly at separating chemical agents from biological agents has only temporarily lessened the influence of this frame. Why has the chemical frame demonstrated such resilience within the biological program?

Perhaps it is the structure of the military's career path that makes it particularly susceptible to a frame. Most organizations can hire leaders from outside, providing an opportunity to inject new ideas into any level of the organization's structure, which can be an effective management tool when facing a crisis. However, military leadership is grown from within the organization. Sufficient rank to hold a leadership position is only achieved after ten to twenty years of service. The training and education required to attain the higher ranks provides an excellent opportunity for the frame to perpetuate itself.

The evidence presented regarding military training makes it possible to appreciate how the frame is perpetuated. During the Cold War, when there was relatively little concern with the biological threat, training was almost exclusively presented as combined chemical/biological training. In such a steady state environment, there is little reason to expect that a serious challenge to the chemical frame would emerge.

Of more interest are the training behaviors observed in the post Gulf War period. Here, despite Presidential directives addressing the biological threat, and Congressional directives addressing training deficiencies, the evidence documents a slow, frame-dominated attempt to improve biological training. As long as the military trains its newest cadre of future leaders under a chemical frame, they will not know any other way of thinking when they reach a position to influence the direction of the program.

Closely associated with training is the background of those chosen to fill positions within the program. The reliance on established educational quotas and arbitrary entrance requirements can serve to perpetuate the frame within the organization. The available data show a strong bias towards personnel with chemical backgrounds within the program. This bias can be perpetuated by leadership, which selects new personnel with similar backgrounds to their own. The type of training and advanced education provided by the organization can then reinforce this bias. While these behaviors can be a significant factor in how the frame is perpetuated, they can also be utilized to eradicate the frame. As entrance requirements and educational quotas can be changed relatively easily, this would be one tool a leader could use to slowly change the character of an organization by bringing in new educational outlooks to challenge the established frame.

One final reason the chemical frame may demonstrate such resilience is a lack of challenge from outside the organization. During the Cold War, the U.S. nuclear strategy was subject to considerable debate, not only from within the military, but from national leadership, the academic community, and the public. This debate served to generate new ideas that created a hostile environment for the perpetuation of a frame. Compared to nuclear weapons, biological weapons posed less of a threat to the nation, and predictably, the U.S. biological defense program received significantly less attention from these outside sources. This lack of external challenge to conventional wisdom may have also been an important factor in the perpetuation of the chemical frame.

Today, the biological threat has been elevated to a status not seen since World War II, and a corresponding increase of interest in U.S. biodefense policy is apparent within the public and academic arenas, while concern over nuclear weapons has dropped from its Cold War levels. While there has already been a notable shift in how the national leadership views biological defense, the developing academic and public interest may emerge as another source of new ideas to challenge the remaining elements of the chemical frame.

Conclusions

Ultimately, it is the perception that chemical agents and biological agents are the same that has created many of today's deficiencies. A military paper written in 2005 epitomized this danger, as its authors still believed the United States possessed biological weapons. If any population should be aware of the status of the U.S. biological weapons program, it is the military, as they are among the most likely to face the threat. Yet we have so intertwined chemical agents and biological agents that one is automatically included with the other, even thirty-five years after the United States destroyed its biological weapons.

If military leaders are still confused as to the nature of the U.S. biodefense program, should we expect a better understanding from any other population? If we as the "WMD experts" create contradictory or even incorrect guidance, how can we expect forces in the field to have confidence in their defensive equipment or training? While a chemical frame may have hamstrung our biodefense program, there are ways to fix the problem.

Recommendations

Given that a chemical frame has influenced the U.S. biodefense posture, and that this influence has negatively impacted U.S. defensive capabilities, how should the program be improved?

The most straightforward solution is the most drastic, and also the least likely to be adopted—simply split the responsibility for chemical defense and biological defense. The Chemical Corps tried a similar approach once in the 1950s, and a separate agency has been recently recommended as a fix for the vaccination program.[9] A split program would have several benefits for biological defense. Having no competing model, the program would be able to view biological agents as a unique threat. Such a move would emphasize the need for personnel educated about and solely dedicated to the biological threat. Finally, physically separating the chemical program from the biological program would allow equal advocacy for both programs, and would prevent cross-pollination of ideas or requirements.

