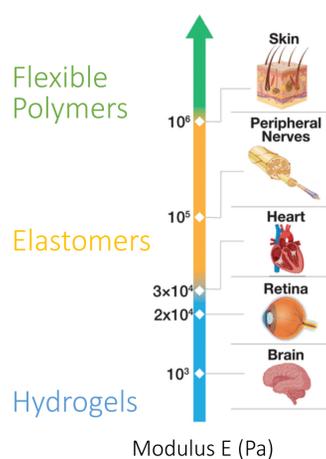


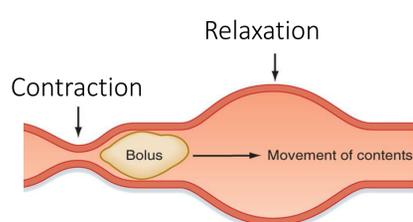
Introduction

- We develop soft bioelectronics for sensing and modulation in the gut and brain.
- **Challenges in the gut:** a) constant movements, b) “dirty” environment, c) low accessibility, d) hard to anchor devices on, etc.
- **Impact:** study GI natural functions, understand its involvement in various diseases/disorders, and its interactions with other systems such as the brain gut axis.

1. Mechanical mismatch: **Soft**



2. Dynamic movements: **Stretchable**

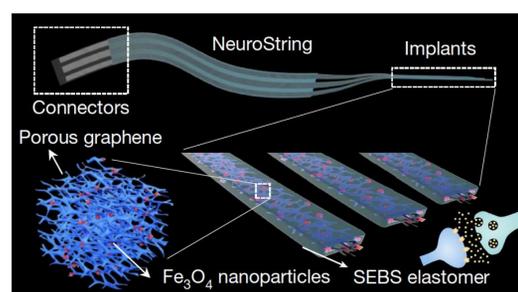


3. Various bio-signals: **Multimodal**

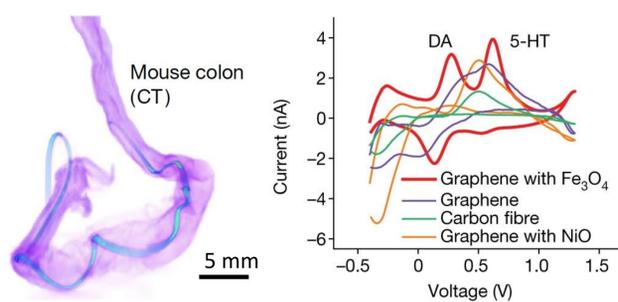
Electrophysiology Electrical recording, stimulation	Biochemistry Neurotransmitters	Biophysics Pressure, motility
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NeuroString 1st gen: tissue-like neurotransmitter biosensors

NeuroString for dopamine and serotonin (5-HT) sensing:

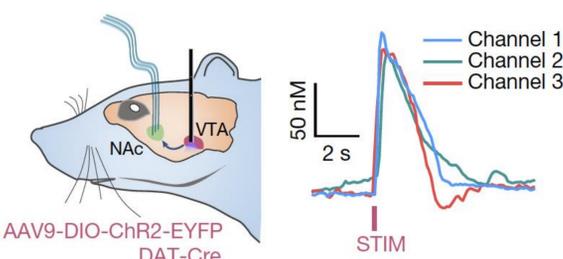


Laser-induced graphene with Fe₃O₄ nanoparticles
High stretchability



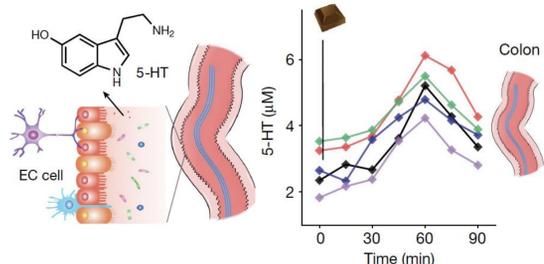
High selectivity and sensitivity

Sensing in the brain:



Dopamine and serotonin sensing in the brain

Sensing in the GI system:



