UNIVERSITY OF MINNESOTA

Minnesota Robotics Institute

ROB 8970 | **ROBOTICS COLLOQUIUM** | **FALL 2025**

Class Report – Lecture 10 (11/07/2025)

Speaker : Prof. Angela Panoskaltsis-Mortari

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Prof. Mortari talked about *3D Biofabrication: The Long and Winding Road*, and described how tissue engineering mixes biology and engineering. She started by comparing scientific and engineering mindsets using the "glass half full" analogy, then introduced 3D bioprinting as a form of 3D printing that uses biomaterials and living cells to build tissues, with goals such as patient-specific organs, disease models, and customized therapies. She showed examples of decellularized organs to explain how tissues retain their natural architecture even after cells are removed. One of the examples focused on recreating the gastroesophageal junction, where her team creates small aligned muscle units and assembles them into larger structures like real tissue, supported by a robotic arm that helps arrange these components into organ-shaped forms. The talk ended with a discussion of the interdisciplinary nature of biofabrication and the capabilities of UMN's 3D bioprinting facility.

Questions

- If we eventually succeed in building biofabricated organs, how would this change the way surgeons, engineers, and biologists work together in the future?
- As robotics students, what skills or backgrounds are most valuable if we want to contribute to 3D biofabrication research?

Comments

- The comparison between how scientists and engineers think about the same "glass of water" was a memorable way to frame tissue engineering.
- The visual examples of decellularized organs and spinning cell-laden fibers made the talk easier to understand.
- The collaboration across surgery, biology, materials, coding, and robotics highlighted how broad the field of biofabrication really is.

What I Liked

- I liked how the lecture followed a real medical problem from the biological challenge to the robotic fabrication approach.
- The demonstration of winding-based organ frames made the complex structure of muscle tissues easy to understand.

Areas for Improvement

- A brief timeline or roadmap for how far current trends are from animal or clinical testing would have helped place the work on the translational path.

Overall Assessment

This lecture gave a clear and interesting introduction to 3D biofabrication focusing on real clinical challenges. Prof. Mortari connected core biology with emerging fabrication strategies like wet-spun micro-tissues and robotically wound organ structures, showing how robotics and tissue engineering naturally overlap. The main takeaway was that while fully printed organs are still a long-term goal, current progress in fiber spinning and robotic winding offers practical ways toward clinically useful bioengineered tissues.