CHEM 6180: Special topics in Analytical Chemistry-Bioanalytical Approaches to Biology

Fall 2024, Syllabus

Introduction of the courses

The activity of life relies on the function of biomolecules in cells. Analysis of biomolecules based on bioanalytic chemistry methods allow to understand the function of life, misfunction that cause diseases, and precise diagnostics. This course aims to stimulate interdisciplinary thinking and discussion covering advanced topics in bioanalytic chemistry methods for biomedical research.

The topics will include: the introduction of structure and function of biomolecules (DNA, RNA, and proteins), DNA synthesis, purification and amplification, analytical methods based on gel electrophoresis, mass spec, imaging, flowcytometry, sequencing. We'll then further cover the state of art analytical technologies for single cell genomics, transcriptomics, and proteomics.

Course objectives

- 1. Understand the basic function of biomolecules (DNA, RNA, proteins).
- 2. Understand the principles and applications of bioanalytical methods (gel electrophoresis, immune-assay, sanger sequencing, fluorescent imaging, et al).
- 3. Know the current frontier methods for bioanalysis (next generation sequencing, proteomics).

Instructor

Fan Hong, Office: CLB 210C, Email: fanhong@ufl.edu

Class Periods

M/W/F 9:35 - 10:25 AM, Location: FLI 0109

Office hours

Office hours: by appointment

Tentative lecture topics

Preliminaries of biomolecules (structures and functions):

- 1. The introduction of biomolecules: DNA, RNA, proteins.
- 2. The chemical mechanism and biological function of DNA, RNA, and proteins.

Analytical approaches for biomolecules (structures and functions):

- 3. Gel electrophoresis for bioanalysis.
- 4. PCR reaction.
- 5. Sanger sequencing.
- 6. Nucleic acid analysis with isothermal amplification methods.
- 7. Immune assay for protein analysis.
- 8. Mass spec for bioanalysis.
- 9. DNA and RNA fluorescence in situ hybridization.
- 10. Protein analysis by immunofluorescence and flow cytometry.

Advanced topics:

- 11. Next generation sequencing technologies.
- 12. Protein analysis based on next generation sequencing, and multi-omics.
- 13. Spatial genomics and transcriptomics.
- 14. Spatial proteomics.
- 15. Emerging technologies for bioanalysis.

Textbook

There is no required textbook for the course. Supplemental reading from current literatures will be provided.

Grading criteria

(20%) Class participation and contributions to discussions.

(20%) Class assignments

(20%) Presentation of a critical review of current publication(s).

(20%) Written materials of 2-page research proposal.

(20%) Final presentation of research proposal.

Scheme

100-90% (A), 90-85% (A-), 84-80% (B+), 79-75% (B), 74-70% (B-), 69-65% (C+), 64-60% (C), 59-55% (C-)

Policy related to class attendance.

Participation in our class is fundamental since improving oral conversation skills is a key objective of the course. Students are expected to attend all the course. Punctuality is recommended. Cell phones should be silent during class time. If you must miss class, please contact me in advance.

Feedback of the course

Students are expected to provide feedback on the quality of the instruction in this course by completing on-line evaluations at https://evaluations.ufl.edu. Evaluations are open two or three weeks before the end of the semester.

UF Honor Code: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

All work submitted by students at the university must adhere to the following pledge: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The university demands honesty in all academic endeavors, as cheating, plagiarism, and other dishonest acts undermine the learning process and harm the academic community. Such actions will not be tolerated; consequences include a minimum penalty of a zero on the assignment and possible suspension. Plagiarism, defined as presenting someone else's ideas, words, or work as your own, is strictly prohibited.

See: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/