Obviously, such a change would face substantial challenges. A new organization would impose a considerable cost in personnel, infrastructure, and resources. It would also have to overcome a massive amount of bureaucratic inertia, and would then run the risk of populating the new program with personnel educated under the influence of a chemical frame. Even if the program were split, at some point the two programs would be under the leadership of one person unless a new Secretarial position was created within the Office of the Secretary of Defense.

A second sweeping but less contentious recommendation is to directly eliminate terms such as WMD, CB, or CBRN from the national lexicon. Every time these terms are used in an official capacity, the implication is that these disparate weapons are somehow linked in threat, defense, or mode of action. Reference to the actual weapon of concern removes confusion and allows development of directed solutions. It also makes individuals aware that these weapons are not the same.

While this solution is not radical, and would be agreed upon by many, it faces decades of inertia. Carus has written an excellent examination of the WMD terminology, in which he notes there are currently over forty different definitions of WMD with official or semi-official standing.[10] A recommendation to change terminology is neither original nor untested, as similar directives have been noted in this work. Yet even direction from the White House has not been able to remove these terms from the national vocabulary. Implementation of such a program would require continuous reinforcement from senior leadership, which would probably require more effort than could be dedicated to the issue.

Given the massive bureaucratic inertia facing these two recommendations, there are other less dramatic actions that would still make considerable strides towards breaking the frame. First, the most important step is to recognize that any organization will be operating under some inherent bias or model of operation. It may be one of the three theories discussed in this work, or one of the many other biases that can impact organizational behavior. Organizations should make efforts to honestly assess their own performance, or better yet, invite outside experts to assess the state of the organization.

Without an outside audit, organizations responsible for managing the programs can easily maintain a bias. In my experience as a program manager, I have never had to justify my programs further than one level above my supervisor, meaning all program reviews have been conducted “in house.” Inviting outside experts to critically review program justifications and requirements can help break an organizational frame by involving perspectives from outside the frame. External reviews should not only involve true technical experts, but also the user. Both must see merit in the approach, and see an operational benefit in the proposed program.

Just as program reviews are usually internal, doctrine and training manuals are also created within the military, serving to perpetuate any existing biases. As with research programs, it would be advantageous to have some sections of proposed doctrine reviewed by experts completely removed from the military culture.[11] Such review would force the developers to validate the reasons for prescribing some actions over others, and would expose recommendations based only upon historical precedent, with no practical foundation.

Education in one field does not necessarily make one an expert in all aspects of a particular mission area, yet knowledge in one area of chemistry, biology, or nuclear physics often qualifies one as a total WMD expert. While this approach makes sense in light of personnel limitations, it exposes organizations to the introduction or perpetuation of frames. Greater awareness of the existence of frames can allow better decision making when hiring personnel or modifying organizational structure to achieve a balance in educational background. Lacking the ability to cover all the educational bases, acceptable alternatives may be to combine organizational resources with other organizations to create joint, single-threat centers of excellence dedicated to only one weapon type, or to rely on experts outside the organization.

Finally, decision makers must understand the positive and negative aspects of a program. Program managers do an excellent job of selling the benefits of their programs, but often do not understand, or are not even aware of, the negative impact of additional requirements placed upon the program. The presence of a frame can blind decision makers to the fact that all threats are not the same, and that over-engineering can actually have a negative impact on readiness.

With that said, there might be a valid case to justify combined biological and chemical requirements within some programs. Logistics, nature of threat, and likelihood of encountering the threat are all valid planning concerns that should be considered when developing program requirements. If the cost/benefit analysis favors one approach, then acknowledge the cost in the program description and move forward. But if the extra cost of additional protection does not justify a joint approach, look to separate the program. Either way, documentation of the decision process is of great importance. Often in military development programs, the justification for one problem becomes gospel for future programs, without an understanding of the original thought process.

Notes

1. Ken Alibek, *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World—Told from Inside by the Man Who Ran It* (New York: Random House, 1999).

2. BASIS and BioWatch were developed by the DOE/NNSA, and JBAIDS is based on dry filter technology adapted to meet an urgent needs statement, combined with PCR detection systems developed by the DoD medical community.

3. Non-persistent agents evaporate rapidly and exist mainly as a gas that moves with the airflow and dissipates relatively quickly. Respiratory protection is the main line of defense against these agents, and they produce little to no residual hazard that would require long-term protective equipment or extensive decontamination after the agent has dissipated.

