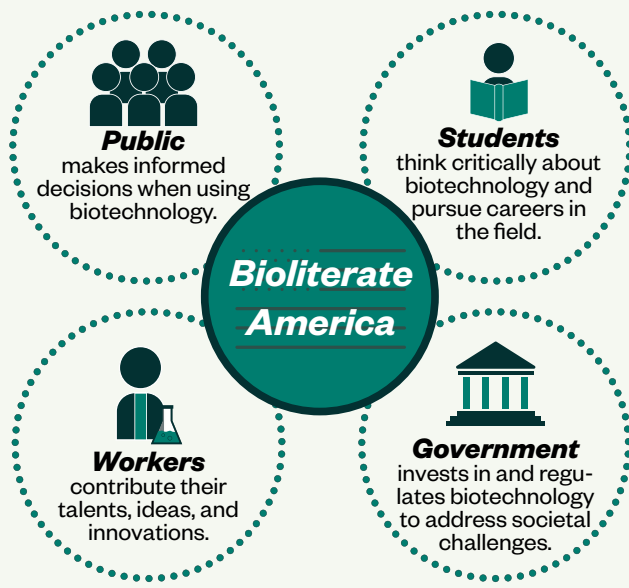


## What is bioliteracy?

*“Bioliteracy” is the concept of imbuing people, personnel, or teams with an understanding of — and ability to engage with — biology and biotechnology. The Commission believes that all Americans—including policymakers in the U.S. Government, students at all levels of education, current and future biotechnology workers, and the broader public—should one day be as comfortable using and engaging with biotechnology in the same way that they do with computers and software in their daily lives and within society.*



## Bioliteracy is vital for Americans

Many of us already use and consume products and applications created with biotechnology in our everyday lives: life-saving medicines, nutritious foods, as well as bio-based alternatives for clothing, plastics, and detergents. A bioliterate citizenry is the next step in being able to take advantage of the potential to use biotechnology intentionally and innovatively.

Bioliterate citizens are equipped with knowledge and confidence to engage with new concepts as biotechnology advances, and to deploy biotechnology solutions to enrich their lives. Additionally, as biotechnology opens doors to yet-to-be-known opportunities and risks, bioliteracy provides foundational knowledge for citizens to act respon-

sibly as stewards of an emerging technology. Increased bioliteracy across all segments of the population will help Americans realize the potential of a robust U.S. biotechnology ecosystem that maximizes the promises of biotechnology for the benefit of all citizens.

## NSCEB's vision for a bio-ready U.S. Government and a bioliterate America

Bioliteracy gives American citizens the knowledge and skills to participate in and contribute to an increasingly technology-driven society and economy. In our **December 2023 Interim Report**,<sup>1</sup> the Commission outlines two main priorities for bioliteracy:

- Promote biotechnology education to increase bioliteracy and bolster the biotechnology workforce.
- Improve the bioliteracy of the U.S. Government workforce.

The next biotechnology innovation that will revolutionize the world will likely come from a student who was once inspired by biology in the classroom or laboratory. Biotechnology education lays the foundation for bioliteracy—promoting understanding of fundamental biology principles, developing critical thinking skills to interpret the new concepts and advances in biotechnology, and inspiring curiosity and lifelong learning. Education in biotechnology should not only include concepts and technical skills but also an understanding of how biotechnology could be deployed within our society and its potential for misuse. Widespread bioliteracy can be built by promoting biology and biotechnology education at all levels (K-12, undergraduate, and postgraduate) and creating accessible pathways to broad participation from diverse groups.

Education and bioliteracy are stepping stones for success in biotechnology careers. Education enables a pipeline of skilled workers to fill jobs within a growing U.S. biotechnology industry and economy by 1) promoting awareness of biotechnology careers and developing talent within future workers, and 2) equipping the current biotechnology workforce with necessary skills and qualifications to keep up with advances in biotechnology. Education and bioliteracy help sustain a robust biotechnology industry and economy with individuals who contribute their talents, ideas, and innovations.

