

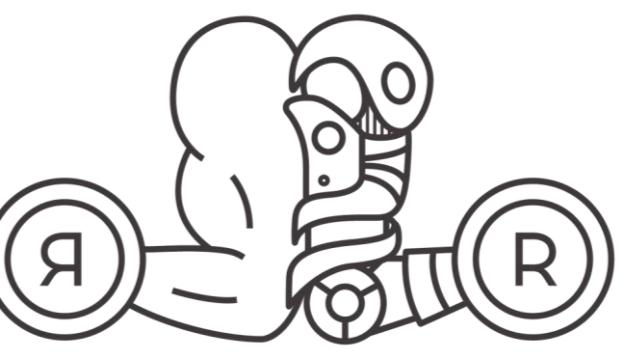
Manufacturing In vitro muscle sheets to test mobility-restoring therapies

MIT HEALS
MIT Health and Life Sciences Collaborative

MIT MECHE

Jasper Lee, Tamara Rossy, Prof. Ritu Raman

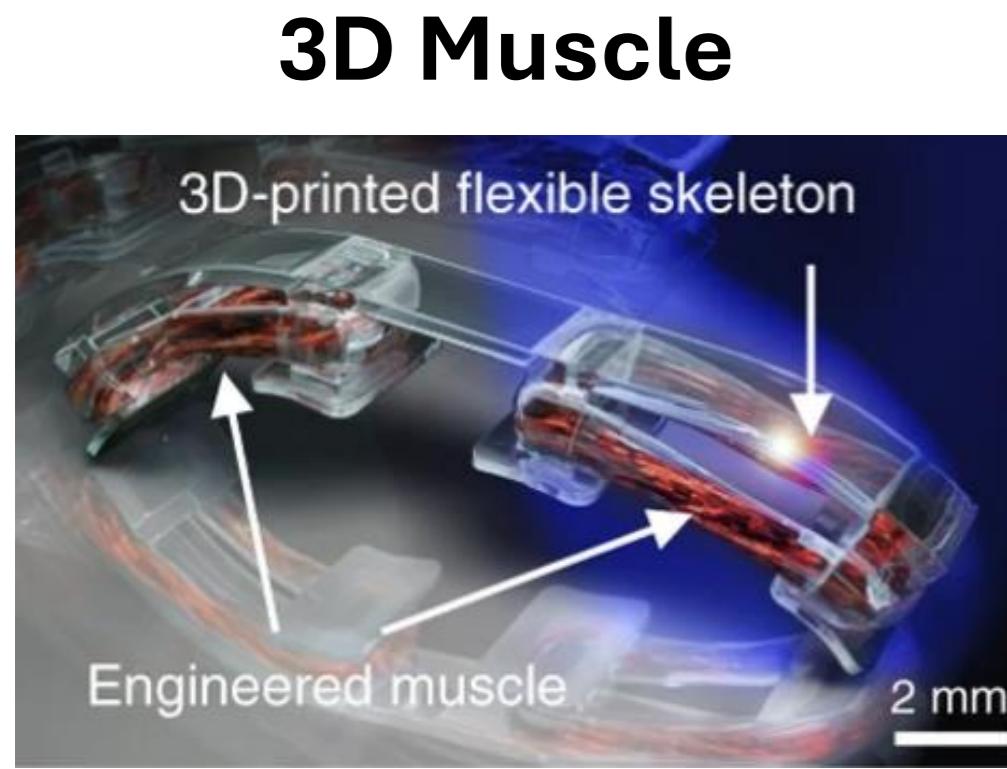
Raman Lab, Department of Mechanical Engineering | November 2025



