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BOOK REVIEW

Exploiting the Challenges to Bioweapons Development

Barriers to Bioweapons: The Challenges of Expertise and Organization for Weapons Development, Sonia Ben Ouagrham-Gormley, Cornell University Press, 2014. 220 pages, $39.95.

ABSTRACT
Widespread and often exaggerated generalizations about the global spread weapons of mass destruction (WMDs) have proven to be not only misleading and technologically naïve, but also unhelpful in formulating effective policies to counter their threat. The new book by George Mason University's Sonia Ben Ouagrham-Gormley dispels the popular narrative that governments and terror groups can easily—and inevitably will—develop WMDs, particularly biological weapons, by exploring the complex external and internal conditions that such programs require, as demonstrated by the Cold War-era biological weapon programs of the superpowers. This empirically grounded and realistic assessment of how states try—and often fail—to develop such programs offers a more reliable basis to craft realistic counterproliferation policies that can elicit international support.

KEYWORDS
Biological weapons; biosecurity; proliferation; terrorism; Soviet Union

In the song "Who's Next?," satirical songwriter and Massachusetts Institute of Technology mathematician Tom Lehrer depicts a sudden onset of nuclear proliferation following China's first nuclear test. The song describes a virtual nuclear "domino effect" in which one state after another acquires "the bomb" to counter acquisition by a rival. It concludes with this verse:

> Luxembourg is next to go
> And (who knows?) maybe Monaco.
> We'll try to stay serene and calm
> When Alabama gets the bomb.
>
> [Chorus]:
> Who's next?
> Who's next?
> Who's next?

Fortunately, the kind of rapid and spontaneous nuclear proliferation caricatured by Lehrer is only a satirical fantasy and his exaggerated notions have no basis in reality. Or do they? Judging from some of the hyperbole surrounding recent debates about Iran, including dire prognostications about imminent nuclear breakout sweeping the Middle East from Doha to Riyadh, perhaps one shouldn't be so sure.

The acquisition of nuclear, biological, and chemical weapons by a growing number of states has replaced superpower conflict as the pre-eminent catastrophic security threat of the twenty-first century. The post-9/11, post-Iraq-War international environment has incited widespread speculation about the spread of weapons of mass destruction (WMD) programs that oftentimes is severely out of sync with empirical reality. "The number of countries that are developing nuclear, chemical and biological weapons of mass destruction is growing," warned then-Secretary of Defense Donald Rumsfeld in 2001, going on to stress his particular concern about "the number of ballistic missiles on the face of the Earth and the number of countries possessing them (that) is growing as well."[1] The forces of globalization, Rumsfeld stressed, virtually guaranteed a rapid diffusion of WMD capabilities, especially to the states that came to comprise the George W. Bush administration's "axis of evil:" North Korea, Iran, and Iraq.

Luckily, Rumsfeld was exaggerating, as he himself might have acknowledged, had he paid attention to available intelligence pointing to the relatively slow and sporadic pace of global WMD proliferation, both then and now. Many alarmist predictions promulgated during the Bill Clinton and George W. Bush administrations have proved manifestly inaccurate, including quasi-official studies such as the 1998 commission report on the worldwide ballistic missile threat to the United States (chaired by Rumsfeld) that erroneously predicted multiple states acquiring nuclear or biologically armed intercontinental range ballistic missiles within five to ten years.[2]

The logic of inexorable, escalating global proliferation has so far proven to be not only historically misleading but technologically naïve and damaging to policy formulation. Without minimizing the seriousness of real risks, leading analysts like Stanford University's Scott Sagan have demonstrated that there is nothing linear or uniform about the strategies driving states' nuclear decisions; and indeed that, compared to previous decades, fewer rather than more states currently have nuclear ambitions.[3] Understanding states' actual motivations and dynamics tends to be a far better foundation for devising strategies to dissuade or prevent proliferation than unexamined, sweeping assumptions. But because states and even non-state actors enjoy greater access to specialized weapons technology and knowledge in the current international technology market, there is a widespread perception that governments and terror groups have already acquired—or will invariably successfully develop—WMD technologies to maximum effect. Such generalizations may have domestic political appeal, but they tend to undermine the analytical foundations for understanding—let alone trying to influence—what actually drives international behavior.