4. In this case, the category of biological weapons excludes toxins and (theoretical) engineered agents.

5. Time, cost, and materials will be greater when the solution must counter all threats. Such requirements can exclude existing commercial capabilities that are acceptable to meet one threat, but do not meet all the requirements imposed by inclusion of all threats.

6. As noted previously, one of the latest decontamination programs under development is taking a "system of systems" approach, and may result in multiple solutions, each tailored to face a specific set of circumstances.

7. This scenario assumes a wind speed of six miles per hour.

8. This is not to imply that research into faster, more sensitive detection should not be pursued. However, until such technology is demonstrated to work in a field environment, with low false alarm rates, and the capability to provide a benefit to a significant portion of the base, alternative detection strategies may be the most logical approach.

9. Lois M. Joellenbeck, Jane S. Durch, and Leslie Z. Benet, eds., *Giving Full Measure to Countermeasures: Addressing Problems in the DoD Program to Develop Medical Countermeasures Against Biological Warfare Agents* (Washington DC: The National Academies Press, 2004).

10. W. Seth Carus, *Defining "Weapons of Mass Destruction"* (Washington DC: National Defense University Press, 2006).

11. The entire document need not be written outside the military, but highly technical areas, or those open to interpretation, would benefit from an external assessment.

APPENDIX

Additional Information

List of military chemical detection equipment[1]

Equipment	Agent	Sensitivity	Time	Cost	Operations/ Maintenance/ Limits	Notes
M-8 Paper *Liquids only*	Nerve-G	100–µ drops	≤30 sec	$1 per book of 25 sheets	Disposable/ hand-held Dry, undamaged paper has indefinite shelf life	Chemical agent detector paper 25 sheets/ book and 50 booklets/box Potential for false positives
	Nerve-VX	100–µ drops				
	Mustard-H	100–µ drops				
M-9 Paper *Liquids only*	Nerve-G	100–µ drops	≤20 sec	$5 per 10-m roll	Disposable/ hand-held 3-year shelf life Carcinogen	Adhesive-backed dispenser roll or books
	Nerve-VX	100–µ drops				
	Mustard-H	100–µ drops				
M-18A2 Detector Kit *Liquid, vapor, aerosol*	Nerve-GB	0.1 mg/m^3	2–3 min	$360	Disposable tubes Hand-held	25 tests per kit Detector tubes, detector tickets, and M-8
	Nerve-VX	0.1 mg/m^3				
	Mustard-H, HN, HD, HT	0.5 mg/m^3				
	Lewisite-L, ED, MD	10.0 mg/m^3				
	Phosgene-CG	12.0 mg/m^3				
	Blood-AC	8.0 mg/m^3				

Equipment	Agent	Sensitivity	Time	Cost	Operations/ Maintenance/ Limits	Notes
M-256A1 Detector Kit *Vapor or liquid*	Nerve-G and VX	0.005 mg/m^3	15 min Series is longer AC— 25 min	$140	Disposable Hand-held 5-year shelf life	Each kit contains 12 disposable plastic sampler-detectors and M-8 paper.
	Mustard-HD	0.02 mg/m^3				
	Lewisite-L	2.0 mg/m^3				
	Phosgene oxime-CX	9.0 mg/m^3				
	Blood-AC, CK	3.0 mg/m^3				
		8.0 mg/m^3				
M-272 Water Test Kit	Nerve-G and VX	0.02 mg/1	7 min	$189	Portable/ lightweight 5-year shelf life USN, USMC	Used to test raw or treated water Type I and II detector tubes Eel enzyme detector tickets Kit conducts 25 tests for each agent
	Mustard-HD	2.0 mg/1	7 min			
	Lewisite	2.0 mg/1	7 min			
	Hydrogen cyanide	2.0 mg/1	6 min			
CAM Chemical Agent Monitor *Vapor only*	Nerve-GA, GB, VX	0.03 mg/m^3	30 sec	$7,500	Hand-held/ portable Battery operated 6–8 hours continuous use Maintenance required	Radioactive source False alarms to perfume, exhaust, paint, additives to diesel fuel
	Blister-HD and HN	0.1 mg/m^3	≤1 min			
ICAM Improved Chemical Agent Detector	Nerve-G and V	0.03 mg/m^3	10 sec	$7,500	4.5 pounds Minimal training	Alarm only False positives common
	Mustard-HD	0.1 mg/m^3	10 sec			

