BIOMATH 209 is a 4-unit graduate course that will review how commonly-used bioassays work. We will explore the basic physical mechanisms and mathematical analyses relevant to a number of analytical probes used in biomedical research. After a preliminary theoretical background, we plan to discuss the following topics:

1. Background: Electrostatics, Poisson-Boltzmann theory
2. Background: Electrokinetics and electroosmosis
3. Background: Stokes flow, dispersion, Darcy’s Law
4. Chromatography (size-exclusion, liquid, gas, paper)
5. Electrophoresis, electroosmosis
6. The blots: Southern, Northern, and Western
7. PCR
8. DNA sequencing approaches, ChiP-seq
9. Systematic Evolution of Ligands by Exponential Enrichment (SELEX)
10. FRAP, FRET, FACS, and FISH
11. OCT, CT, PET, MRI

Prerequisites include proficiency in ordinary differential equations, linear algebra, and complex analysis. Key references will be provided throughout the course. Grades will be evaluated by a final project which may involve a literature review of research involving one or more technologies, or a theory-based extension of their analyses.