Sonia Ben Ouagrham-Gormley's excellent book, *Barriers to Bioweapons*, is a welcome antidote to this blizzard of empirically unhinged and unhelpful opinion. She provides a detailed account of the evolution of the US and Soviet biological weapon (BW) programs that makes an original contribution to the historical and technical literature, drawing on interviews with Russian and American scientists and newly declassified archival work to offer invaluable insights into these highly protected programs. More importantly, Ben Ouagrham-Gormley's book is a fascinating study of the phenomenology of scientific knowledge, providing a compelling analysis of how knowledge is acquired, developed, transmitted, and, at the same time, diluted or lost as a result of organizational, social, economic, political, and ultimately very human factors that vary widely within countries and over time.

The central contribution of Ben Ouagrham-Gormley's work is her detailed assessment of the mix of complex variables that account for scientific success. Her book asks fundamental questions about the external and internal conditions required to create a research environment that supports scientific endeavors and encourages tangible breakthroughs—in this case, for an effective, usable biological weapon capability. What kinds of research conditions best support the development of a successful product that will work as designed? What can we learn from these experiences that might apply to future experimental weapon programs—or their prevention? These questions are especially important for an enterprise that involves the military application of volatile, fragile, and potentially extremely dangerous materials—like bio-organisms—that also are very susceptible to their environment, as well as human error.

It was commonly assumed during the Cold War that an authoritarian society like the Soviet Union would enjoy special advantages in mounting programs to develop special weapons capabilities, including those that involved poorly understood, controversial, and difficult-to-handle materials like bio-organisms. By their very nature, BW programs require closely guarded and controlled conditions and the observance of strict secrecy. In addition to its ability (and inclination) to enforce draconian rules about access and disclosure, the Soviet government could draw on its centralized power to marshal human and material resources for BW research without much regard to cost or political opprobrium. And indeed, Soviet BW programs, relative to those in the United States, enjoyed a higher level of investment in facilities and support for research and development while emphasizing rapid progress toward effective product development. Together, these factors would seem to have guaranteed the Soviet Union a far greater chance of success in achieving significant BW capabilities.

This assumption is not supported by the performance of Soviet scientists, according to Ben Ouagrham-Gormley, for reasons that are not readily discernible by measuring the level of investment or relative priority accorded by the Soviet government to its BW program. Forced to work in highly compartmentalized environments with little opportunity for interaction with other scientists—not even inside their own labs, let alone more widely—Soviet BW researchers' creativity and ability to innovate was stifled to a point of dysfunction, and to the direct detriment of innovation and potential scientific advances. The presence of political overseers, including members of the KGB, who reported on the scientists' progress to political authorities, added to the chilling effect on scientific enterprise, impeding effective knowledge transmission, and crippling morale. The instances in which individuals felt pressured to falsify results in the interest of personal or program survival only further undercut or slowed progress.[4] Some scientists revealed that they sacrificed scientific judgment in order to follow directives, even when they knew in advance that the work would fail. It was only when the government eased certain restrictions to allow scientists to communicate more openly—select instances in which an effort was needed to push forward an innovation or increase production—that measurable success rates improved.

Ben Ouagrham-Gormley's analysis of how internal organizational, political, and other social factors can affect the success or failure of a complex technical enterprise is particularly strong in her description of the importance of *tacit* knowledge, as distinct from various forms of explicit or instrumental knowledge. Tacit knowledge refers to the kind of implicit understanding individuals acquire through common experience about what is needed to solve problems and overcome obstacles. Tacit knowledge by definition cannot be communicated or transferred through written or verbal instruction, much as it is not possible to teach someone how to ride a bicycle with the use of a manual. It requires regular interaction and direct experience with others involved with similar problems and problem solving. Ben Ouagrham-Gormley demonstrates through her case analysis how the degree of access by researchers to tacit knowledge also influenced the effective transmission and relative utility of more explicit knowledge, thereby advancing or hindering overall scientific progress.