Equipment	Agent	Sensitivity	Time	Cost	Operations/ Maintenance/ Limits	Notes
ICAM-APD Improved Chemical Agent Detector—Advanced Point Detector	Nerve-G	0.1 mg/m^3	30 sec	$15,000	12 pounds including batteries Low maintenance Minimal training	Audible and visual alarm
	Nerve-V	0.04 mg/m^3	30 sec			
	Mustard-H	2.0 mg/m^3	10 sec			
	Lewisite-L	2.0 mg/m^3	10 sec			
ICAD Miniature Chemical Agent Detector	Nerve-G	0.2–0.5 mg/m^3	2 min (30 sec for high levels)	$2,800	8 oz pocket-mounted 4 months service No maintenance Minimal training	Audible and visual alarm Marines No radioactivity
	Mustard-HD	10 mg/m^3				
	Lewisite-C	10 mg/m^3				
	Cyanide-AC, CK	50 mg/m^3	2 min			
	Phosgene-CG	25 mg/m^3	15 sec			
M-90 D1A Chemical Agent Detector *Vapor only*	Nerve-G,V	0.02 mg/m^3	10 sec	$16,000	15 lb. with battery Radioactive source exempt from licensing Minimal training	Ion mobility spectroscopy and metal conductivity technology can monitor up to 30 chemicals in parallel Alarm only
	Mustard	0.2 mg/m^3	10 sec			
	Lewisite	0.8 mg/m^3	80 sec			
	Blood	N/A				
M-8A1 Alarm Automatic Chemical Agent Alarm *Vapor only*	Nerve-GA, GB, GD	0.2 mg/m^3	≤2 min	$2,555	Vehicle battery operated Maintenance required	Radioactive source (license required) Automatic unattended operation Remote placement
	Nerve-VX	0.4 mg/m^3	≤2 min			
	Mustard-HD	10 mg/m^3	≤2 min			

Equipment	Agent	Sensitivity	Time	Cost	Operations/ Maintenance/ Limits	Notes
MM-1 Mobile Mass Spectrometry Gas Chroma-tograph *Vapor*	20–30 CWA	‹10 mg/m^2 of surface area	$\le$45 sec	$300,000 military $100,000 civilian	Heater volatizes surface contaminants	German "Fuchs" (FOX Recon System/Vehicle)
RSCAAL M-21 *Vapor*	Nerve-G	90 mg/m^3		$110,000	Line-of-sight dependent 10 year shelf life 2-person portable tripod	Passive infrared energy detector 3 miles Visual/audible warning from 400 meters
	Mustard-H	2,300 mg/m^3				
	Lewisite-L	500 mg/m^3				
SAW Mini-CAD *Vapor*	Nerve-GB	1.0 mg/m^3	1 min	$5,500	Minimal training Field use 1 pound No calibration	Alarm only False alarms from gasoline vapor, glass cleaner
	Nerve-GD	0.12 mg/m^3	1 min			
	Mustard-HD	0.6 mg/m^3	1 min			
ACADA (XM22) *Vapor*	Nerve-G	0.1 mg/m^3	30 sec	$8,000	Vehicle mounted, battery powered Radioactive source (license required) Minimal training	Audible alarm Bargraph display—low, high, very high.
	Mustard-HD	2 mg/m^3	30 sec			
	Lewisite	—	—			
Field Mini-CAMS	Nerve-G, V	‹0.0001 mg/m^3	‹5 min	$34,000	Designed for field Industry monitoring (10 lb.) 8 hours training 24 hour/7 day operations	Plug-in modules increase versatility Threshold lower than AEL
	Mustard-H	‹0.003 mg/m^3	‹5 min			
	Lewisite-L	‹0.003 mg/m^3	‹5 min			

