

Statement of Work

The National Academies of Sciences, Engineering, and Medicine has established a Standing Committee on Biotechnology Capabilities and National Security Needs, which uniquely has focused on advances at the nexus of the life sciences and other disciplines and their applications and simultaneous risks to U.S. national security. This standing committee is associated with an ad hoc consensus study committee, who are cleared and provide consensus findings, conclusions and recommendations for the national security community to leverage and/or remain vigilant against adversary use of advanced biotechnologies. During the first two years of the Standing Committee's existence, the National Academies identified numerous research and technology development activities of potential interest to the national security community and ultimately selected four to look at in greater detail. Unclassified workshops (two virtual and two hybrid) here held under the auspices of the standing committee on the following topics: biology-based communication and information transmission, emerging biological detection technologies including neurotechnologies, microbiome-gut-brain axis, and biohybrid and bioinspired materials. The associated ad hoc committee prepared two classified consensus reports, one on biology-based communication and information transmission and a second on biohybrid and bioinspired materials and microbiome-gut-brain axis. Discussions that took place at the four unclassified, public workshops were captured in publicly accessible proceedings-in-brief.

The National Security Commission on Emerging Biotechnology seeks to build on the National Academies' standing and ad hoc committees' work to inform its work streams on horizon scanning of biotechnologies and risk assessment and mitigation. Specifically, the National Security Commission on Emerging Biotechnology requests the National Academies address the following topics under the auspices of the Standing Committee on Biotechnology Capabilities and National Security Needs and associated ad hoc consensus study Committee on Biotechnology Capabilities for National Security Needs.

- Enduring capability for identifying and assessing over-the-horizon biotechnology development.
- Innovative approach to evaluating traditional and non-traditional applications of emerging biotechnologies.
- Successful methods for communicating national security needs and requirements to industry and academia
- Exemplars of effective and ineffective regulatory processes enabling biotechnology transfer between government and commercial entities.

The committees will use AI/ML and experimental/laboratory automation in biotechnology research and development as specific examples as they discuss the more expansive topics.

Standing Committee on Biotechnology Capabilities and National Security Needs

Within its current statement of task (included below), Standing Committee on Biotechnology Capabilities and National Security Needs will:

- Meet bi-monthly to discuss biotechnology developments, specifically focusing on advances from interdisciplinary research and development with the life sciences and other disciplines (i.e., at the fringes of biotechnology research and development)
- Conduct a workshop to:
 - The applicability of AI/ML and automated experimentation for biotechnology discovery and development for various applications, including health and medicine, food and agriculture, industrial materials and chemicals, environmental remediation, and energy production for defense.
 - Opportunities for using AI/ML and experimental/laboratory automation to prevent misuse of biotechnology. This topic will include, but not be limited to current examples

- of value, which involves screening novel biotechnologies and products for their dual-use applications, and encrypting or otherwise protecting sensitive data.
- Identify methodologies, information sources, and data that effectively and reliably can forecast biotechnology developments by the United States and its competitors and adversaries. The developments should focus on AI/ML and automated laboratories for biotechnology research and development, and highlight current and anticipated future capability gaps.
 - Discuss approaches for identifying and tracking opportunities for driving innovation, including technical, financial, policy, and other similar types of drivers.
 - Discuss approaches for identifying inaccuracies in science and technology materials (e.g., literature, patents, pre-print publications, conference presentations) that might change assessments of the biotechnology trends and potential.
 - Discuss existing domestic and international methodologies for assessing the costs and benefits of investing or not investing in development and adoption of emerging technologies for national security. These methodologies may be used for biotechnology or other technologies where elements of the analyses can be translated to biotechnology.
- Prepare a Proceedings-in-Brief summarizing the key themes resulting from the workshop discussions. This Proceedings-in-Brief will undergo peer review according to National Academies' policies and practices, and be published on the National Academies Press website.
 - Conduct a series of meetings of experts to discuss the following topics. Transcripts from each meeting will be provided to the National Security Commission on Emerging Biotechnology.
 - Discuss the feasibility of developing a research and development network in the United States that drives biotechnology innovation through the combined application of AI/ML, automation, and biology; b) development and securing of large volumes of high-quality data sets that can support AI/ML for biotechnology defense innovation; and c) examples wherein the government communicated its needs and specific requirements clearly and effectively, or ineffectively.
 - Future defense capabilities, as forecasted by the Defense Department, that could be achieved through innovative biotechnologies.
 - Understand the sufficiency of regulatory processes that allow transition of defense-specific biotechnology products and services to different sectors (specifically, focusing on decoupling and subsequently transferring technologies to industry for commercialization) using AI/ML, automated laboratories, and biotechnology research.

Standing Committee Statement of Task

The National Academies of Sciences, Engineering, and Medicine will establish a standing committee that will convene meetings and workshops as mechanisms to enable the national security community to identify advanced biotechnology capabilities of particular interest, discuss potential barriers or challenges to adoption, and build partnerships between the national security stakeholders and biotechnology experts across a variety of sectors and fields. This group will provide opportunities for ongoing discussion between national security officials, biotechnology experts, and funders from a variety of organizational sectors, scientific disciplines, and fields. Any related products from workshops or other activities would be generated by separate, ad hoc committees. Specifically, the standing committee explores:

- The applicability of commercially available or advanced biotechnologies and life science research for addressing current or anticipated needs of different U.S. national security agencies.
- Practical or operational factors (e.g., workforce, infrastructure, policy/governance, and security considerations) needed to enable technology transition to agency use.
- Early-stage biotechnology and life science research that demonstrate promising scientific or technical capabilities for addressing national security needs.
- The innovation ecosystem needed to translate early-stage research into practical application.

Committee on Biotechnology Capabilities for National Security Needs

The ad hoc consensus study Committee on Biotechnology Capabilities for National Security Needs statement of task will be revised to provide specific recommendations to the National Security Commission on Emerging Biotechnology. The updated statement of task is included here:

Ad hoc consensus committee statement of task

The National Academies of Sciences, Engineering, and Medicine will convene an ad hoc study Committee on Biotechnology Capabilities for National Security Needs, which is associated with the Standing Committee on Biotechnology Capabilities and National Security Needs, to produce a brief unclassified consensus report and brief, classified addendum highlighting specific actions for:

- The applicability of AI/ML and automated experimentation for biotechnology discovery and development for various applications, including health and medicine, food and agriculture, industrial materials and chemicals, environmental remediation, and energy production for defense.
- The feasibility of developing a research and development network in the United States that drives biotechnology innovation through the combined application of AI/ML, automation, and biology; b) development and securing of large volumes of high-quality data sets that can support AI/ML for biotechnology defense innovation; and c) examples wherein the government communicated its needs and specific requirements clearly and effectively, or ineffectively.
- Future defense capabilities, as forecasted by the Defense Department, that could be achieved through innovative biotechnologies.
- Opportunities for using AI/ML and experimental/laboratory automation to prevent misuse of biotechnology.
- Practical or operational factors (e.g., expertise, infrastructure, laboratory capacity, data sources, computing infrastructure, and policy/governance) needed to enable investments needed to reach the goal of a nationwide network research hubs wherein highly innovative research and development on AI/ML, automation, and biotechnology tools are conducted to address defense problems.

The ad hoc study committee will build on the work from the Standing Committee, which will explore related topics in a series of convenings (e.g., workshop and meetings of experts). The ad hoc study committee's report will focus on artificial intelligence and experimental/laboratory automation in biotechnology research.