UF UNIVERSITY of FLORIDA
IFAS
Microbiology and Cell Science

MCB6458: POST-TRANSLATIONAL MODIFICATIONS IN MICROBIOLOGY

MARIOLA J FERRARO

2 Credit Hours

Summer C 2025

RATIONALE FOR COURSE

The primary objective of this microbiology course is to enhance student learning while improving both team collaboration and individual writing skills. To achieve this, the course will employ an innovative approach to student learning through interactive group projects and proposal writing. The group projects will require students to synthesize published research findings while also encouraging them to think critically and "outside the box." Moreover, we hope that students will leverage the knowledge they acquire in the course to explore how post-translational modifications can be used to improve human health, food and agriculture, and natural resources. By mastering the art of review writing, students will gain a better understanding of their chosen field of study.

INSTRUCTOR

Mariola J. Ferraro, Ph.D:

- mjferraro@ufl.edu
- 352-846-0954
- My preferred method for communication is Canvas message or e-mail. Zoom, phone, or in-person conferences are by appointment only (please use e-mail to schedule).

DELIVERY METHOD/MEETING TIME:

All assignments, question/answer sessions, and other materials will be available online asynchronously. Class discussion and review sessions will be held in Canvas through 'conferences' for off-campus students to ask questions and interact with their instructor.

COURSE DESCRIPTION

Post-translational Modifications in Microbiology. This course will cover the various types, functions, and mechanisms of post-translational modifications (PTMs) in microbiology. The curriculum will also include the methods used to identify PTMs and their impact on cell biology, human health, and biotechnology. Students will have the opportunity to synthesize existing literature and develop skills in writing a research proposal.

COURSE OBJECTIVES/GOALS/LEARNING OUTCOMES

By the end of the students will be able to:

- Analyze the molecular and cellular biology of post-translational modifications (PTMs) using relevant literature
- Evaluate and interpret primary research articles that discuss PTMs, using critical thinking skills.
- Evaluate the role of PTMs in real-life applications such as controlling pathogenesis, engineering microbial biocatalysts in the production of renewable fuels and chemicals, or agricultural applications.
- Demonstrate teamwork skills in completing a successful group project.
- Analyze the peer-reviewed literature.
- Apply acquired skills in reviewing and scoring peer's projects.

COURSE MATERIAL AND ASSIGNMENTS

Suggested Readings and Resources: Assigned peer-reviewed readings are included with assignments. Please see the individual Canvas modules for more details.

POINTS TOTALS

Assignments/Quizzes	Points
Quiz 1	5 pts
Quiz 2	50 pts
Quiz 3	50 pts
Quiz 4	50 pts
Group project – a division of work and a 1-page draft of the proposed project	25 pts
Group project - preliminary list of references (5 references per student)	20 pts
Group project - final written report	100 pts
Group project – oral report	100 pts
Peer evaluation of group projects	100 pts
Total:	500 pts

GRADING POLICIES

Late submissions are accepted, with a penalty of 20% for each day of lateness. Please remember that Canvas is a computer and is precise, so do not wait until the last minute

to start or submit your assignment. 11:59:00 is on time, 11:59:30 is late. If you have a legitimate excuse as to why your assignment is late or missing, please submit your documentation to the Dean of Students Office. If you have a grading concern when you receive feedback, you must submit this request within 1 week of receiving your grade on the assignment. Requests after one week will not be accepted. My goal is to grade all assignments within 1 week of due date, but there may be delays in grading during the semester. Make-up assignments or extended deadlines will be assessed on a case-by-case basis. Reach out to me directly if you require such an accommodation. I do understand that things happen, but it is important to meet deadlines both in college and in the real world.

