CAREER: Adaptive Actuation and Control in Embodied Biohybrid Robots

PI: Victoria A. Webster-Wood, Carnegie Mellon University

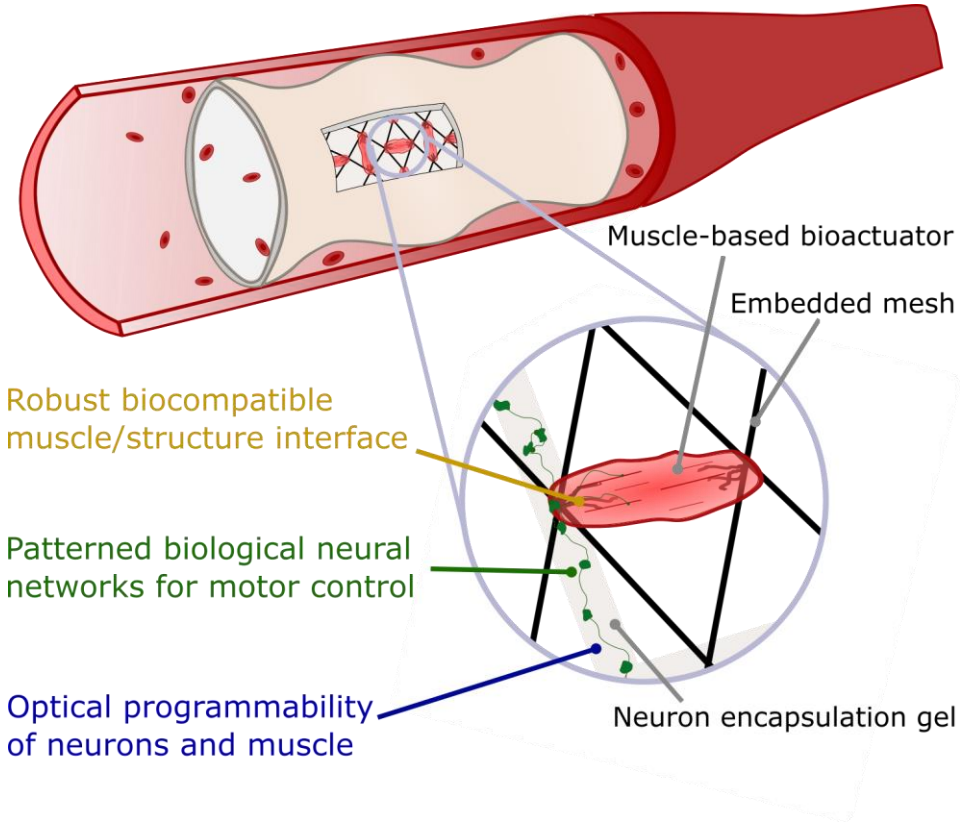
Award ID# FRR-2044785, Award Date April 1, 2021

Challenge

- Current bioactuators are limited to interfacing with soft or small-scale substrates
- Bioactuator stimulation approaches often result in low actuation forces and muscle fatigue

Solution

- Enable adaptive bioactuation of a wide range of robotic peripheries through embedded fiber-based interfaces
- Model and fabricate bioinspired biological neural networks for bioactuator motor control
- ‘Program’ integrated bioactuators and biological neural networks for robotic applications



