

BIOM581B5/ECE581B5 Electrochemical Sensors

Tom Chen/Chuck Henry
School of Biomedical Engineering

Course Description: This is an introductory course covering the fundamentals of electrochemistry and applications of electrochemical methods to detect certain class of chemicals/molecules. Students will study the oxidation-reduction mechanism and the interpretation of electrochemical results. Fundamental design of electrochemical sensor experiments and basic components needed for an electrochemical sensor system will be illustrated using different form of electrodes and potentiostat equipment.

Prerequisite Courses: BIOM 101 OR LIFE 102 OR instructor permission (in case of H.S. biology); CHEM 111; PH 142; MATH 255 or MATH 261;

Course Grade Mode: Traditional

Course Learning Objectives

Upon successful completion of this course students will be able to

- 1) Have the fundamental knowledge of electrochemistry.
- 2) Describe the biological recognition mechanism using electrochemistry.
- 3) Understand the performance parameters of electrochemical sensors and the way they are measured.
- 4) Have a fundamental knowledge about the modern instrumentation for electrochemical sensing.

Course Content:

Week	Topics
1	Fundamental concepts of electrochemistry, electron transfer mechanism, oxidation and reduction process (Redox), oxidation potentials and reduction potentials, and electrochemical methods (cyclic voltammetry and amperometry).
2	Electrode configurations & materials that facilitate redox process at the electrode surface. The roles reference, counter, and working electrodes play.
3	Performance parameters of electrochemical sensors including selectivity, sensitivity, linearity, detection limit, and variations.
4	Instrumentation used for electrochemical sensing including laboratory bench-top potentiostat and highly-integrated electrochemical sensing systems
5	Hands-on demo sessions to use the bench-top potentiostat to perform neurotransmitter detection using electrochemical methods.

Assessment Components	Percentage of Grade
Final exam	30
Homework, Reading Assignment, and Lab	55
Quizzes, optionally including clicker participation	15

Textbooks and Course Materials: A set of slides and reading materials prepared by the instructor and distributed in the class.