SuperUROP

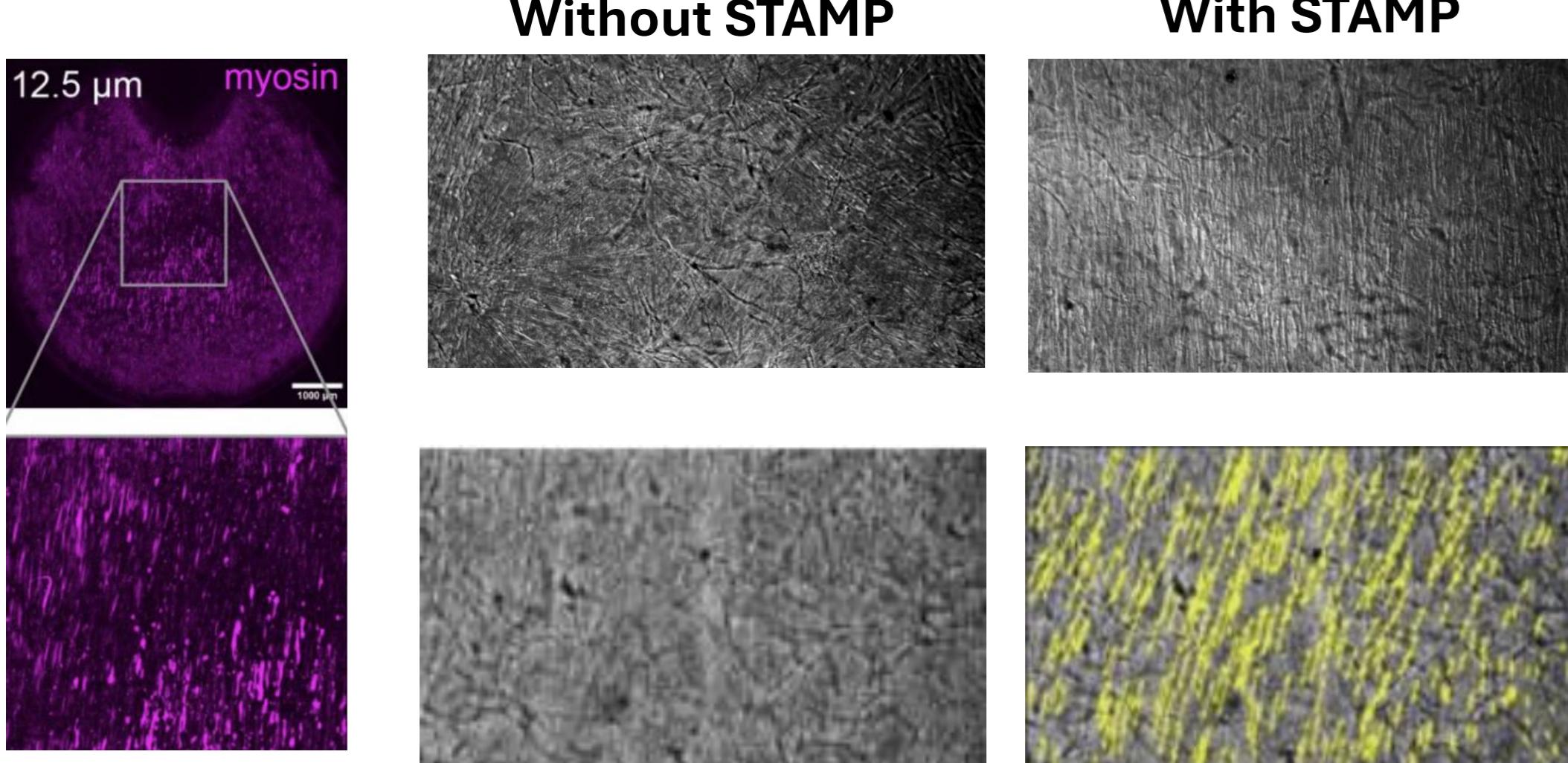
Advanced Undergraduate Research Opportunities Program

Background



Pros: 2D muscle is better-suited for **high-content imaging** and replication
Cons: 2D muscles suffer from **delamination** and **tears**

Raman Lab develops “**STAMP**” method to micro-topographically pattern hydrogel with grooves to **control cell alignment** and **contraction direction**

