**CHM 6180 Biosensors Syllabus 2024**

**Lecture hours** – Monday, Wednesday, Friday Period 4 (10:40 AM - 11:30 AM) FLI0109

**Instructor** – Dr. Charles R. Martin, University Distinguished Professor of Chemistry
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**Office hours** - TBA

**Rationale for Course** - The development of biosensors, for example, the commercial blood glucose sensor, is a triumph of modern analytical chemistry. In addition to improving human health, biosensors act as research tools for scientists and engineers in a diversity of fields including chemistry, biochemistry genetics, biomedical engineering, proteomics, molecular biology, and materials science. For these reasons, understanding biosensing technologies, and the basic science and engineering principles behind these technologies, is important training for any 21st century STEM student.

**Course Description and Objectives** - This class will focus on practical, real-world biosensing technologies such as enzyme-based biosensors, gene chips, and ion-selective electrodes. I will review the basic principles behind the operation of these devices and discuss the advantages and disadvantages of each. Just as importantly, I will unify these very different technologies by discussing core issues common to all, such as chemical recognition and binding, and transduction of that recognition event into a measurable electrical signal. This will require reviewing some basic science and engineering issues including solution chemistry, electronics, and mass transport.

**Reading** – There is no formal text, but you will be e-mailed PDF files of important research and review articles.

**Grading** – There will be a midterm and a final, each worth 40% of grade. Both will be take home. I would like this class to be very interactive between student and professor. We will have in-class discussions of the material, and students asking questions is always appreciated. The remaining 20% of the grade will be for these class-participation activities.

**Outline** –
1. Neural cells teach us the principles of biosensing
2. The ubiquitous glass pH electrode illustrates what a sensor physically is
3. A review of solution chemistry and basic concepts in analytical chemistry
4. Electronic signals, signal-to-background ratio, and detection limits
5. Calibration curves, the method of standard addition, and sensitivity
6. Ion-selective electrodes and potentiometry
7. The Clark oxygen electrode and an introduction to electrochemical sensors
8. Enzyme-based biosensors, *e.g.*, the blood glucose sensor
9. Array-based DNA "biochip" sensors with fluorescence detection
10. Nanopore DNA sequencing