

Prof. Stéphanie P. Lacour

Yasemin Engür

Yash Vyza

Scott Erickson

Desirée Maula

Pietro Palopoli

Amitabh Yadav

NX-422 Neural Interfaces

Project introduction



Fall 2024

Design your own neural interface

Target a disease?

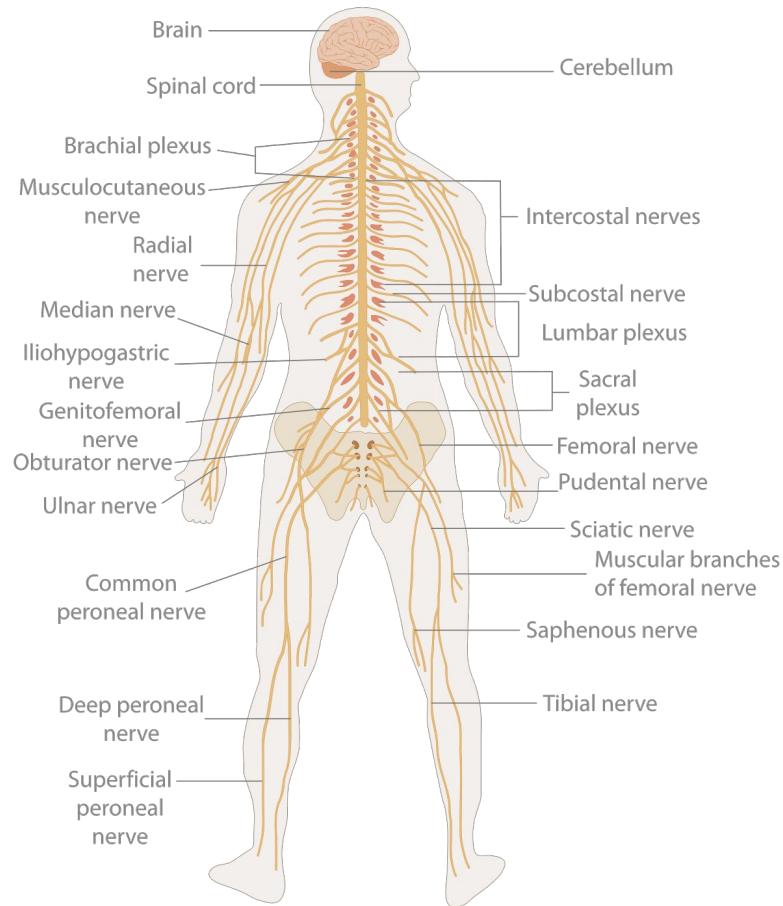


Target a tissue?

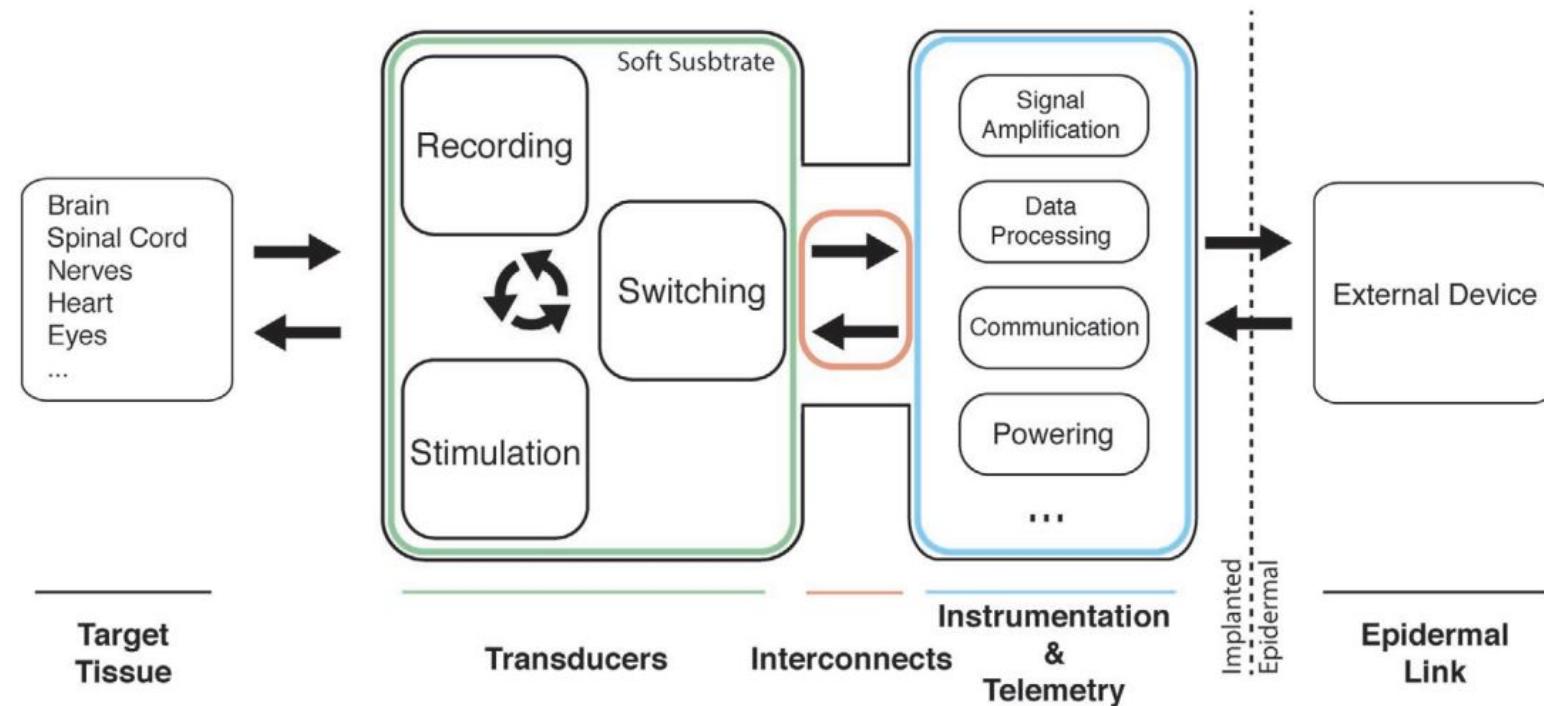
Use a specific
technology?