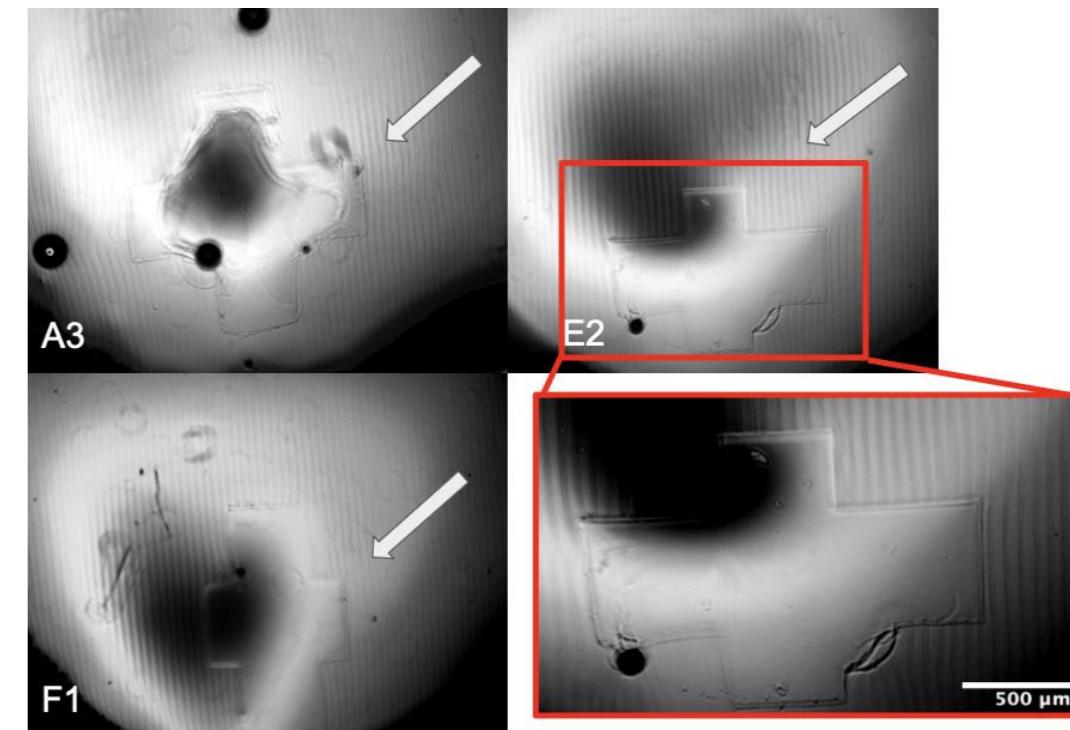
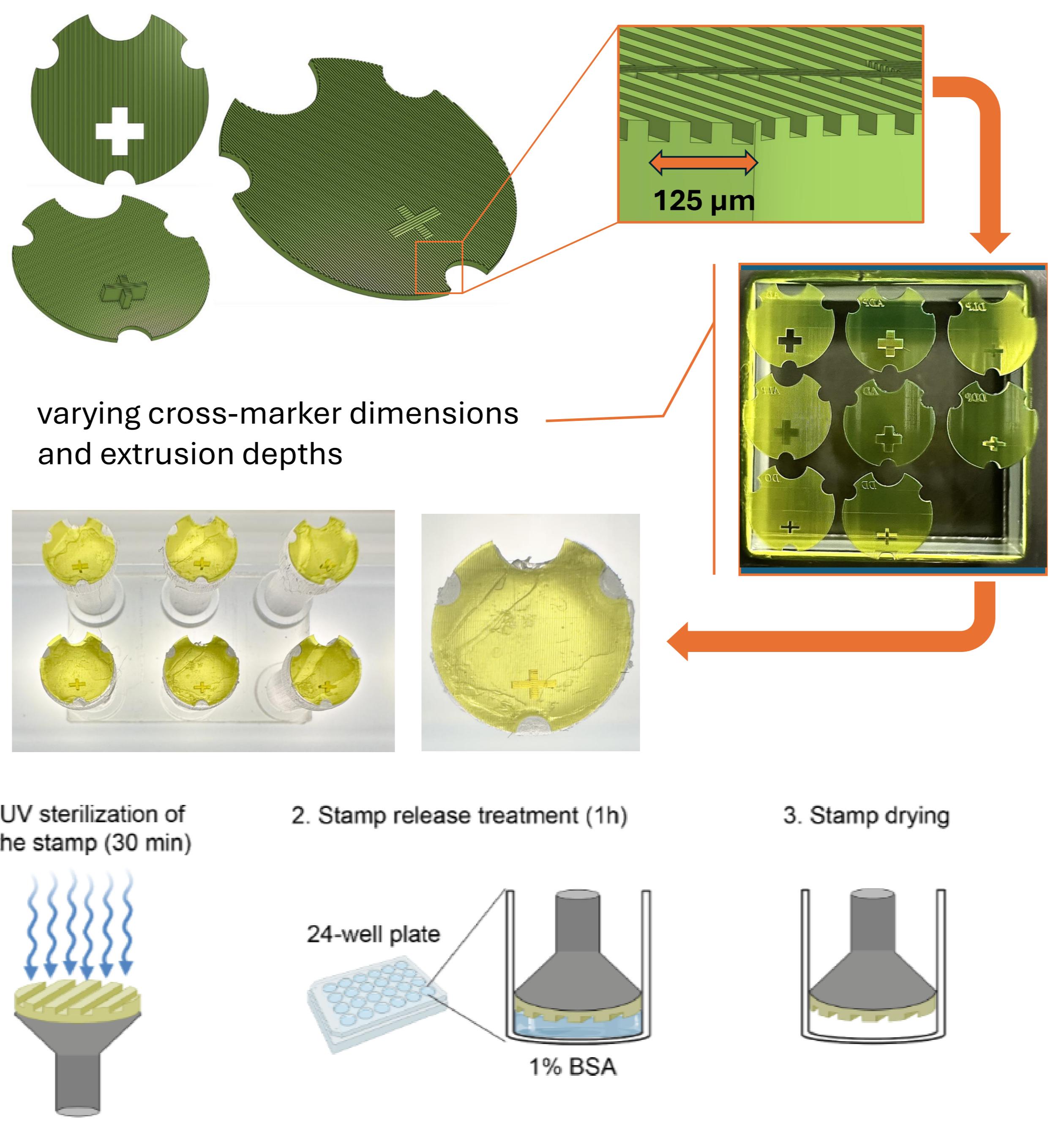