CAREER: Adaptive Actuation and Control in Embodied Biohybrid Robots

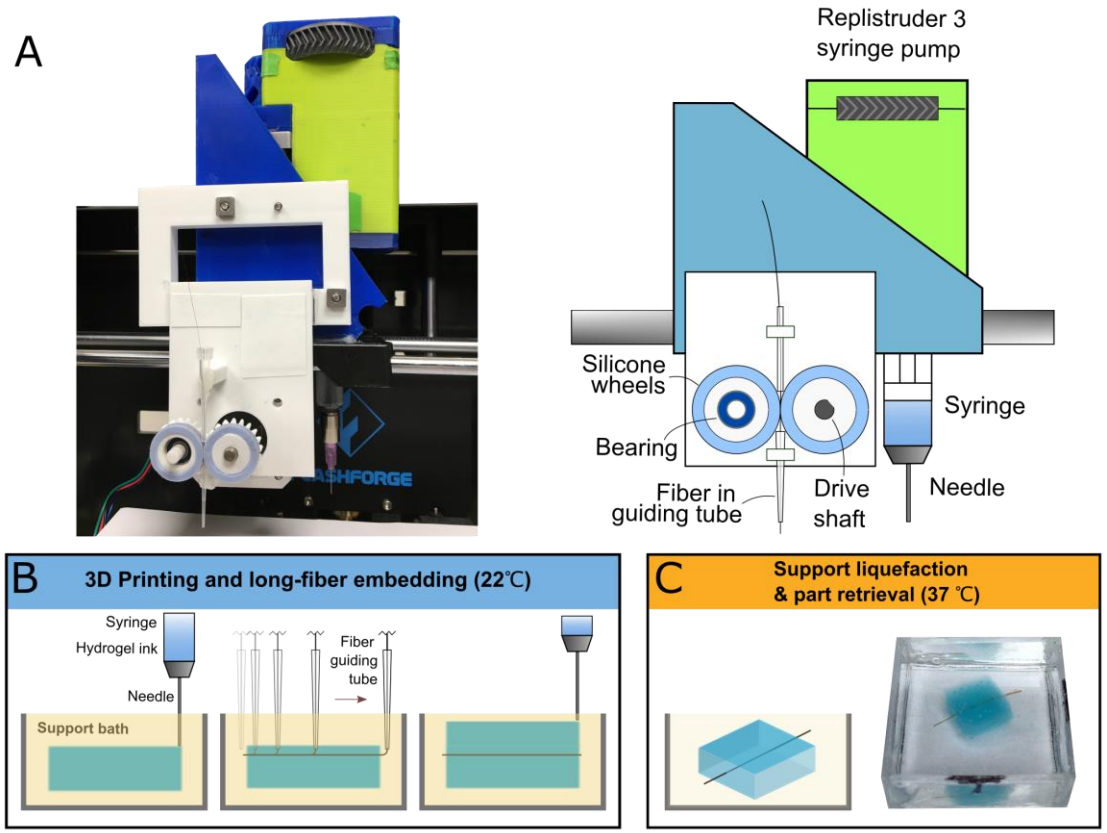
PI: Victoria A. Webster-Wood, Carnegie Mellon University

Award ID# FRR-2044785, Award Date April 1, 2021

Highlights

- Long fiber embedded FRESH printing for printing fiber based biocompatible interfaces

  W. Sun et al. ACS Biomaterials Science & Engineering. Dec. 2021.
  W. Sun et al. HardwareX. March 2022.



CAREER: Adaptive Actuation and Control in Embodied Biohybrid Robots

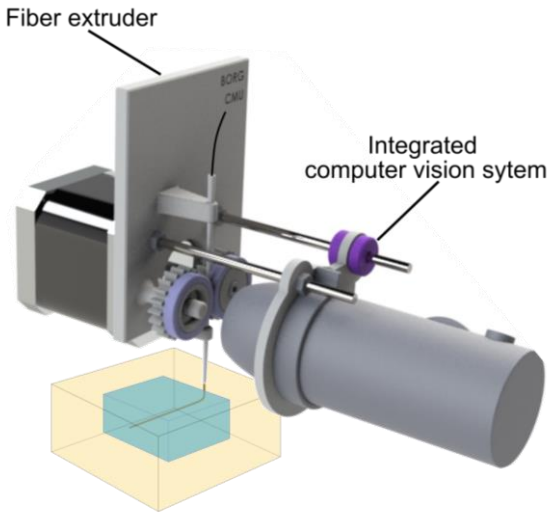
PI: Victoria A. Webster-Wood, Carnegie Mellon University

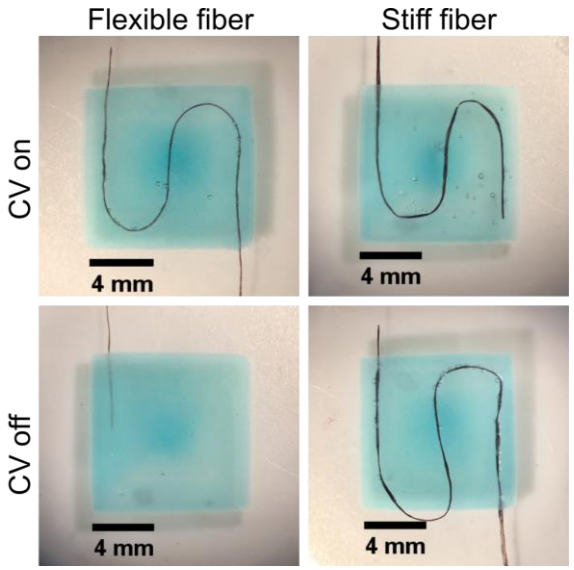
Award ID# FRR-2044785, Award Date April 1, 2021

Highlights

- Long fiber embedded FRESH printing for printing fiber based biocompatible interfaces
- Improved print fidelity within computer vision-based feedback control of extruder