Final grades will be based on the following performance standards:

95 -100 %	=	A
90 - 94.9 %	=	A-
87 - 89.9 %	=	B+
84 - 86.9 %	=	B
80 - 83.9 %	=	B-
77 - 79.9 %	=	C+
74 - 76.9 %	=	C
70 - 73.9 %	=	C-
67 - 69.9 %	=	D+
63 - 66.9 %	=	D
60 - 62.9%	=	D-
Less than 60.0 %	=	E

ATTENDANCE POLICY

As this is a **fully online, asynchronous course**, you are expected to exhibit a high level of self-discipline. Each module was designed for completion on a week-by-week basis (with a few exceptions of assignments being worked on over multiple modules). During Week 1, I recommend you peruse each module in Canvas to familiarize yourself with deliverables, number of lectures, and readings. If you have a particular way you like to organize your workload, I encourage you to set up these systems in Week 1 so you can keep track of your work. Each module includes assigned readings, videos, supplemental materials, and assignments. Please complete all modules within their respective weeks and by their listed deadlines. You are expected to complete all assignments by their stated due date. Additionally, I expect you to complete the readings in advance of watching the lectures. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with

university attendance policies.

MATERIALS AND SUPPLIES FEES

There are no additional fees for this course.

COURSE ASSESSMENTS

QUIZZES (155 POINTS TOTAL):

Four different quizzes are included: Quiz 1 is based on the syllabus; Quiz 2 and Quiz 3 are based on Lectures 1 and 2, respectively; and Quiz 4 is based on the reading assignment.

WRITTEN GROUP PROJECT (145 POINTS TOTAL):

In this collaborative assignment, students will work together to explore a specific type of post-translational modification (PTM) occurring on proteins in ARCHAEA or BACTERIA. The project involves gathering, synthesizing, and critically analyzing information related to the chosen PTM. If assigned to focus on ubiquitin modifications in Eukaryota, students should examine PTMs catalyzed by enzymes from bacterial pathogens. This project includes:

- Division of Work and 1-Page Draft Proposal (**25 pts**): Outline the team's strategy and preliminary thesis.
- Preliminary List of References **(20 pts**): Include at least 5 references per student, relevant to the PTM.
- Final Written Report (**100 pts**): A comprehensive analysis and synthesis of the chosen PTM.

Project Objectives:

- Critically analyze research articles to understand the molecular mechanisms and functional implications of the chosen PTM.
- Identify knowledge gaps in the current literature and propose innovative approaches for further investigation.
- Synthesize findings into a comprehensive report that conveys a thorough understanding of the PTM.

List of Possible Post-Translational Modifications for Group Projects:

1. Phosphorylation
    a. Arginine
    b. Serine/Threonine and Tyrosine
    c. Histidine and Aspartic Acid
2. ADP-ribosylation
3. Methylation
4. Glycosylation

5. Acetylation (Nα- and Nε-acetylation)
6. Lipidation
7. S-Nitrosylation and S-Sulfhydration
8. S-Glutathionylation
9. Methionine oxidation – as a reversible process
10. Uridylylation
11. Adenylylation
12. Unique modifications of translation elongation factors (attachment of ethanolamine phosphoglycerol, diphthamide and hypusine)
13. Ubiquitin-like modifications (sampylation, pupylation)
14. Ubiquitin modification in Eukaryota catalyzed by bacterial enzymes
15. Targeted proteolysis (select a regulatory protease – *e.g.*, Clp, Lon, Proteasome)
16. Specific polypeptide cleavage (*e.g.,* removal of signal peptides)

Report Format and Requirements:

The students will collaborate to research, synthesize, and present information on a specific post-translational modification in microbiology, adhering to the provided format. Templates available on the Canvas platform will assist in organizing the written portion of the group project. The project aims to equip students with the skills necessary to effectively gather, synthesize, and articulate a comprehensive understanding of the chosen post-translational modification. Templates are structured to aid students in developing a suitable outline for their paper, ensuring adherence to the guidelines.

The final report should be 10-15 pages long (**excluding** title page, figures, references, and tables), Font Arial 12, single-spaced. Additionally, **three supplementary tables (1-3) are required**, detailing modified protein names, accession numbers, modified residues (including amino acid position if known), enzymes catalyzing the modification, and relevant references.

All references should be listed separately, following a standardized citation format. The report must be uploaded to Canvas e-Learning, where plagiarism will be checked using TurnItIn. Each student will receive an individual grade based on their contributions to the project, with a **mandatory contribution to at least one of the Supplementary Tables**, clearly indicating their contributions.

The final report should adhere to the following format:

1. **Title**
   - Provide a concise and descriptive title that reflects the focus and significance of the project.

