ECE 14:332:436:04: Personalized Biosensors for Global Health
ECE 16:332:519:02: Personalized Biosensors for Global Health

Logistics:

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Office hours: TBA

Classes: Tuesdays and Thursdays 3.20 PM – 4.40 PM
Course Materials: http://sakai.rutgers.edu/

Course Description:

This course provides a detailed background on the engineering principles used for biosensing applications in disease diagnostics for global health applications. Fabrication and characterization of the point-of-care biosensors will be taught. The course will also introduce students to the microfluidics principles, on-chip sample processing, surface functionalization techniques and label-free detection of biomolecules. Course will highlight the development of personalized predictive systems for global health care using machine learning techniques. Course will also include case studies of POC sensors for global health-care. Finally, students will work in groups of 2-3 and will do a project on a personalized biosensor design for a specific global health application.

Subject Area:

Bioelectrical Engineering, Microfabrication, Biosensors and Global Health

Notes:

Grading: Home-work assignments (10% of grade), two exams (25% each, total 50% of grade), term project (30% of grade), class presentation (10% of grade). Term project will focus on developing a new biosensor-based idea for a global health application including developing a design, characterization and/or simulations of the sensor and submitting a term paper.

Topics:

- Introduction to biosensors, and their potential global health applications.
- Biosensing elements and modalities
- Electrical biosensing (electrochemical, conductance, and impedance sensors)
- Optical biosensing (fluorescence detection and Raman Spectroscopy)
- Acoustic biosensing
- Nanotechnology for global health applications
- Next Generation DNA Sequencing
- Biostatistics to evaluate performance of biosensors.
- Nanoparticles for sensing and therapeutics
- Clinical data integration with biosensors
- Machine learning for predictive prognostics in global health
- Case Studies: HIV sensors
- Case Studies: Sepsis sensors
- Case Studies: TB/ Malaria sensors

Instructional Objectives:

- To teach fundamental biosensing principles involved in disease diagnostic devices
- To teach design, fabrication and characterization of biosensors
- To teach assay integration for a point-of-care sensor
- To teach biochemical, bioelectrical, structural, optical and acoustic sensing methodologies
- To expose students to global health care needs and biosensor design for diagnostic applications
- To instill “need-driven” based critical thinking in students to solve global health challenges using bioelectrical engineering principles
- Finally, to further develop the students’ ability for effective communication, presentation and group participation.