  W. Sun et al. International Conference of Additive Manufacturing for a Better World (AM Conference) 2022. Accepted.





CAREER: Adaptive Actuation and Control in Embodied Biohybrid Robots

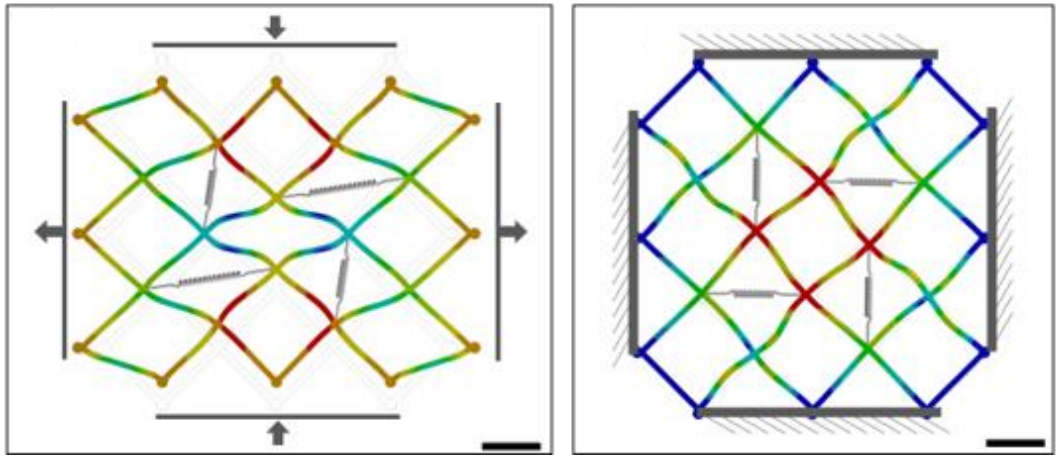
PI: Victoria A. Webster-Wood, Carnegie Mellon University

Award ID# FRR-2044785, Award Date April 1, 2021

Highlights

- Long fiber embedded FRESH printing for printing fiber based biocompatible interfaces
- Improved print fidelity within computer vision-based feedback control of extruder
- Computational tools for calculating muscle force based on mesh deflection

Schaffer et al. in preparation.



CAREER: Adaptive Actuation and Control in Embodied Biohybrid Robots

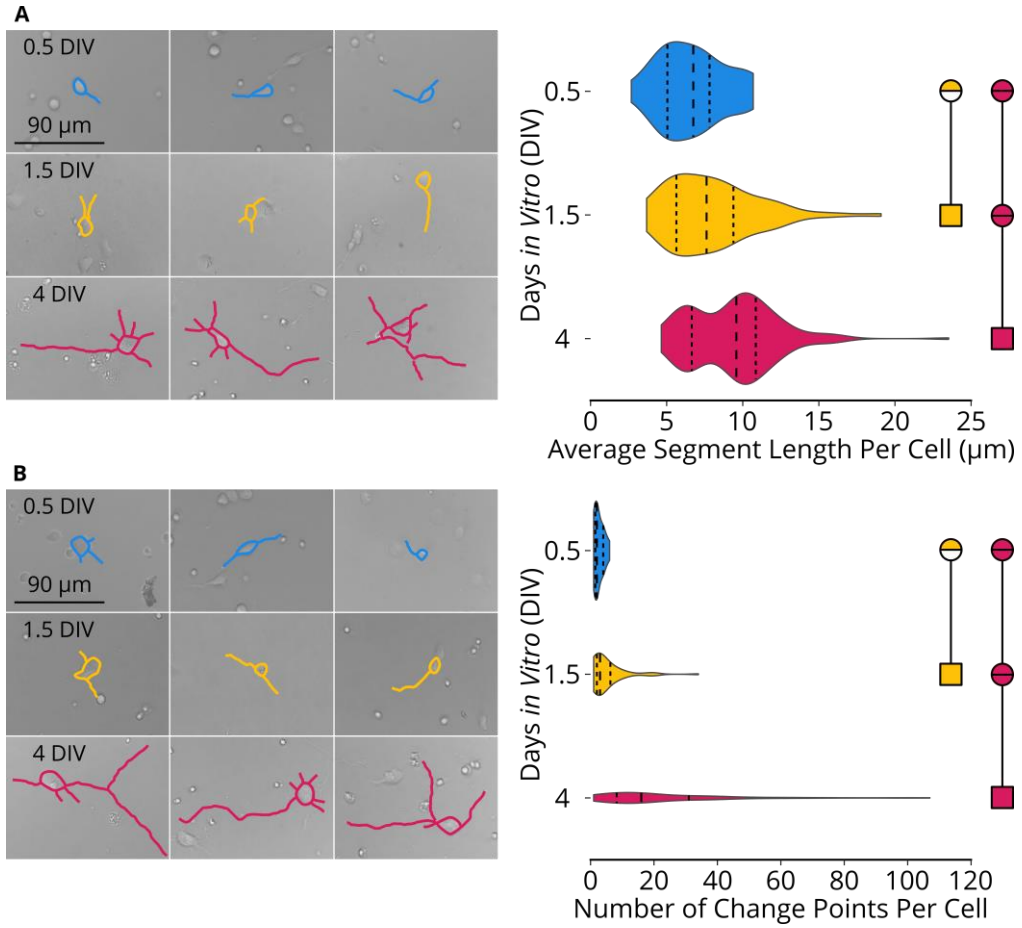
PI: Victoria A. Webster-Wood, Carnegie Mellon University

