CENTRAL INTELLIGENCE AGENCY DIRECTORATE OF INTELLIGENCE

The Darker Bioweapons Future

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A panel of life science experts convened for the Strategic Assessments Group by the National Academy of Sciences concluded that advances in biotechnology, coupled with the difficulty in detecting nefarious biological activity, have the potential to create a much more dangerous biological warfare (BW) threat. The panel noted:

- The effects of some of these engineered biological agents could be worse than any disease known to man.

- The genomic revolution is pushing biotechnology into an explosive growth phase. Panelists asserted that the resulting wave front of knowledge will evolve rapidly and be so broad, complex, and widely available to the public that traditional intelligence means for monitoring WMD development could prove inadequate to deal with the threat from these advanced biological weapons.

- Detection of related activities, particularly the development of novel bioengineered pathogens, will depend increasingly on more specific human intelligence and, argued panelists, will necessitate a closer—and perhaps qualitatively different—working relationship between the intelligence and biological sciences communities.

The Threat From Advanced BW

In the last several decades, the world has witnessed a knowledge explosion in the life sciences based on an understanding of genes and how they work. According to panel members, practical applications of this new and burgeoning knowledge base will accelerate dramatically and unpredictably:

- As one expert remarked: "In the life sciences, we now are where information technology was in the 1960s; more than any other science, it will revolutionize the 21st century."

Growing understanding of the complex biochemical pathways that underlie life processes has the potential to enable a class of new, more virulent biological agents engineered to attack distinct biochemical pathways and elicit specific effects, claimed panel members. The same science that may cure some of our worst diseases could be used to create the world's most frightening weapons.

The know-how to develop some of these weapons already exists. For example:

- Australian researchers recently inadvertently showed that the virulence of mousepox virus can be significantly enhanced by the incorporation of a standard immunoregulator gene, a technique that could be applied to other naturally occurring pathogens such as anthrax or smallpox, greatly increasing their lethality.

- Indeed, other biologists have synthesized a key smallpox viral protein and shown its effectiveness in blocking critical aspects of the human immune response.

- A team of biologists recently created a polio virus *in vitro* from scratch.

According to the scientists convened, other classes of unconventional pathogens that may arise over the next decade and beyond include binary BW agents that only become effective when two components are combined (a particularly insidious example would be a mild pathogen that when combined with its antidote becomes virulent); "designer" BW agents created to be antibiotic resistant or to evade an immune response; weaponized gene therapy vectors that effect permanent change in the victim's genetic makeup; or a "stealth" virus, which could lie dormant inside the

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victim for an extended period before *being* triggered. For example, one panelist cited the possibility of a stealth virus attack that could cripple a large portion of people in their forties with severe arthritis, concealing its hostile origin and leaving a country with massive health and economic problems.

According to experts, the biotechnology underlying the development of advanced biological agents is likely to advance very rapidly, causing a diverse and elusive threat spectrum. The resulting diversity of new BW agents could enable such a broad range of attack scenarios that it would be virtually impossible to anticipate and defend against, they say. As a result, there could be a considerable lag time in developing effective biodefense measures.

However, effective countermeasures, once developed, could be leveraged against a range of BW agents, asserted attendees, citing current research aimed at developing protocols for augmenting common elements of the body's response to disease, rather than treating individual diseases. Such treatments could strengthen our defense against attacks by ABW agents.

Implications for Warning

The experts emphasized that, because the processes, techniques, equipment and know-how needed for advanced bio agent development are dual use, it will be extremely difficult to distinguish between legitimate biological research activities and production of advanced BW agents.

- The panel contrasted the difficulty of detecting advanced bioweapons with that of detecting nuclear weapons, which has always had clear surveillance and detection "observables," such as highly enriched uranium or telltale production equipment.

Consequently, most panelists argued that a qualitatively different relationship between the government and life sciences communities might be needed to most effectively grapple with the future BW threat.

They cited the pace, breadth, and volume of the evolving bioscience knowledge base, coupled with its dual-use nature and the fact that most is publicly available via electronic means and very hard to track, as the driving forces for enhanced cooperation. Most panelists agreed that the US life sciences research community was more or less "over its Vietnam-era distrust" of the national security establishment and would be open to more collaboration.

- One possibility, they argued, might be early government assistance to life sciences community efforts to develop its own "standards and norms" intended to differentiate between "legitimate" and "illegitimate" research, efforts recently initiated by the US biological sciences community.

- A more comprehensive vision articulated by one panelist was for the bioscience community at large to aid the government by acting as "a living sensor web"—at international conferences, in university labs, and through informal networks—to identify and alert it to new technical advances with weaponization potential. The workshop did not discuss the legal or regulatory implications of any such changes.