Nervous system: not only the brain!

- Brain (deep vs. cortex)
- Sensory systems (vision, audition, touch, etc)
- Motor system (central system vs. peripheral nerves)
- Etc!



Consider all aspects of the design



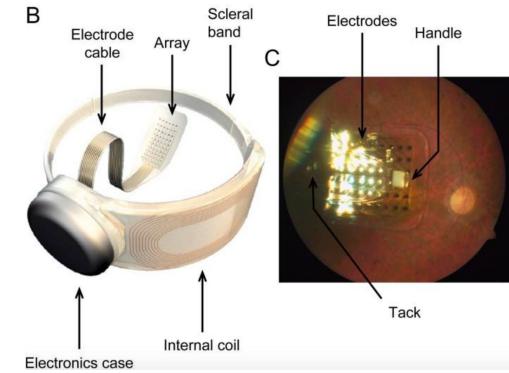
Innovation can be on one or multiple fronts

- Materials
- Use/application
- Interface electronics
- Miniaturization
- Integration
- Usability
- System power and communication
- Mechanical properties

Ex. Retinal implant

Stimulation of retinal neurons to restore vision in patients with retinal degeneration

- Stimulation mechanism
- Wireless integration
- Material adhesion/conformability
- Manufacturing



Argus II

Power

Integration

Wireless

Electronics

Materials

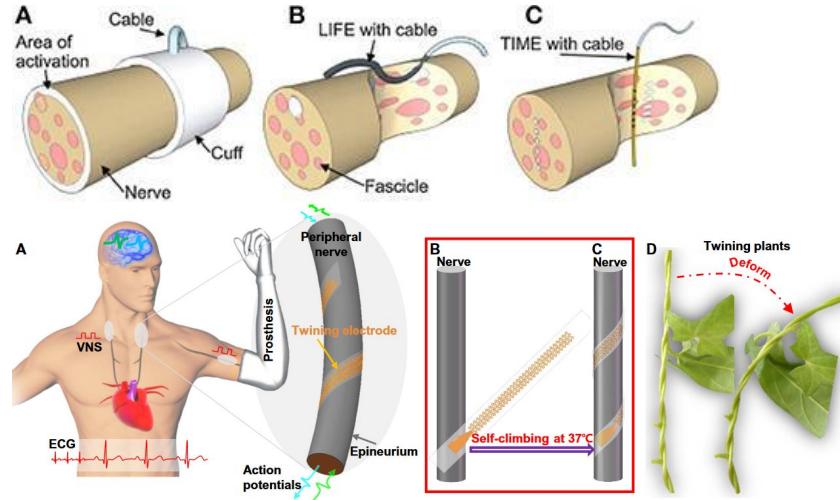
Biocomp.

Application

Ex. Peripheral nerve interface

Implants for sensing or actuation

- Interface type (cuff, intraneuronal)
- Wireless integration
- Material
- Manufacturing
- Implantation technique



Zhang 2019

Power

Integration

Wireless

Electronics

Materials

Biocomp.

Mechanics

1. State of the art
2. Innovation
3. Implementation
 - Fabrication (materials, processes)
 - Connections (electrical components)
 - Power
 - Etc
4. Feasibility assessment
5. Discussion/Conclusion

Start forming teams and brainstorm!

- Teams of 4
- Mandatory **mix of backgrounds** (2-3 different sections represented)
- Start to discuss a possible **application/part of the nervous system** you want to interface
- **Sign up sheet** available on Moodle to register your team with a tentative project title (**deadline for registration: 20 September @23:59**)
- Summary of project guidelines available on Moodle

Main project deadlines

- Project registration (Moodle→Google doc): **Friday, September 20th, 23:59**
- 2-page summary (one per team): **Friday, October 11th, 23:59**
 - Ungraded
- Project presentations: **December 12-13**
 - 20% final grade
- Project report (one per team): **Friday, December 20th, 12:00**
 - 40% final grade

For discussion about projects/course material

- ~9 groups per 2 TAs
- Meet after lectures (10am-11am, Thu/Fri)
 - or on Zoom/in person (TA availability)

Exercise sessions

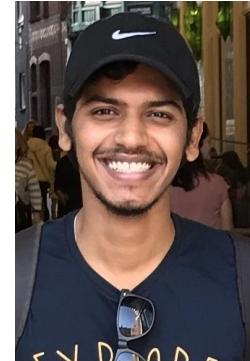
- 3x per semester



Scott



Desirée



Yash



Pietro



Yasemin



Amitabh