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Using Biology for Communication and Information Transmission

Agenda
January 2022

A Virtual Workshop of
The Standing Committee on Biotechnology Capabilities and National Security Needs

ALL TIMES LISTED ARE IN EASTERN TIME. AGENDA MAY BE UPDATED WITH ADDITIONAL SPEAKERS AND SESSIONS

This workshop will explore cutting-edge biotechnologies and research for enabling new approaches for **communication and information transmission**. Speakers will explore new and emerging advances in and applications of these biotechnologies and research activities; the innovation ecosystem that is driving the research, development, and application of these technologies; and critical societal implications that must be considered in the adoption and translation of such biotechnologies. The speakers also will explore workforce needs, infrastructure, and policy and governance associated with development and use of the **biology-based information transmission and communication** research and technologies.

Session 1: Thursday, January 20, 1:00-2:30 PM ET

Biological Means of Information Transfer and Applications of Stored Data

- **Elliot Chaikof***, Harvard Medical School (moderator)
- **Yaniv Erlich**, Eleven Therapeutics
- **Pinar Zorlutuna**, University of Notre Dame
- **Mark Bathe**, Massachusetts Institute of Technology
- **Yevgeniy (Eugene) Vorobeychik**, Washington University in St. Louis
- **Nicholas Evans**, University of Massachusetts Lowell

Session 2: Friday, January 21, 2:30-4:00 PM ET

Molecular Communication and Computation and Biology's Impact on Information Science

- **Andrew Kilianski†**, IAVI (moderator)
- **Andrew Eckford**, York University
- **Ángel Goñi-Moreno**, Technical University of Madrid (UPM)
- **Urbashi Mitra**, University of Southern California
- **Nicholas Evans**, University of Massachusetts Lowell

* Member of the Standing Committee on Biotechnology Capabilities and National Security Needs and Workshop Planning Committee

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Discussion Questions:

1. What is the technology and what are the intended uses or applications of your work/technology?
2. Of those, which are traditional and which are the most “out of the box”?
3. What is the timeline to completion of these applications? What are the knowledge gaps or technical requirements that would affect these timelines?
4. If these new uses are successful, what are the potential ethical, legal, societal, and/or safety and security issues you might be facing or considering?
5. Are there essential workforce and infrastructure needs to achieve the applications?
6. Scenario question: If you had \$5 m over three years...what would you do with it?

Additional Discussion Questions for Consideration:

1. What is the maturity level of this research? Is this technology being used in any commercially available products?
2. What innovation in this space is happening in the private sector?
3. What practical or operational factors are needed to further advance this research and the application of this technology? (e.g. workforce needs, infrastructure, governance)
4. What legal, ethical, security, policy, safety, security, and other considerations should be considered with regards to this research and technology?
 - a. Are sufficient laws, regulations or policies in place to ensure that the technology preserves privacy of US citizens?
 - b. Are sufficient laws, regulations or policies in place to ensure that the technology is not misused by countries to violate human rights?
 - c. For the communications workshop: Are sufficient laws, regulations or policies in place to ensure that any military/intelligence use of the technology does not fall into the hands of adversarial countries?
5. What is the potential for ripple disruption, if two or more technologies are compounded or sequentially employed?
6. What would the future potential of this technology be? What are stepping stones required to reach that potential?
 - a. What else is needed? New materials? New basic biology understanding? New manufacturing capabilities?
 - b. What relevant limitations exists?
7. What is the current state of the technology vis-à-vis safety and reliability, robustness, resilience (capacity to absorb a disturbance whether through misuse, such as cyber-physical or otherwise), interoperability with legacy technology and ecosystems?
8. Landscape of markets and market potential for technologies
 - a. Commercial applications - different sectors too (transportation, health)
9. Map out the development, application, and deployment of your technology

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- a. What is the next innovation needed before your technology?
- b. What are the key technical barriers preventing commercialization of the technology?
- 10. Workforce needs - many emerging technologies require a combination of information tech/data/computational/etc and traditional wet lab/bio-based expertise. What is needed, how can this be advanced/etc.
 - a. Structural changes in training and engagement across sectors, fields in traditional training - how foster?
- 11. What are the intended uses or applications of your work/technology?
 - a. Of those, which are traditional and which are the most “out of the box”?
 - b. What is the timeline of these applications?
- 12. What steps do we perceive should be taken to implement a collective intelligence for the interdisciplinary collaboration that will be needed?
- 13. What are the potential/implications of generating integrated working platforms connecting the common skillsets that are identified as new career fields emerge?
- 14. What steps do we see will be needed to ensure equitable distribution of the innovations across the global research community?
- 15. What is the capability to translate biomedical into clinical applications that reduce health data disparities?
- 16. Has enough innovation occurred to indicate the changes STEM education needs to change to support the current and future innovation?
- 17. What are the possibilities of the DIY Science Community contributing to the overall discussion of biotech topics?
- 18. Does the innovation align such that diversity and equity in clinical considerations are accommodated earlier in the research process?