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Seth Baum's proposal has been understood as naïve and misguided by several academics and experts working in disarmament and has been subject to sustained criticism. They claim that Baum's thought experiment relies on a grossly oversimplified understanding of the nature of, and relationship between, biological and nuclear security.

Historically, faith in nuclear deterrence has contributed to the decision of at least one state to limit its biological weapon aspirations.<sup>1</sup> However, this does not mean that the international norm against biological weapons is, or should be, subservient to the nuclear disarmament challenge. Indeed, as Nicholas Sims notes in making this point, from a disarmament perspective it is the nuclear sector which lags behind the international biological and chemical weapon treaties.<sup>2</sup> Furthermore, analysis of historical programmes as well as contemporary assessments of biological weapons clearly points to the conclusion that biological weapons are neither strategically, technically or ethically suitable replacements for existing nuclear stockpiles. This means that Dr Baum's approach is in no way reconcilable with the understandings of those who have critiqued his work publicly. As I have noted previously, Baum's tentative hypothesis is not convincing enough to overturn the major canons of biological disarmament. Furthermore, it would be misguided to invest time and effort assessing this particular policy programme, in both ethical and practical terms.<sup>3</sup>

The key value of Baum's academic thought experiment has been that the paper has stimulated reflection on the reasons why biological weapons are not, and should not be, part of today's military arsenals. Such a discussion is important, as in recent years the question of 'why' biological weapons are prohibited has often taken a backseat to the distinct question of 'how' biological weapons are prohibited. It is apparent, for example, that the emergence of concerns about terrorism since 2001 has contributed to further stigmatization of biological weapons, which has meant that less emphasis has been placed on the need for reflection upon why all forms of biological weaponry are prohibited. There are of course a wide range of reasons why such prohibitions continue, which go beyond those immediately elicited by Baum's proposal. With this in mind, I want to take the opportunity afforded by this symposium to outline two key approaches to arguing against Baum's proposal.

The first approach, which I refer to as the 'modular' approach, accepts, for the purposes of argument, the initial terms of the deal proposed by Baum. In this approach arguments about the desirability of biological weapons are reduced to technical discussions about their suitability as a strategic deterrent weapon in terms of ascribed intrinsic qualities. In the papers by Gregory Koblenz and Martin Furmanski for example, several characteristics are identified which make biological weapons unsuitable as a 'like for like' replacement of nuclear weapons as a strategic deterrent.<sup>4</sup> This includes unpredictability, the existence of defences against biological weapons and the untested nature of such weapons. However, relying exclusively on such an approach would allow a number of misguided assumptions within the proposal to go unchallenged. This risks framing the debate in terms of the immediate utility of biological weapons in a specific scenario, to the neglect of reflecting on the unintended consequences of pursuing the development of such weapons as well as the political feasibility of pursuing this option. It is these concerns which form the basis of the second approach to arguing against Baum's proposal, which I refer to as the 'false dichotomy' approach. This approach challenges more fundamental assumptions about the world in which nuclear weapons exist in, pointing to the unintended consequences of Dr Baum's proposal.

The first unintended consequences relate to the rolling-back the 1972 Biological Weapons Convention. This would be entirely necessary if biological weapons were to be developed and stockpiled as a strategic deterrent by states. This would open the door for other states to pursue such capabilities, and have impacts upon other disarmament treaties. Such a situation would potentially lead to numerous states, including states which are currently non-nuclear, to pursue programmes which would destabilize international security and pose grave risks to

public safety. One needs only to look at the available historical safety records of the secret offensive programmes involving weaponized agents,<sup>5</sup> and indeed even much more recent biodefense and public health work, to be convinced that the development of such weapons, anywhere, would raise significant risks. Added to this, as has also been noted by Furmanski, such development would likely be understood to necessitate secretive research involving humans.<sup>6</sup>

In relation to the issue of political feasibility, it would appear that Dr Baum's piece suffers from a fundamental internal inconsistency. This is because the motivation for his paper appears to be a concern that states ignore the massive, low probability and unintended consequences of maintaining existing nuclear stockpiles. Yet, his paper amounts to an argument that states, such as the US, should pursue a policy, based on assumed long-term gains, which would raise a host of more immediate and tangible risks to their own national safety and security. These issues have already been discussed at length, and I will not go into them here. It is worth noting however, that offensive programmes would also require huge financial resources. For example, it has been estimated that the Soviet Union invested over USD 35 billion into its offensive programme between 1972 and 1992.<sup>7</sup> Although this programme covered a wide range of projects, it is indicative of the type of costs associated with such programmes by one superpower. There is of course also a real potential for arms races to develop in terms of offensive and defensive work which would justify further significant and sustained investment by states involved. If a small nuclear arsenal was to be maintained alongside this capacity, as Baum maintains, it would seem that little of this cost could be offset against cutbacks on nuclear spending. In contrast, the Organisation for the Prohibition of Chemical Weapons, an international body with a verification system, has an annual budget less than USD 100 million.<sup>8</sup> Arms control must be a cheaper alternative. Further to this, Baum's argument that it is worth reflecting on and assessing the feasibility of such a strategy also suffers from the same inconsistency, as it is essentially a call for further, and by necessity, secretive research by states into the viability of biological weapons as strategic deterrents which would straddle the distinction between offensive and defensive biological research. Some of this work would carry with it the type of security and safety implications just discussed. It makes little sense then for states to take such a gamble in order to address the unprovable claim that such actions could potentially avert a catastrophe that they do not fully comprehend.<sup>9</sup>

Our time would be much better served in finding other ways to challenge the prevailing wisdom, institutions and political systems which propagate the maintenance of such sizeable arsenals. Indeed, as stated by a colleague recently in response to the debate, this is political software as well as a military hardware issue.<sup>10</sup>

1. Brian Balmer, *Britain and Biological Warfare: Expert Advice and Science Policy, 1930–65* (London: Palgrave, 2001); and Nicholas Roger Alan Sims, *The Future of Biological Disarmament: Strengthening the Treaty Ban on Weapons* (London: Routledge, 2009), p. 186.

2. Sims, *The Future of Biological Disarmament*, p. 18.

3. Brett Edwards, 'The "False Allure" of Biological Weapons Deterrence', *Bulletin of the Atomic Scientists*, March 2015.

4. Gregory Koblentz, 'The Myth of Biological Weapons as the Poor man's Atomic Bomb', *Bulletin of the Atomic Scientists*, March 2015; Martin Furmanski, 'Bringing a Knife to a Gunfight: Biological Weapons as Deterrents in a Nuclear-Armed World', *ibid.*

5. See, for example, Ken Alibek and Stephen Handelman, *Biohazard* (New York: Random House, 2008).

6. Martin Furmanski, 'Testing Bioweapons: The Catch-22', *Bulletin of the Atomic Scientists*, March 2015.

7. Sonia Ben Ouagrham-Gormley, *Barriers to Bioweapons: The Challenges of Expertise and Organization for Weapon Development* (New York: Cornell University Press, 2014), p. 35.
8. In 2015 the annual budget was approximately USD 77.9 million.
9. Something which Baum has himself noted. See Seth D. Baum, 'Winter-Safe Deterrence: The Risk of Nuclear Winter and Its Challenge to Deterrence', *Contemporary Security Policy*, Vol. 36, No. 1 (2 January 2015), p. 124.
10. Sascha Sauerteig, 'Winter-Safe Deterrence and the Problem of Hardware and Software', *Biochemical Security 2030 Project*, March 2015.