As seen with AI, emerging technologies are advancing more rapidly than governments can regulate and legislate. Biotechnology is no different. The U.S. Government is a prime target for bioliteracy development. For example, policymakers who develop the laws and rules to govern biotechnology should understand the fundamental principles of how biotechnology functions. Bioliterate policymakers can more effectively develop laws and rules to govern biotechnology and make informed decisions about which biotechnology innovations receive government support and funding. In addition, strengthening bioliteracy within the Federal workforce can enable a bio-ready U.S. Government to act decisively to protect American citizens in the face of biological incidents and emergencies (e.g., outbreaks involving infectious pathogens, bioterrorism); to effectively forecast and harness biotechnology solutions to address national and global challenges; and to expand opportunities for widespread participation in the U.S.'s biotechnology industry.

We have entered the age of biology. We stand at the edge of a transformative biotechnological revolution, one that could yield countless innovations and bring advanced manufacturing to every part of America. The Commission envisions a near future in which biotechnology is widely understood as a growing technological field and students, workers, and citizens are more commonly equipped with a baseline understanding of the science behind it. A bioliterate society would be empowered to make educated decisions about biotechnology products and applications, to participate in the biotechnology industry and economy, and to seek biotechnology solutions to meet societal challenges in this new era.

## **Bioliteracy in action across the United States**

Different groups and organizations across our country are driving bioliteracy efforts and expanding access to biology education, tools, and resources for the public, students, and workers. We see bioliteracy in action in workforce education centers, community workspaces, virtual classrooms, mobile biology labs and others. Some examples are below:

The **International Genetically Engineered Machine (iGEM)** competition, run by the U.S. non-profit organization iGEM Foundation, has been the driver of creating the synthetic biology community by attracting students and others from over 60 countries to compete on interdisciplinary teams. Since its inception in 2004, iGEM has trained over 75,000 participants and generated over 4,000 projects

that serve as proofs of concept in biotechnology innovation.<sup>2</sup>

**InnovATEBIO National Biotechnology Education Center** advances education of highly skilled technicians for the nation's biotechnology workforce. InnovATEBIO encompasses a national network for biotechnology workforce education that includes 134 college programs across 39 states, including Puerto Rico. The Center offers 38 biotech-related degrees and certificates in biotechnology and biomanufacturing.<sup>3</sup>

**BioBuilder** is a non-profit that offers open source, free curricula to provide hands-on experiences in synthetic biology, empowering teachers and schools to better serve students and employers. Since 2011, BioBuilder has grown to partner with schools in almost every state, and around the world.<sup>4</sup>

The non-profit **National Education Equity Lab**, with support from Stanford Digital Education, offers an *Introduction to Bioengineering* online course to Title I high schools to enable low-income students across the country to learn about bioengineering. In 2023, the course was offered to 10 Title I high schools in California, Colorado, Florida, New York, and South Carolina.<sup>5</sup>

**BioBus** helps K-12 and college students in New York City access biology, with a focus on students underrepresented in the scientific community due to factors such as race, gender, economic status, and physical access. Since 2008, BioBus's mobile labs have reached more than 900 schools and community organizations primarily in NYC public and charter schools and in New England.<sup>6</sup>

## **Sources**

- 1 National Security Commission on Emerging Biotechnology Interim Report. <https://www.biotech.senate.gov/press-releases/interim-report/>
- 2 International Genetically Engineered Machine. <https://igem.org/>
- 3 InnovATEBIO. <https://innovatebio.org/about>
- 4 BioBuilder. <https://biobuilder.org/>
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For any questions about this white paper, or the bioliteracy work at the National Security Commission on Emerging Biotechnology, please contact us at [ideas@biotech.senate.gov](mailto:ideas@biotech.senate.gov).

Staff at the National Security Commission on Emerging Biotechnology authored this paper with input from the expert Commissioners. The content and recommendations of this white paper do not necessarily represent positions officially adopted by the Commission.

