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Commission on Science and Technology (CSTD)
Topic 2: Emerging Biotech Regulation and Open-Access Science
YUNMUN XXXVII

Recent breakthroughs in synthetic biology, molecular design, and gene-editing tools like CRISPR-Cas9 have radically reshaped the field of life sciences, lowering the financial and technical barriers to manipulating and optimizing genetic material. Democratizing access to biological tools has accelerated research in personalized oncology, crop resilience, and target disease eradication through gene drives. However, this accessibility significantly increases global biosecurity risks. The proliferation of low-cost gene synthesis services and accessible cloud laboratories makes it significantly easier to engineer biological materials outside traditional, high-containment university or governmental facilities.[1]

The democratization of science simultaneously introduces serious bio-engineering threats, ranging from unintended ecological disruption to the deliberate synthesis of deadly pathogens. Artificial intelligence models trained on protein structures, such as AlphaFold, let researchers predict and design molecular structures with high precision, but these same tools can also be used to engineer toxic compounds that bypass standard biosecurity detection algorithms.[2] Traditional oversight mechanisms, which rely on institutional biosafety committees and voluntary provider screening of DNA orders, struggle to keep pace with decentralized biohacking communities, international mail-order genetic material, and open-source genomic databases. These risks demonstrate the need for stronger, targeted biosecurity regulations that establish consistent safety standards without unnecessarily limiting legitimate scientific research or public access to non-hazardous biological information.

Compounding these safety concerns is patent hoarding and market consolidation by pharmaceutical monopolies. Aggressive intellectual property strategies surround core gene-editing systems, where academic institutions and corporate conglomerates engage in complex patent litigation to secure broad claims coverage over fundamental CRISPR technologies[3]. This legal fencing allows dominant pharmaceutical companies to impose

1 National Academies of Sciences, Engineering, and Medicine (NASEM), 2018
2 Urbina, F., Lentzos, F., Invernizzi, C., & Ekins, S. (2022), Nature Machine Intelligence
3 Sherkow, J. S. (2017). The CRISPR Patent Interference in Context. Nature Biotechnology
4 Convention on Biological Diversity (CBD), (2022). Digital Sequence Information on Genetic Resources and the Kunming-Montreal Global Biodiversity Framework.
5 Gene Synthesis Guidance (GDM), (2021). Standards for Provider Screening of Synthetic DNA Orders, Biosecurity Standards Working Group.

exorbitant licensing fees on small firms and public research initiatives, delaying the development of affordable diagnostics and gene therapies. Lower-income countries are often priced out of life-saving medical applications developed from biological sequence data originally sourced from their own native biodiversity, a practice often referred to as biopiracy.[4] Unlike biosecurity regulation, which is necessary to prevent biological harm, overly restrictive patent practices can limit competition, concentrate scientific resources in the hands of a few corporations, and prevent beneficial technologies from reaching the public. Addressing this problem therefore requires greater transparency in patent licensing, safeguards against anti-competitive practices, and fairer access to essential research tools, rather than removing all intellectual property protections.

To safeguard global public health while fostering scientific progress, international regulatory frameworks must balance security guardrails with equitable, open-access science. Establishing mandatory biosecurity screening protocols for all commercial gene-synthesis providers worldwide is a critical baseline step.[5] At the same time, global health agencies must champion open-access genomic repositories and equitable technology-transfer hubs, similar to the WHO's mRNA technology transfer program. Governments and international organizations should also encourage fair licensing agreements, support public-sector research, and strengthen competition policies to prevent pharmaceutical companies from using patent control to obstruct affordable innovation. While biosecurity vulnerabilities and equitable access remain pressing challenges, various policy pathways exist, including open-science licensing models, strengthened international biological safety treaties, and flexible regulatory oversight. Ultimately, determining the optimal combination of solutions remains open to research and debate by delegates. By adopting these measures, the scientific community can mitigate dual-use biosecurity risks without foreclosing life-saving biomedical innovations for vulnerable populations.

To guide you in your research, please see the following questions to focus on:

- How can the international community address the potential misuse of AI-driven protein design and gene-editing tools while ensuring that these technologies remain accessible for beneficial applications in medicine, agriculture, and public health?

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- How can international genomic databases and open-access research initiatives promote scientific collaboration while simultaneously preventing the misuse of sensitive biological information and protecting the privacy of individuals whose genetic data is collected?
- How can the international community facilitate the affordable development and distribution of gene therapies, genetic diagnostics, and other biotechnology-based treatments, particularly in low- and middle-income countries?

Please remember to represent your country's position, not your own personal perspective, and to utilize legitimate, credible sources. Finally, when drafting your position papers, please follow YU's UG1 policy on the use of artificial intelligence: you may use AI to check and correct the grammar, vocabulary, spelling, and mechanics of text you have already written. AI may not generate, rewrite, or restructure your content.

If you have any questions, please don't hesitate to reach out! My email is elsamuel@mail.yu.edu.

Sincerely,

Eliana Samuels

Chair, Commission on Science and Technology for Development

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