2. ***Student Names***
   - Include the names of all contributing students, along with their affiliations.

3. **Sections (for each section and subsection indicate with initials who contributed to which parts of paper):**

I. **Introduction to the Post-Translational Modification (PTM), Chemistry and Mechanisms of the PTM:** Define the PTM and its significance in cellular processes, providing context for the subsequent sections. Describe the chemical mechanisms underlying the PTM, including structural changes and reactions involved.

II. **Protein Factors and Enzymes of the PTM Pathway:** Summarize the key protein factors and enzymes responsible for catalyzing the PTM, including modifiers and regulatory proteins.

- ***Supplementary Table 1***

III. Biological Functions of the PTM: Discuss the biological functions and regulatory roles of the PTM in cellular processes.

IV. **Distribution and Evolutionary Conservation of the PTM:** Explore the distribution of the PTM across different biological domains and its evolutionary conservation, highlighting diversity and functional implications.

- ***Supplementary Table 2***

V. **Known Protein Targets and Residues Affected by the PTM:** Compile a list of known protein targets and the specific amino acid residues affected by the PTM, referencing relevant literature sources.

- ***Supplementary Table 3***

VI. **Methods for Detection and Site Mapping of the PTM:** Review experimental techniques and methodologies for detecting and mapping the site(s) of the PTM on target proteins, including biochemical assays and mass spectrometry.

VII. **Applications and Benefits of the PTM:** Discuss potential applications and benefits of the PTM in various fields, such as medicine, biotechnology, and environmental science.

VIII. **Conclusion and Future Directions:** Summarize the main findings and implications of the study, highlighting key insights and potential avenues for future research. Define what should be still done about this particular PTM, what are some of the gaps that you could identify?

4. References:

- Include a comprehensive list of references cited throughout the report, following a standardized citation format.

5. Tables (required).

a. Protein Factors and Enzymes (Supplementary Table 1):

This table provides a comprehensive overview of the protein factors and enzymes involved in the assigned post-translational modification pathway. It includes information on enzymes responsible for adding and removing the modification, as well as the modification itself if it acts as a protein modifier (e.g., ubiquitin, SAMP, Pup).

b. Phylogenetic Distribution (Supplementary Table 2):

This table illustrates the phylogenetic distribution of the protein factors associated with the assigned post-translational modification system. It helps to understand the evolutionary conservation and diversity of the modification pathway across different biological domains.

c. Known Protein Targets and Affected Residues (Supplementary Table 3):

This table compiles known protein targets and the specific amino acid residues affected by the assigned post-translational modification. It serves as a reference for understanding the functional implications and regulatory roles of modification in cellular processes.

6. **Supplementary Figures (voluntary):** Present supplementary figures that support the findings and analysis presented in the report, clearly indicating the source of each.

Supplementary Table 1: Protein factors of the assigned post-translational modification pathway. This table should include the enzymes that add and remove the post-translational modification and the modification itself if it is a protein modifier (e.g., ubiquitin, SAMP, Pup).

Supplementary Table 2. Phylogenetic distribution of the protein factors of the assigned post-translational modification system.

Supplementary Table 3. Known protein targets and affected amino acid residues of the assigned post-translational modification pathway.

Note: Ensure proper documentation of each student's contribution by following these guidelines:

- Include page numbers at the bottom of each page of your project paper for easy reference.
- Include the initials or names of each student next to the sections they contributed to. This will clarify which sections of the project were contributed by each student and aid in grading.

Following these guidelines will facilitate transparent documentation of contributions and enhance the assessment process so each student is fairly graded.

ORAL GROUP PRESENTATION PORTION OF THE PROJECT (100 POINTS):

In this segment, students will present the contents of their written report through a recorded slide presentation. Each presentation should not exceed 20 minutes. Each student will be graded individually based on their contributions to the group project. Thus, students need to introduce themselves during the presentation and initial the slides for

which they have contributed. Additionally, include your names on the slides you are presenting.

Guidelines for recording the slide presentation.

