**BMED 48X3 - Intro to Neuroengineering**

**Spring 2018**

**Prof. Annabelle Singer**

**Learning Objectives**

* Identify key aspects of the nervous systems that can be the basis for measurement and intervention
* Understand what aspects of the biology are relevant to a particular neurotechnology
* Analyze existing neurotechnologies
* Design novel neurotechnology

**Prerequisites:** CS1371 (MatLab Course for engineers) AND BMED 2400 or ISYE 3770 (Stats). Ideally taken by students later in their curriculum (Junior or Senior years).

**Schedule of Topics**

*Each number indicates a class meeting*

**Introduction**

1. Introduce course structure, problem statement, deliverables, form groups
	1. Background on problem statement

**Fundamentals of the Nervous System**

1. Lecture: Neurons & Neural circuits
2. Group Work
3. Paper Discussion
4. Group work
5. Lecture: Interactions with the rest of the body & Diseases of the nervous system
	1. Diseases of circuits: Parkinson’s, Epilepsy, AD
6. Group Work
7. Paper Discussion
8. Presentations: 3 Ideas for new neurotechnology addressing problem statement

**Measurement**

1. Lecture: What do you need to know to make an effective measurement?
2. Group Work: include group & peer evaluation
3. Paper Discussion
4. Group Work
5. Lecture: Modalities: Behavior, Chemical, Electrical, Optical, Clinical applications
6. Group Work
7. Paper Discussion
8. Groups Work
9. Lecture: What is a Model?
10. Presentations: Plan to evaluate your novel neurotechnology

**Manipulation**

1. Lecture: What do you need to know to manipulate a system?
2. Group Work
3. Paper Discussion
4. Group Work
5. Lecture: Modalities: Behavioral, Pharmaceutical, Electrical stimulation, Magnetic stimulation, Genetic manipulation, Optical manipulation, Clinical applications
6. Group Work
7. Paper Discussion

**Group Project Presentations**

1. Final Presentations
2. Final Presentations
3. Final Presentations
4. Final Presentations

**Grading**

* Presentation I (20%), Presentation II (20%), Peer Evaluation (10%), Final presentation (20%), Final White Paper (20%), Class participation (10%)
* Class participation includes paper discussions and group work

**Assignments**

* **Exams**
	+ No exam
	+ Instead a group white paper for the final project will be due on the date of exam
* **Projects**
	+ In groups, students will design a novel neurotechnology inspired by problems described in the Brain Initiative
	+ Students will present their projects in class, receive feedback, and write up a white paper about their proposed design

**Reading**

* Textbook: **Principles of Neural Science** by [Eric R. Kandel](https://en.wikipedia.org/wiki/Eric_R._Kandel), [James H. Schwartz](https://en.wikipedia.org/wiki/James_H._Schwartz_%28neurobiologist%29), and [Thomas M. Jessell](https://en.wikipedia.org/wiki/Thomas_Jessell).
* Additional readings will be assigned and will be discussed in class