MCBA 743

Molecular Methods of Biomedical Research II
Spring 2025

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Description

Advanced molecular methods. Students will be introduced to and trained in advanced molecular techniques that could be utilized in a proteomics or genomics laboratory, including SDS PAGE, Western blot, ELISA, and Flow Cytometry.

Prerequisites

There are no prerequisites for this course.

Learning Outcomes

After successful completion of this course, you will be able to:

1. Isolate and quantify protein.
2. Run SDS PAGE and Western Blot.
3. Run an ELISA.
4. Design, isolate, and analyze samples with Flow Cytometry.

Required Texts

All required course materials and laboratory manuals will be provided on the first day of class.

Course Assignments and Grading

Laboratory Reports

Students will be expected to submit a total of 2 laboratory reports during the semester. Report information will be based on lecture and lab results. Lab report 1 will be based on western blots and ELISAs. Lab report 2 will be based on flow cytometry.

Quizzes

Quizzes will be a combination of multiple choice and short-answer questions on lecture material from the previous week. If you are paying attention in lectures, and studying the PowerPoints, the quizzes will be an excellent way to bolster your course grade.

However, if you miss class or are tardy when the quiz is given, you cannot make it up later.

Evaluation and Grading Scale

All graded materials will be promptly graded and returned. All grades will be posted on Blackboard. You are strongly encouraged to check your scores in Blackboard regularly. A final letter grade will be assigned based on percentages.

Assignment Weights	Percent
Lab Participation	22%
Quizzes	18%
Report 1	30%
Report 2	30%
Total	100%

Lab Participation (14 labs @ 10 points) = 140 points
Quizzes (12 quizzes @10 points) = 120
Report 1= 200 points
Report 2 = 200 points
Total Points - 660 points

Grading Scale

89.5% - 100% = A
84.5% - 89.4% = B+
79.5% - 84.4% = B
74.5% - 79.4% = C+
69.5% - 74.4% = C
64.5% - 69.4% = D+
59.5% - 64.4% = D
0% - 59.4% = F

Course Policies and Procedures

All graduate students are subject to the academic policies, regulations, and academic standards of both The Graduate School and the department, school and/or college in which enrolled.

USC graduate bulletin (https://academicbulletins.sc.edu/graduate/policies-regulations/graduate-academic-regulations)

Attendance Policy

When you miss class, you miss important information. If you are absent, you are responsible for learning material covered in class. If you have an excused absence (https://academicbulletins.sc.edu/undergraduate/policies-regulations/undergraduate-academic-regulations), you will be permitted to make up coursework or complete an equivalent assignment agreed upon with me.
To arrange excuses for absences that can be anticipated at the start of the term, you should:

- Submit a request in writing (email is acceptable) stating the dates of the anticipated absence no later than the end of the second week of the course.
- Explain the reason for absence. In some cases, documentation may be required. Please consult the policy (https://academicbulletins.sc.edu/undergraduate/policies-regulations/undergraduate-academic-regulations) for additional information.
- Include any request for make-up work.

To arrange excuses for absences that cannot be anticipated at the start of the term, (e.g. legal proceedings or illness), you should, at the first opportunity, submit in writing a request stating:

- The date of absence
- The reason for absence. In some cases, documentation may be required. Please consult the policy for additional information.
- Any request for make-up work as soon as reasonably possible after you become aware of the need to be absent.

Academic Integrity

As a partner in your learning, it is important to both of us that any assignment submission is a pure reflection of your work and understanding. The introduction of artificial intelligence options to complete academic work jeopardizes my ability to evaluate your understanding of our course content and robs you of the ability to master the subject matter.

Suspicions of use of artificial intelligence aids will be referred to the Office of Academic Integrity as alleged violations of Cheating, defined as “unauthorized assistance in connection with any academic work” and/or Falsification, which includes “Misrepresenting or misleading others with respect to academic work or misrepresenting facts for an academic advantage”.

You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in a minimum academic penalty of your failing the assignment, and will result in additional disciplinary measures. This includes improper citation of sources, using another student's work, and any other form of academic misrepresentation.

The first tenet of the Carolinian Creed is, "I will practice personal and academic integrity."

Below are some websites for you to visit to learn more about University policies:

- Carolinian Creed (http://www.sa.sc.edu/creed)
- Academic Responsibility (http://www.sc.edu/policies/staf625.pdf)
- Office of Student Conduct and Academic Integrity (https://www.sa.sc.edu/academicintegrity/)
- Information Security Policy and Standards (https://sc.edu/about/offices_and_divisions/division_of_information_technology/security/policy/universitypolicy/)

Disability Services

Student Disability Resource Center (http://www.sa.sc.edu/sds/): The Student Disability Resource Center (SDRC) empowers students to manage challenges and limitations imposed by disabilities. Students with disabilities are encouraged to contact me to discuss the logistics of any accommodations needed to fulfill course requirements (within the first week of the semester). In order to receive reasonable accommodations from me, you must be registered with the Student Disability Resource Center (1705 College Street, Close-Hipp Suite 102, Columbia, SC 29208, 803-777-6142). Any student with a documented disability should contact the SDRC to make arrangements for appropriate accommodation.