References

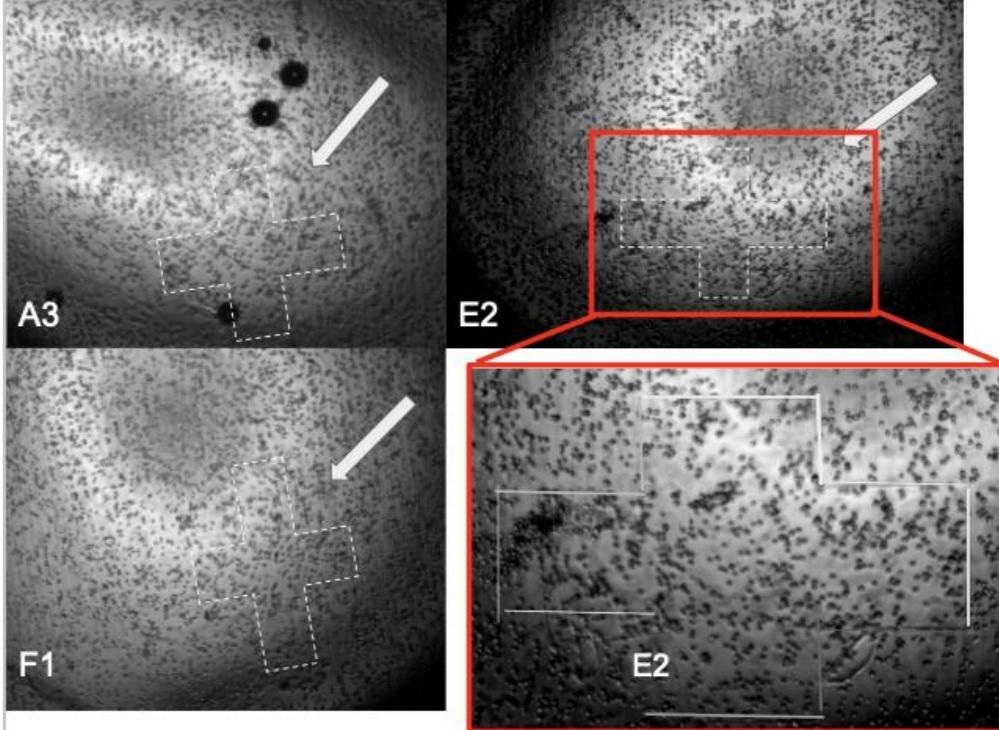
[1] Rossy, T., Schwendeman, L. et al. (2025). Leveraging microtopography to pattern multi-oriented muscle actuators. *Biomater. Sci.*, 13(11), 2891–2907

