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THE FUTURE OF ENGINEERING BIOLOGY:

WHY WE MAY NOT GET THERE

Domitilla Del Vecchio, PhD

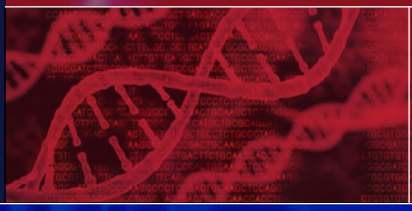
PROFESSOR OF MECHANICAL ENGINEERING

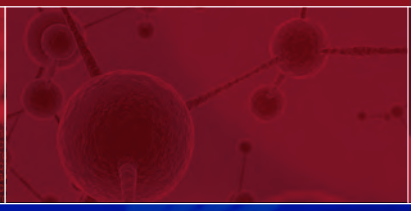
MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)

DATE
June 16th

TIME
11:00am - 12:00pm

VIEW ON
YouTube





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ABSTRACT

THE FUTURE OF ENGINEERING BIOLOGY: WHY WE MAY NOT GET THERE

About 20 years ago the first two human-made genetic circuits were built in living cells, demonstrating for the first time our ability to perform rational design with biological hardware. A new field was born, called “Synthetic Biology,” with a mind-blowing vision in which genetic circuits made of biomolecules could be automatically designed to achieve capabilities such as curing cancer, regenerating damaged tissue, bio-sensing, materials and energy production. Today, more than 20 years later, despite remarkable successes, we are still largely unable to engineer sophisticated genetic circuits that behave as intended. This is especially due to lack of robustness of human-made genetic circuits to changes in intra-and extra-cellular context. For example, although these circuits perform well in defined lab conditions, changes in nutrients, temperature or the simple activation of other cellular genetic components prevent them from functioning as intended. How can we then use such human-made genetic systems in real-world applications, where intra and extra-cellular conditions will vary unexpectedly? Only by achieving robustness.

In this talk, Del Vecchio will illustrate how systems and control theory, which has been instrumental to achieve robustness in traditional engineering systems like electronics, telecommunication, and aviation, can be adapted to tackle issues of robustness in engineering biology. The adaptation of control design techniques to the new physical domain of biology, however, is not straightforward and requires substantial re-thinking of existing approaches and often the development of new solutions. Although these solutions are promising and have demonstrated initial success, there are still many more problems related to a lack of robustness. The talk will thus conclude with an outlook on critical needs and potential solution avenues.

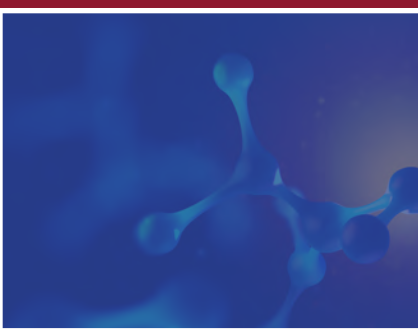
Domitilla Del Vecchio, PhD

PROFESSOR OF MECHANICAL ENGINEERING

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)

ABOUT THE SPEAKER

Domitilla Del Vecchio received her Ph.D. degree in Control and Dynamical Systems from the California Institute of Technology, Pasadena, and the Laurea degree in Electrical Engineering (Automation) from the University of Rome at Tor Vergata in 2005 and 1999, respectively. From 2006 to 2010, she was an Assistant Professor in the Department of Electrical Engineering and Computer Science and in the Center for Computational Medicine and Bioinformatics at the University of Michigan, Ann Arbor. In 2010, she joined the Department of Mechanical Engineering at the Massachusetts Institute of Technology (MIT), where she is currently Professor and member of the Synthetic Biology Center. She is an IEEE Fellow since 2021 and a recipient of several awards, including the Newton Award for Transformative Ideas during the COVID-19 Pandemic (2020), the 2016 Bose Research Award (MIT), the Donald P. Eckman Award from the American Automatic Control Council (2010), the NSF Career Award (2007), and the Bank of Italy Fellowship (2000). Her research focuses on developing techniques to make synthetic genetic circuits robust to context and on applying these approaches to biosensing and cell fate control for regenerative medicine applications.



ABOUT LECTURES | 2022

NSF Bioeconomy Coordinating Committee Distinguished Lecture Series

NSF invests in fundamental research to support biotechnology and advance the U.S. bioeconomy across all fields of science and engineering. Presented by NSF's Bioeconomy Coordinating Committee and NSF Directorates, this distinguished lecture series will bring in individual speakers and panels representing the science and technology funded by a Directorate every month. Speakers will present on research and broader impacts in areas associated with biotechnology and the bioeconomy that are of interest broadly across the foundation.

All sessions will be conducted virtually.

For more information, refer to the NSF Bioeconomy Distinguished Lecture Series **website** or contact **Jared Dashoff at jdashoff@nsf.gov**.

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