Mental Health

If stress is impacting you or getting in the way of your ability to do your schoolwork, maintain relationships, eat, sleep, or enjoy yourself, please reach out to any of our mental health resources. Most of these services are offered at no cost as they are covered by the Student Health Services tuition fee. For all available mental health resources, check out Student Health Services Mental Health (https://www.sc.edu/about/offices_and_divisions/health_services/mental-health/index.php) and the quick reference list below.

- Wellness Coaching can help you improve in areas related to emotional and physical wellbeing (e.g., sleep, resiliency, balanced eating and more) – schedule an appointment at (803) 777-6518 or on MyHealthSpace (https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx)
- Access virtual self-help modules via Therapy Assistance Online (TAO) (https://us.taoconnect.org/register) **–** see TAO registration instructions (https://www.sc.edu/about/offices_and_divisions/health_services/medical-services/counseling-and-psychiatry/online-support/index.php).
- Access additional articles and videos on health and wellness topics on the Wellness Hub, thriveatcarolina.com, or by downloading the CampusWell (https://www.campuswell.com/) app and searching for University of South Carolina.

- Counseling & Psychiatry offers individual and group counseling and psychiatric services – schedule an appointment at (803) 777-5223 or on MyHealthSpace (https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx).
- Access the 24-hr Mental Health Support Line at (833) 664-2854.
- Access an anonymous mental health screening program (https://www.uscscreening.org/welcome.cfm?access=website)

Course Schedule

Week 1: January 8

Lecture

Potts: Intro

1. Introduction to the IRF
2. Rules for use of IRF
3. Course Requirements

Lab : No Lab

Week 2: January 15

MLK day No Classes

Week 3: January 22

Lecture: Dr. Potts

1. Proteins – extraction and handling
2. Protein quantification
3. Protein electrophoresis
4. Techniques – Western blotting, 2DGE, EMSA

Lab:

1. Denaturing SDS PAGE
2. Western blot
3. Coomassie staining

Week 4: January 29

Lecture – Dr. Kumar

Lecture –ELISA

Lab: Start and Finish protein ELISA labs

Week 5: February 5

Lecture: Dr. Azhar

Use of Cre recombinase transgenic mice to generate conditional knockout

Lab: protein labs

Week 6: February 12

Lecture – Dr. Azhar
Mouse gene targeting and ES cell technology, global gene knockout and knock-in mice

Lab: Genomic DNA extraction from mouse tail snips

Week 7: February 19

Lecture – Dr. Frizzell
Mass Spectrometry

1. **Mass Spectrometry and GC and LC-MS**

Lab: PCR Genotyping to detect wild-type and knockout, conditional knockout, Cre-deleted alleles.

Week 8: February 26

Lecture – Dr. Potts:
Stem Cell Biology and use in Biomedical Sciences

Lab: Finish Mouse labs
Lab Stem Cell isolation and passage

Week 9: March 4

No class Spring Break

Week 10: March 12

Lecture – Dr. Kubinak
Flow Cytometry: Theory and Principles

Lab: Introduction to instrument (FACSAria II)

1. LEARNING OBJECTIVE: students will be introduced to instrument and will be tasked with designing their own 4-color marker panel

Week 11: March 19

Lecture – Dr. Kubinak
Flow Cytometry: Practical Application

Lab: Sample preparation and data acquisition

1. LEARNING OBJECTIVE: students will be tasked with isolating lymphocytes from mouse spleen and collecting data on the relative abundance of T cells and B cells

Week 12: March 26

Lecture – Dr. Kubinak
Flow Cytometry: **Data Analysis and Summary**

Lab: Data Analysis using FloJo Software

1. LEARNING OBJECTIVE: Students will be introduced to FloJo analysis software and will be tasked with using this software to produce publication quality plots and data

Week 13: April 1

Lecture –Dr. Kubinak
Flow Cytometry: Introduction to Cell Sorting

Lab: Sort purification and enrichment analysis

-LEARNING OBJECTIVE: Students will be tasked with sorting fluorescent beads and calculating the abundance of target bead population before and after sorting to determine enrichment efficiency

Week 14: April 8

Lecture –Dr. Ting Fung Ma

1. **Biostatistics for Biomedical research**

Week 15: April 15

Lecture – Dr. Potts:
Bioplex: Theory and Use

Week 16: April 22

Lecture – Dr. Richard Steet Greenwood Genetics Institute

Week 17: April 29

Lecture –Dr. Katrina Harmon: Organogenesis Company
Jobs in Biotechnology sector