



Artificial Soft Tissues & Functional Bio-Interfaces

Prof. Lizhi Xu Research Lab

Department of Mechanical Engineering

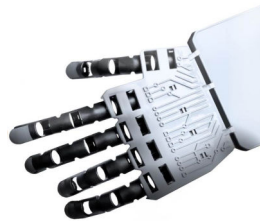
Biological Tissue vs. Abiotic Tools: Challenges



Mismatches:

Biological Tissue:

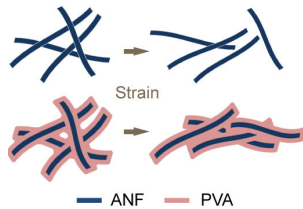
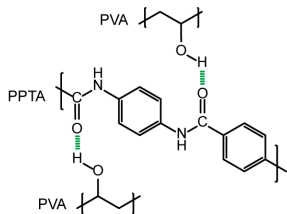
Soft, dynamic, & water-rich



Abiotic Tools:

Rigid, static, & dry

Artificial Cartilage, Ligaments & Tendons



Synthetic microfibrillar composites mimicking the interplay among collagen, proteoglycan, and water in load-bearing soft tissues

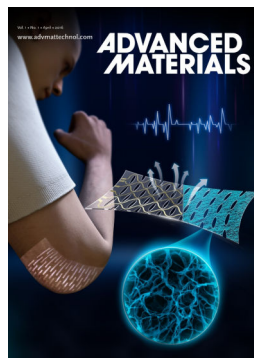
L. Xu, N. A. Kotov* *et al. Adv. Mater.* 30, 1703343 (2018)

M. Sun†, H. Li†, L. Xu* *et al. Sci. Adv.* 9, eade697 (2023)

Tissue-Integrated Soft Bioelectronics



Conformal neural interfaces



Soft bioelectronics for tissue engineering

Epidermal electronics

H. Li, Y.A. Huang*, L. Xu* *et al. Adv. Mater.* 33, 2004425 (2021)

H. He†, X. Wei†, Y. Lin*, L. Xu* *et al. Nat. Commun.* 13, 4242 (2022)

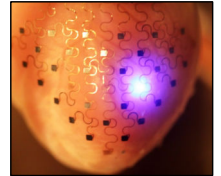
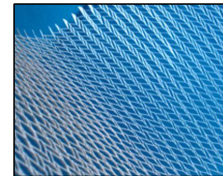
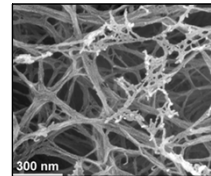
H. Liu†, H. Li†, Z. Wang†, L. Xu* *et al. Adv. Mater.* 34, 2207350 (2022)

Biomimetic Soft Materials and Devices: An Overview

Biomimetic Composites

Reconfigurable Structures

Bio-Integrated Devices

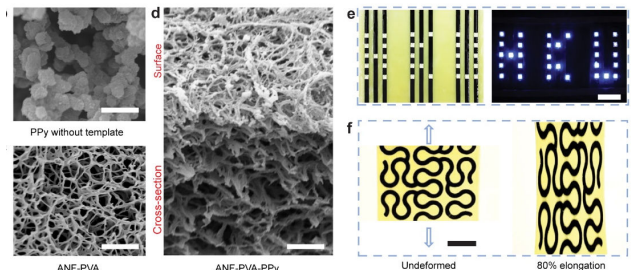
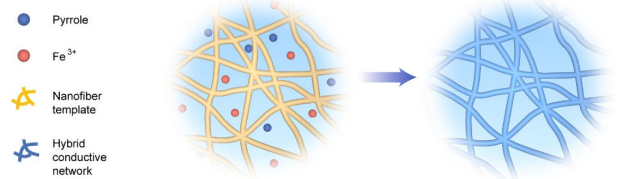


Nano

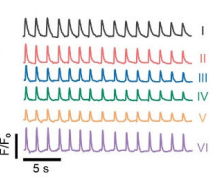
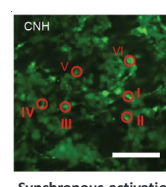
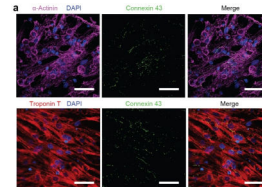
Macro

Applications: biomedical implants, soft bioelectronics, tissue engineering construct, etc.

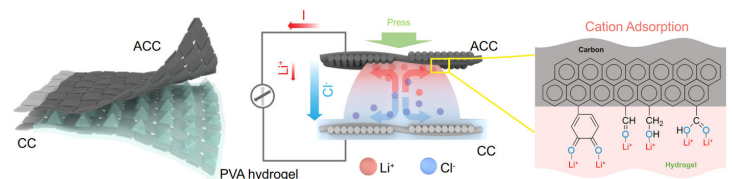
Biocompatible & Electroactive Hydrogels



Hybrid assembly of polymeric nanofiber networks for robust and electronically conductive hydrogels



Conductive hydrogels for cardiac tissue engineering



Mechanoionic asymmetry design for high-current hydrogel generator

H. He†, H. Li†, L. Xu* *et al. Nat. Commun.* 14, 759 (2023)

H. Li†, W. Zhang†, L. Xu* *et al. Sci. Adv.* 10, eado1019 (2024)

H. Liu, X. Pu*, L. Xu* *et al. Nat. Commun.* 15, 1494 (2024)