

BOT6508C, Proteomics: Theory and Practice, Fall 2015

Instructor: ***Dr. Sixue Chen, Associate Professor of Biology,
Director of ICBR Proteomics and Mass Spectrometry***

Class Hours: ***Tuesday: period 3, Thursday periods 3 & 4***

Class Location: ***Cancer and Genetics Complex, Room 351***

Office Hours: ***Cancer and Genetics Complex, Room 438***

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Office hours: Tue 1 hour before or after class (or by appointment).

Course Description:

In the era of systems biology, the study of proteomics and other omics has become increasingly important as the huge contribution from genome sequencing, computational biology and technological breakthroughs in analytical chemistry greatly impacts science in different areas. This course is designed to cover fundamentals as well as the new development in proteomics and mass spectrometry and put the knowledge into practice through scientific reasoning and hands-on laboratory sessions. The goal is to develop a comprehensive understanding of proteomics principles and applications in biomedical research. Special attention will be given to new technologies and research frontiers. The advanced course provides a perspective and training in the following:

1. General biochemical properties of proteins
2. Protein fractionation, separation and purification technologies
3. Fundamentals of mass spectrometry
4. Mass spectrometry applications in protein identification and characterization
5. Protein databases and bioinformatics
6. Experimental design and quality control in proteomics
7. Protein array technology
8. Application of proteomics/mass spectrometry in solving scientific problems

This course is for students interested in learning or applying proteomics and having hands-on experience using proteomics tools.

Course Policy:

This is a three credit course that is offered in the fall semester of odd numbered years. The course meets Tuesday for one period (3, 9:35-10:20am) and Tuesday for two periods (3 & 4, 9:35-11:25am). Tuesday is usually scheduled for lectures and discussions, and Tuesday is often scheduled for hands-on laboratory work. Material covered in the laboratory session will reinforce concepts presented in the lectures. Students are expected to interact actively during class, live discussions and questions during lecture and lab are encouraged. A lab fee of \$100.00 will be charged at the time of registration to cover chemicals, supplies and operation of mass spectrometers.

Prerequisites:

Biochemistry or consent of the instructor. Admission is for graduate students only.

Textbook

Introducing Proteomics, from concepts to sample preparation, mass spectrometry and data analysis by J. Lovric (2011), Wiley-Blackwell Publishers. Exams are based on the lectures, the textbook and the materials covered in the laboratory.

Grades

The course will contain several take home problems to help participants become familiar with the concepts and technologies. The final exam will consist of a complex, real life scientific situation that embodies what has been discussed in the course. Participants will also be expected to assess critically and make presentations of selected research articles. The take home problems, class participation and presentations are worth 60% of the points. The remaining 40% of the points are based on the final exam.

University Support Services

Resources are available on campus to help students meet academic goals and solve personal problems, which interfere with their academic performance. Resources include:

1. University Counseling Center, 301 Peabody Hall, 392-1575, personal and career counseling.
2. Student Mental Health, Student Health Care Center, 392-1171, personal counseling.
3. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

Provisional schedule

Date	Topic	Note
Aug 27, Thur	Introduction: Proteome, proteomics and protein fractionation, separation and purification I	
Sept 1, Tue	Protein fractionation, separation and purification II	
Sept 3, Thur	Protein extraction and sample preparation	Lab: ICBR
Sept 8, Tue	Mass spectrometry (MS) fundamentals I	
Sept 10, Thur	Protein quantification and Isoelectric focusing	Lab: ICBR
Sept 15, Tue	Protein 2D gel electrophoresis	Lab 435
Sept 17, Thur	Protein digestion and peptide extraction	Lab: ICBR
Sept 22, Tue	Mass spectrometry (MS) fundamentals II	
Sept 24, Thur	Protein identification by MS technologies	
Sept 29, Tue	Gel spot picking and image analysis demonstration	
Oct 1, Thur	Peptide purification and peptide mass fingerprinting	Lab: ICBR
Oct 6, Tue	Protein de novo sequencing and top down proteomics	
Oct 8, Thur	iTRAQ sample preparation	Lab: ICBR
Oct 13, Tue	Electrospray MS/MS analysis of peptides	Proteomics lab
Oct 15, Thur	Quantitative proteomics	
Oct 20, Tue	Protein databases, bioinformatics and data analysis	
Oct 22, Thur	iTRAQ sample preparation	Lab 435
Oct 27, Tue	Protein posttranslational modification	
Oct 29, Thur	HPLC fractionation of iTRAQ samples	Lab: ICBR
Nov 3, Tue	LC-MS/MS of iTRAQ samples and protein phosphorylation analysis, demo	Proteomics lab
Nov 5, Thur	Protein interaction and complex formation	
Nov 10, Tue	Protein array technology	
Nov 12, Thur	Accurate molecular weight and/or complex analysis	Proteomics lab
Nov 17, Tue	Proteomics application I	
Nov 19, Thur	Proteomics application II	
Nov 24, Tue	Proteomics application III	
Nov 26, Thur	<i>Thanksgiving, no class</i>	
Dec 1, Tue	Proteomics application IV	
Dec 3, Thur	Proteomics application V	
Dec 8, Tue	Proteomics, systems biology and discussions	
Dec 10, Thur	Final exam	