# BOT6508C, Proteomics: Theory and Practice, Fall 2017

***Instructor:*** ***Dr. Sixue Chen, Professor and Faculty Director of 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: 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 many different areas. This course is designed to cover fundamentals as well as the new developments 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 biological 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 technologies
8. Application of proteomics/mass spectrometry in solving biomedical 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 Thursday for two periods (3 & 4, 9:35-11:25am). Tuesday is usually scheduled for lectures and discussions, and Thursday is often scheduled for hands-on laboratory work. Material covered in the laboratory session will reinforce concepts presented in lecture. Students are expected to interact actively during class, and questions during lecture and lab are encouraged. A lab fee of $100.00 will be charged at the time of registration to defray costs of chemicals, supplies and operation of mass spectrometers.

### *Prerequisites:*

Biochemistry or consent of the instructor is needed. Admission is for graduate students only. Maximum class size: 16.

### *Suggested textbook*

**Proteomics: Advanced Concepts and Perspectives** by Handley, Arthur (2015).

### *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. The exams are based on the lectures, literature discussed and the material covered in the laboratory. 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.

## Provisonal schedule

| Date | Topic | Note |
|---|---|---|
| Aug 24, Thur | Introduction: Proteins and protein biochemical properties | |
| Aug 29, Tue | Proteome, proteomics and protein fractionation, separation and purification I | |
| Aug 31, Thur | Protein extraction and sample preparation | Lab: ICBR |
| Sept 5, Tue | Protein fractionation, separation and purification II | |
| Sept 7, Thur | Protein quantification and Isoelectric focusing | Lab: ICBR |
| Sept 12, Tue | Mass spectrometry (MS) fundamentals I | |
| Sept 14, Thur | Protein 2D gel electrophoresis | Lab 435 |
| Sept 19, Tue | Mass spectrometry (MS) fundamentals II | |
| Sept 21, Thur | Protein identification by MS technologies | |
| Sept 26, Tue | Gel spot picking and image analysis demonstration | Proteomics lab |
| Sept 28, Thur | Protein digestion and peptide extraction | Lab: ICBR |
| Oct 3, Tue | Protein de novo sequencing and top down proteomics | |
| Oct 5, Thur | Peptide purification and peptide mass fingerprinting | Lab: ICBR |
| Oct 10, Tue | Quantitative proteomics I | |
| Oct 12, Thur | Quantitative proteomics II | |
| Oct 17, Tue | Protein databases, bioinformatics and data analysis | |
| Oct 19, Thur | Electrospray MS/MS analysis of peptides | Proteomics lab |
| Oct 24, Tue | iTRAQ sample preparation-in solution trypsin digestion | Lab 435 |
| Oct 26, Thur | Proteogenomics | |
| Oct 31, Tue | iTRAQ labeling and protein modifications | Lab 435 |
| Nov 2, Thur | HPLC fractionation of iTRAQ samples | Proteomics lab |
| Nov 7, Tue | LC-MS/MS of iTRAQ samples and protein phosphorylation analysis | Proteomics lab |
| Nov 09, Thur | Protein array technologies | |
| Nov 14, Tue | Accurate molecular weight and/or complex analysis | Proteomics lab |
| Nov 16, Thur | Proteomics application I | |
| Nov 21, Tue | Proteomics application II | |
| *Nov 23, Thur* | *Thanksgiving, no class* | |
| Nov 28, Tue | Proteomics application III | |
| Nov 30, Thur | Proteomics application IV | |
| Dec 5, Tue | Proteomics application V | |
| Dec 7, Thur | Proteomics, systems biology and discussions | |
| Dec 12, Tue | Final exam due | |