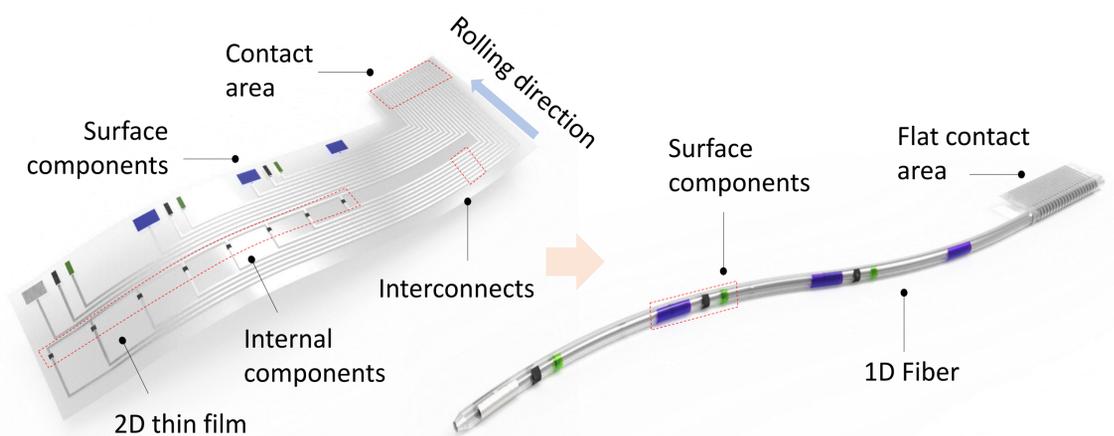
Serotonin changes in the colon
Brain-gut axis

Li et al. Nature 606, 94 (2022)

S-NeuroString 2nd gen: high-density bioelectronic fibers

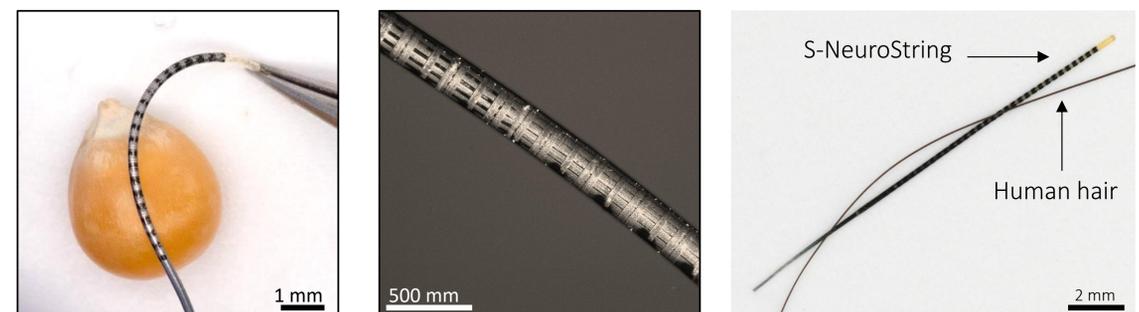
- Bioelectronic fibers are promising for minimally invasive implantation.
- **Current limitations:** a) low density of active components, b) poor control over fiber structure and device orientation on fiber, and c) limited functionality.
- **Why?** Incompatibility of thin and curved fibers with traditional micropatterning techniques designed for flat surfaces.

Solution: transformation of 2D thin films into micron-scale fibers



Khatib, M., et al. "Spiral NeuroString: High-Density Soft Bioelectronic Fibers for Multimodal Sensing and Stimulation." *bioRxiv* (2023): 2023-10.

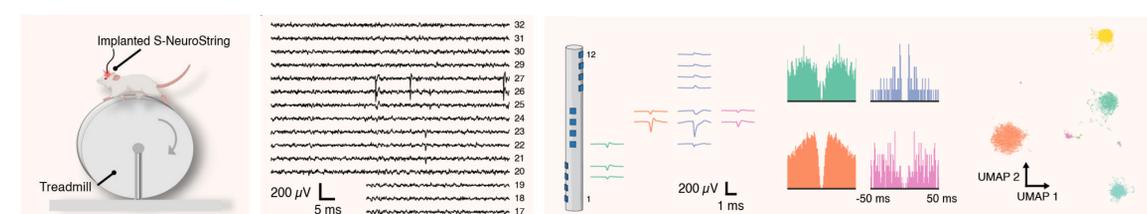
S-NeuroString 2nd gen: sensing and stimulation in the gut and brain



Serotonin and motility sensing in the gut



Single unit and LFP recording in the brain



Acknowledgement

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