Equipment	Agent	Sensitivity	Time	Cost	Operations/ Maintenance/ Limits	Notes
Viking Spectratrak GC/MS	Nerve-G, V	‹0.0001 mg/m^3	‹10 min	$100,000	Field use, but 85 pounds Needs 120v AC, helium 40 hours training	Lab quality analysis Library of 62,000 chemical signatures.
	Mustard-HD	‹0.003 mg/m^3	‹10 min			
	Many others					
HP 6890 GC with flame photometric detector	Nerve-G, V	‹0.0001 mg/m^3	‹10 min	$50,000	Not designed for field use Gas, air, 220v AC 40 hours training	State-of-the-art gas chroma-tograph Used by CWC treaty lab
	Mustard-HD	‹0.0006 mg/m^3	‹10 min			
	Many others					

Additional References of Combined CW/BW Documents

• **1951**—A DoD directive addressing chemical and biological warfare readiness made ten references to chemical and biological weapons as a single entity when discussing topics such as logistics, employment, munitions, testing, etc. This same document only once referred to chemical agents and biological agents as separate weapons.[2]

• **1952**—A memo to the Secretary of Defense referencing chemical and biological warfare readiness directed services to “achieve both CW and BW readiness with at least one good weapon system in the hands of the operating forces.”[3]

• **1955**—The Air Force identified the need for facilities to test “BW-CW munitions.”[4]

• **1958**—The Chief Chemical Officer discussed biological agents as “CBR capability.”[5]

• **1953**—An Air Force Memo from the "BW-CW" division referenced a plan to evaluate previous Army "BW-CW" work.[6]

• **1960**—A U.S. Army report to Congress combined chemical, biological, and radiological agents as "CBR," and placed them together under the category of "toxic" warfare.[7] This report never once differentiated between the weapons, even combining them at a strategic level, stating that "if CBR is to be considered a deterrent force in the U.S. arsenal of weapons, the program of research and advocacy here will have to be accompanied by an adequate program of manufacture and deployment of CBR munitions."

• **1962**—The Joint Chiefs of Staff combined chemical and biological weapons as one subject when addressing offensive plans, defensive capabilities, testing, and service requirements.[8]

Examples of 1950s Chemical Detection Parameters

- A disposable G agent detector with the following requirements:[9]
  - "instantaneous" detection via color change
  - extremely small, lightweight detection device
  - simple instructions
- Requirements for a standoff G-Agent detector:[10]
  - automated, instantaneous detection of G agents
  - scan path of half a mile to five miles
  - small, transportable, low power, easy to operate
- Air Force 1954 requirements list for a chemical detector:[11]
  - "a means of rapid detection of hazardous concentration of toxic airborne chemical warfare agents"

- "an ability to determine the identity of the agent at the time of detection is desirable"
- "sufficiently rapid in detection ability to enable enactment of warning and protective measures prior to any marked increase in airborne CW hazard"

Examples of 1950s Biological Detection Parameters

A 1954 Air Force detector request specifically stated the need "to provide sufficient warning of the appearance of toxic (CW and BW) agents to permit activation of protective measures before widespread exposure of personnel occurs."[12] The specific requirements for biological weapons detection were almost identical to requirements for the above-listed chemical detector:

- "rapid detection of hazardous concentrations of airborne anti-personnel biological warfare agents"
- "sufficiently rapid in detection ability to enable enactment of warning and protective measures prior to any marked increase in the BW hazard"
- identify the agent at the time of detection

Notes

1. National Research Council, *Chemical and Biological Terrorism: Research and Development to Improve Civilian Medical Response* (Washington, DC: The National Academies Press, 1999).

2. R. Lovett, "Department of Defense Directive 200.01-ITS," 21 December 1951, accessed 29 July 2011 from U.S. Department of Energy OpenNet, https://www.osti.gov/opennet/index.jsp.

3. C. E. Hutchin to the Secretary of Defense, memorandum, “Chemical and Biological Warfare Readiness,” 25 April 1952, accessed from The National Security Archive, http://nsarchive.gwu.edu/radiation/dir/mstreet/commeet/meet4/brief4.gfr/tab_l/br4l1d.txt.

4. Ibid.

5. U.S. Army Chemical Corps Historical Office. “Summary of Major Events and Problems, FY 1958,” March 1959, accessed 14 July 2011 from Federation of American Scientists, http://www.fas.org/cw/cwc_archive/CW_history/1959_majorevents&problems.pdf.

6. F. Seller to All Branch Chiefs, memorandum, “Study of RDB Report,” 6 April 1953.

7. *Pamphlet 3-2: Research in CBR* (Washington, DC: Department of the Army, 1960).

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