ENCH 486/686. A Survey of Sensors and Instrumentation

The purpose of this course is to provide a detailed understanding of biological sensing as well as the underlying engineering principles used to detect biomolecules such as DNA, proteins, and cells in complex environments and samples. The course will center heavily around biological sensing modalities used by bioengineers and synthetic biologists for applications in diagnostics and environmental monitoring. A heavy emphasis will be placed on developing a fundamental understanding of biological design principles by leaning heavily on literature to inform the lectures, class discussions, and assignments.

Logistics: The course is currently scheduled to be from 4:30 to 7:00 PM on Tuesdays in Sondheim on the main campus.

Brief overview of topics to be covered (Subject to Change):

Class #	Date	Description	Notes
1	Jan-28-2025	Course overview, survey, definitions, biological inspiration, overview and history of field	
2	Feb-4-2025	Calibration, dynamic range, signal to noise, sensitivity, selectivity, interference	Assign journal papers for student presentations
3	Feb-11-2025	Basics of detection methods: Electrochemistry, colorimetry, and human perceivable signals	
4	Feb-18-2025	Sensing and interacting with the environment as a biological organism	Take Home Exam 1
5	Feb-25-2025	Enzymatic, membrane protein sensors, and signal cascades	Student Research Article Presentations
6	Mar-4-2025	Affinity sensors: antibodies, nucleotides,binding affinity, FRET	
7	Mar-11-2025	Whole cell sensors: bacteria, yeast, mammalian cells	Midterm Exam
8	Mar-18-2025	Spring Break	
9	Mar-25-2025	Microarray and microfluidics-based lab-on-a-chip technology	Select Topics for Literature and Final Paper
10	Apr-1-2025	Biological imaging of complex environments brain, soil, and space	
11	Apr-8-2025	Wearable devices and noise in complex samples	
12	Apr-15-2025	Biosensing tools for the detection of bacterial and viral clinical, environmental, and food pathogens	Final paper outlines due
13	Apr-22-2025	Project Day	
14	Apr-29-2025	Measuring complex samples, multi-analyte detection, continuous measurements, reagentless biosensors	
15	May-6-2025	Implantable sensors, biocompatibility issues	