

Welcome to Proteomics Laboratory!

Orbitrap mass analyzer with movement of separated peptide or protein ions (left). This analyzer is used in proteomics to produce a mass spectrum (right). Courtesy of Thermo Scientific.

Why proteomics?

The global proteomics market was worth \$27 billion in 2022 and is expected to reach \$104 billion by 2032.

However, the impact on biology and medicine is priceless through generating unique knowledge in basic science, diagnostics and therapeutics.

This course provides a tremendous and unique opportunity to obtain hands-on access to leading edge advanced equipment (mass spectrometry). Equivalent opportunities are not available elsewhere at Columbia or at almost any other university.

Ride a beam of ions into the future of Biomedicine!

You will:

- Learn to prepare protein samples
- Calibrate the instrument
- Operate ultraperformance liquid chromatography (UPLC) system
- Introduce the sample into the mass spectrometer
- Operate the mass spectrometer
- Collect the data
- Analyze and interpret the data.

Those who continue in this field will find employment opportunities unequalled in most other areas of science

Other courses may provide access to only low value technology that is sometimes outmoded. Here you will be a hands-on operator with leading edge, state-of-art equipment and produce “big data” with your own hands.

Genomics tells you what might happen, but proteomics tells you what is happening in biology and medicine.

The course is highly rated by past students and is now enhanced with unique innovative instructional methods that bring real-time access to instrument operation performed by your fellow students.

This course deals with the proteome: the expressed protein complement of a cell, organelle, matrix, tissue, organ or organism. The study of the proteome (proteomics) is

broadly applicable to life sciences research, and is increasingly important in academic, government and industrial research through extension of the impact of advances in genomics. These techniques are being applied to basic research, exploratory studies of cancer and other diseases, drug discovery and many other topics. Techniques of mass spectrometry relating to proteomics will be covered. Emphasis will be on liquid chromatography/ mass spectrometry (LC/MS) with electrospray ionization. Database searching and interpretation for identification of proteins will be intensively studied, and practiced supported by background tutorials and exercises covering other techniques used in proteomics.

The course is open to Ph.D. and advanced undergraduate students with background in genetics or molecular biology. Students in the M.A. in Biotechnology Program are welcome to register (points can be counted against laboratory requirement for that program), . Students should be comfortable with basic biotechnology laboratory techniques as well as being interested in doing computational work in a Windows environment.

This course includes lecture material in addition to laboratory exercises. Lectures are necessary to provide students sufficient background to understand the laboratory exercises. Lectures will typically be at the beginning of some laboratory sessions.

Course Aims

This class will provide experience in mass spectrometry to the extent practicable in a 3 pt. course as well as thorough grounding in computational biology for protein identification. The aim of the course is to enable students to achieve a level of mastery of these techniques through example lab exercises, tutorial lectures and practice. The expected outcome of the course would be mastery of a discrete skill set that would allow a student to identify proteins using these techniques. There will also be exposure through demonstration and lecture/tutorial to a wide range of other proteomic strategies and hardware including other mass spectrometers and strategies in comparative proteomics.

Prerequisites

For permission of instructor; please contact by [email](#). Graduate and undergraduate students are welcome to attend.

"Short course" auditing by postdoctoral researchers is also possible. Contact us for more information.

Students should bring a Windows laptop computer to some classes. A Mac laptop also can be used with special software that we will recommend.

Grading

Grading is based on approximately four lab reports that are submitted during the semester. There will be no exams.

Other Info

The time will be every Thursday at 12:30 PM - 3:30 PM. The first class will be held on Thursday, September 7, 2023 at 12:30 PM in Room 900 in Fairchild Center ***We hope to see you there.***

This course is held during the Fall semester each year.

[Schedule of labs, topics and assignments \(no exams in this course; lab reports only\):](#)