Award ID# FRR-2044785, Award Date April 1, 2021

Highlights

- Long fiber embedded FRESH printing for printing fiber based biocompatible interfaces
- Improved print fidelity within computer vision-based feedback control of extruder
- Computational tools for calculating muscle force based on mesh deflection
- Quantitative analysis of neuron growth for model validation

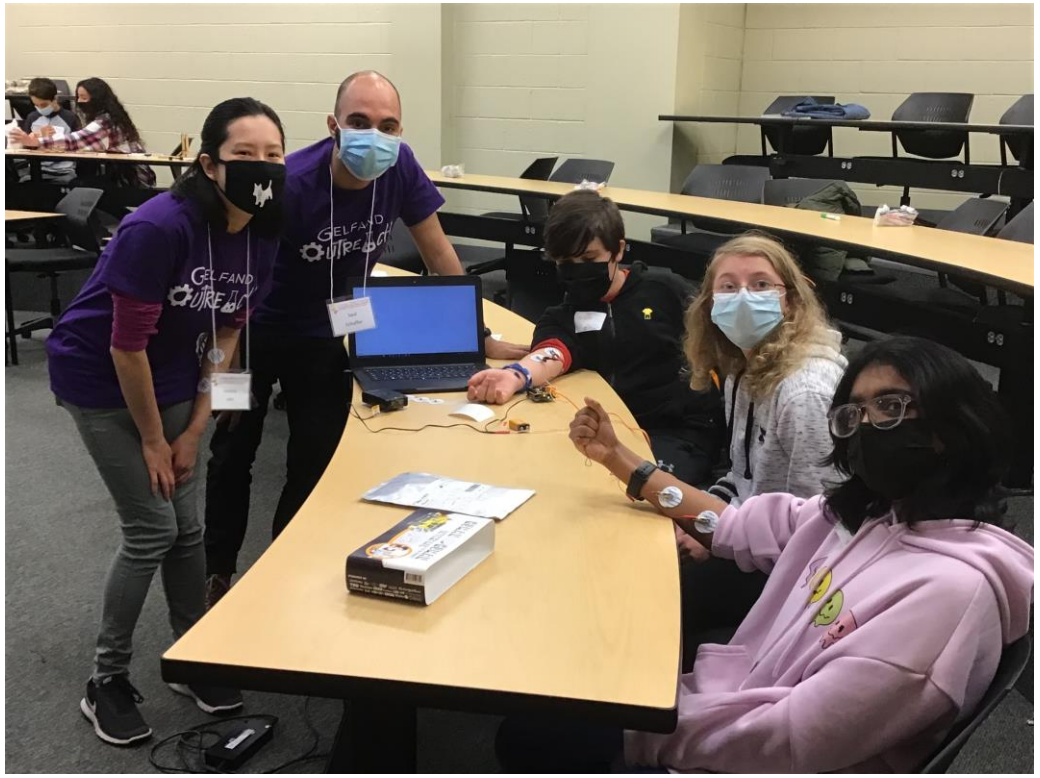
  Qian et al. under revision, Scientific Reports.
  Liao et al. in preparation.



CAREER: Adaptive Actuation and Control in Embodied Biohybrid Robots

PI: Victoria A. Webster-Wood, Carnegie Mellon University

Award ID# FRR-2044785, Award Date April 1, 2021



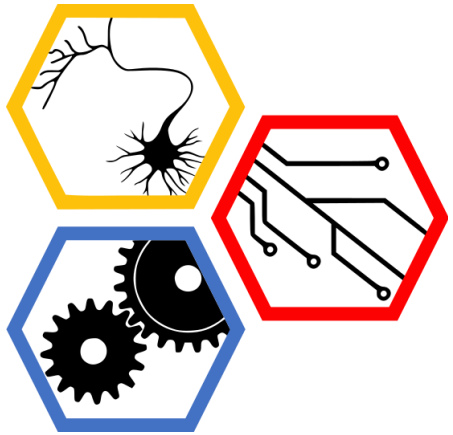
Scientific Impact

- LFE-FRESH printer is broadly applicable to hydrogel and fiber combinations for biohybrid robotics and beyond

Broader Impacts

- Helped improve visibility of CMU Women Faculty in Robotics List
  - 9 new additions
- Engaged in K-12 outreach on biohybrid robotics
- Designing new Summer course on Introduction to Biohybrid Robotics Research to scale undergraduate research experiences
- Hosted 5 undergraduate researchers through research for credit, tracking career outcomes

Thank you!



Carnegie Mellon University

The Biohybrid and Organic Robotics Group