In the Soviet experience, the overwhelming preoccupation with secrecy precluded the effective transfer or application of tacit knowledge, since it would have required wider and more open collaboration among scientists both inside and outside of the specialized, classified programs. The organizational culture of the US program, by contrast, allowed for broad and routine interaction among scientists, including with academics and nonspecialists, in a way that encouraged all aspects of learning, critical thinking, and technical adaptation. This wasn't, however, always the case in the United States. In its early years, the US program suffered from an overly classified and constrained research environment, which led to problems similar to those that beset the centrally controlled efforts of the Soviet Union several years later.[5] Soviet programs did succeed in developing technical experts who compensated for their relative lack of creativity or freedom to innovate by becoming adept at integrating basic research into applied concepts and weapons development. Soviet scientists, endowed with considerable resources from the state, were directed to develop usable products as quickly as possible and did so without consideration to the ethics of biological research for military application, debates around which arguably mired their American peers.

The policy implications that follow from this excellent analytical work are clear and compelling. Efforts to control the proliferation of WMD—and BW in particular—would benefit from a deeper understanding and more accurate assessment of the many difficulties that even superpowers face in trying to develop biological agents for effective military use. The current, popular proliferation narrative—which has only intensified since the malicious use of anthrax spores in the immediate aftermath of 9/11—views the development and use of BW, not only as relatively easy to achieve, but as a plausible instrument for state or nonstate actors to advance their interests. These misconceptions neglect essential facts that Ben Ouagrham-Gormley's research demonstrates, particularly that there are many obstacles to the effective development of BW. These obstacles represent important weaknesses that international control efforts can target and exploit, including: inherent difficulties of acquiring the expertise needded to develop effective or usable systems; the tendency toward rapid attrition of knowledge when operating outside of a laboratory environment for any period of time; the immense operational difficulties and limited military utility of BW use on the battlefield; and the strong international norms that have developed in opposition to BW development and use.

Armed with a better and more nuanced understanding of both the internal and external factors that affected the success of BW programs, the international community could devise better ways to realistically stem BW proliferation. Such control efforts offer a more practical and realistic approach to blunting current and prospective threats, according to Ben Ouagrham-Gormley, than the current US preoccupation with developing advanced biodefenses—an elusive and expensive technological challenge. Much as the Rumsfeld Commission dramatically underestimated the obstacles and overestimated the risks of the proliferation of intercontinental ballistic missiles, partly as a way to encourage support for missile defenses, the quest for technological solutions to BW proliferation cannot be allowed to displace more achievable, near-term remedies that the international community could realistically support.

NOTES

1. Donald Rumsfeld, prepared testimony for the Senate Armed Services Committee, "Defense Strategy Review," 107th Cong., 1st sess., June 21, 2001.
2. As summarized in the unclassified report of the Commission to Assess the Ballistic Missile Threat to the United States (known as the Rumsfeld Commission), in 1988, the United States faced an imminent threat of intercontinental range ballistic missiles armed with biological or nuclear warheads from several states, including North Korea and Iran, within five years (and Iraq in ten years) from the time each state decided to undertake development, although the United States would have diminished or nonexistent intelligence warning about this threat.

For various reasons, including faulty analysis, these predictions have not come to fruition after seventeen years. *Report of the Commission to Assess the Ballistic Missile Threat to the United States,* July 15, 1988, <http://fas.org/irp/threat/bm-threat.htm>.

3. Scott D. Sagan, "Why Do States Build Nuclear Weapons: Three Models in Search of a Bomb," *International Security* 21 (Winter, 1996–97), pp. 54–86.
4. The instances of falsification are revealing and suggest an implicit parallel to certain Western defense programs in which performance results are said to be skewed or exaggerated in response to the pressures of unrealistic political expectations, such as US efforts to develop ballistic missile defenses. Political interference impedes genuine scientific discovery across a variety of contexts, not just authoritarian states.
5. In 1941, the United States first undertook feasibility studies on a potential offensive bioweapon program, though, according to Ben Ouagrham-Gormley, "actual offensive work […] did not commence until the fall of 1943, when construction of the first research buildings at Fort Detrick—the program's central facility—was completed." President Richard M. Nixon terminated the US bioweapons program in 1969.

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