[2] Raman, R., Cvetkovic, C. & Bashir, R. A modular approach to the design, fabrication, and characterization of muscle-powered biological machines. *Nat Protoc* 12, 519–533 (2017)

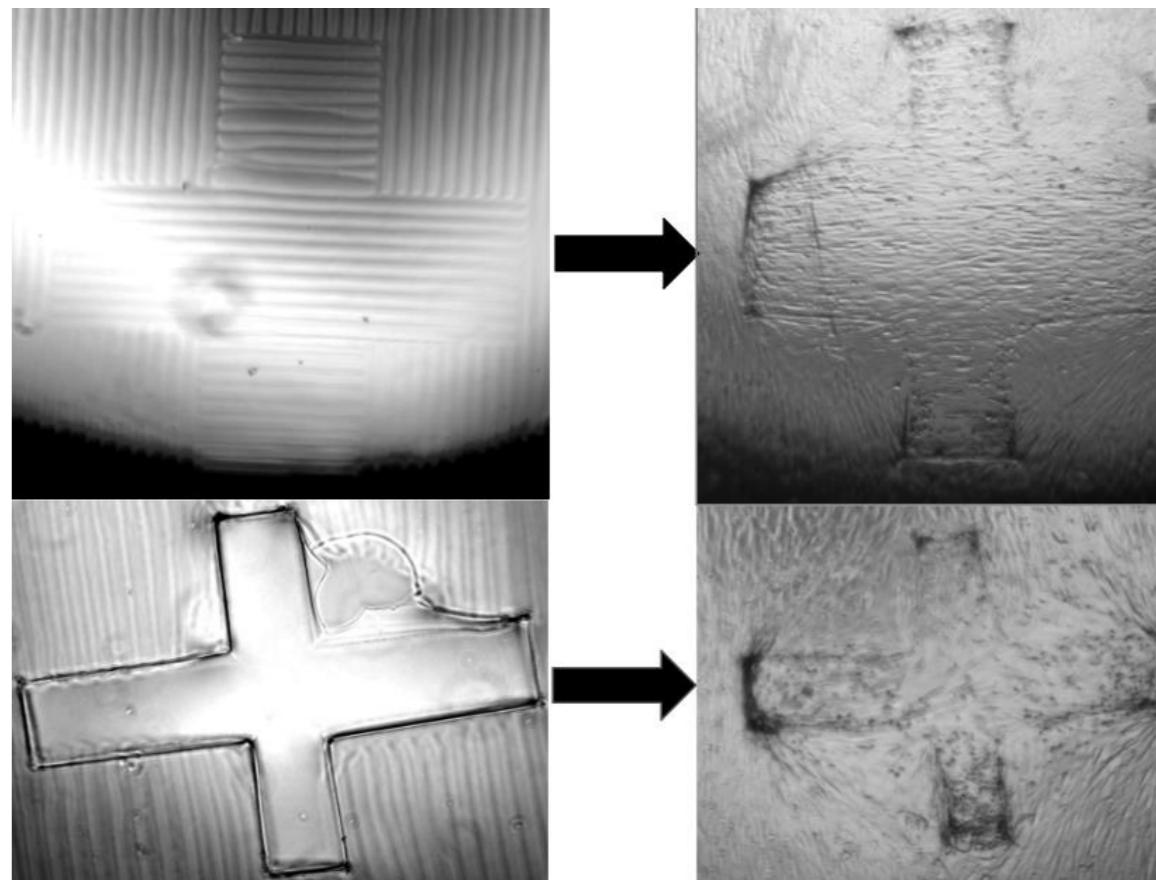
Design



Pre-cell seeding: Cross-markers are **clear** and feature **no distortions** in shape integrity



Post-cell-seeding: Cross-markers are very **faint** and are **ineffective**



Pre-cell seeding: Cross-markers are **clear** and feature **no distortions** in shape integrity

Post-cell seeding: Cross-markers are **clear** and feature **visible patterning**

Next Steps

1. **Scale** this process up to **96 STAMPS** to achieve more **reliable high-throughput** experimental data
2. **Streamline** the assembly **process** with an alignment “grid” and multi-channel pipettes
3. **Incorporate** drug **dosages** such as caffeine to the muscle sheets for **force readout** analysis