- Develop a General Outline: Within the first few days of class, collaborate with your team to create a comprehensive outline for the slide presentation. Use this outline as a guide to evenly distribute the workload among team members.
- Record the slide presentation along with an audio recording that guides the viewer through the content. Clearly identify yourself during the recording to ensure individual contributions are recognized.
- It's recommended to use the 'record slide show' option in PowerPoint for recording the group presentation. Each student can record their portion separately, and these recordings can later be merged into a single PowerPoint (.pptx) file.
- Once the recording is complete, one of the group members should upload the presentation to Canvas. Please designate a team leader for this task to ensure timely submission.

SCIENTIFIC PEER EVALUATION OF WRITTEN PROJECT (100 POINTS):

Objective:

Each student will provide an independent scientific review (500-700 words) of the group projects presented by their peers. This evaluation aims to foster critical thinking, enhance scientific communication skills, and provide constructive feedback to peers.

Review Content:

1. **Written Summary:**
   - Provide a concise summary of each modification made by the group.

2. **Critical Evaluation:**
   - Assess the strengths and weaknesses of the group project, supported by appropriate scientific rationale.
   - Focus on the following scientific criteria:
   - Scientific Accuracy: Assess the accuracy and validity of the scientific content.
   - Approach: Evaluate the methodology and approach used in the project.
   - Innovation: Identify any novel or creative aspects introduced.
3. **Impact:**
   - Analyze the potential impact or significance of the project within the scientific community.
4. **Scoring:**
   - Assign scores ranging from 1 (highest) to 10 (lowest) for each criterion, providing justification for each score given.

Note: Focus on the scientific content and avoid commenting on the presentation style or grammar.

WEEKLY COURSE SCHEDULE

Week	Starts	Lectures or activities	Deliverables
1	5/12	• **Introduction Lecture.** • Office hours to answer any questions: **5/16** 10AM EST.	• **Quiz 1:** Syllabus
2	5/19	• **Lecture 1.** Overview of the different types of post-translational modifications. • Assign students to group projects. • Students work on group projects.	• **Quiz 2.** Based on Lecture 1.
3	5/26	• **Lecture 2.** Methods to study PTMs. • Students work on the written report.	• **Quiz 3.** Based on Lecture 1. • Deliverable: **Group project – a division of work and a 1-page draft** of the proposed document.
4	6/2	• Students work on the written report. • Office hours: 6/7 10 AM EST	• **Group project – at least five references per student** (individual submissions) related to the group project.
5	6/9	• Students work on the written report. • Read assigned paper.	• **Quiz 4** based on assigned literature
6	6/16	• Students work on the written report. • June 19: Juneteenth • Start work on oral presentation. • Office hours: 6/21 10 AM EST	
7	6/24	• Summer break	
8	6/30	• Students work on group project. • Students work on oral presentation. • July 4: Independence Day	
9	7/7	• Scientific feedback from the instructor. • Assignment of papers for peer evaluation. • Students work on peer evaluations. • Work on oral presentation	**Group project –written report** due at the end of the week
10	7/14	• Work on oral presentation. • Students work on peer evaluations.	• **Group project – oral presentation** due at the end of the week
11	7/21	• Work on peer evaluations. • Office hours: 7/19 10 AM EST	
12	7/27	• Final presentations and discussions. • Course wrap-up and final remarks.	• **Scientific peer evaluation** of projects.
13	8/4	• Course feedback and evaluations.	

UF POLICIES

Privacy

Any online class sessions may be audio-visually recorded. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image.

Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to having your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared.

As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

University Policy on Accommodating Students with Disabilities

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center. It is important for students to share their accommodation letter with their instructor and discuss their access needs as early as possible in the semester. Accommodations are **not** retroactive.

University Policy on Academic Conduct

UF students are bound by The Honor Pledge, which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code specifies behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor for this class.

Plagiarism

The Student Honor Code and Student Conduct Code states that:

- "A Student must not represent as the Student’s own work all or any portion of the work of another. Plagiarism includes but is not limited to:
- Stealing, misquoting, insufficiently paraphrasing, or patch-writing.
- Self-plagiarism, which is the reuse of the Student’s own submitted work, or the simultaneous submission of the Student’s own work, without the full and clear acknowledgment and permission of the Faculty to whom it is submitted.
- Submitting materials from any source without proper attribution.
- Submitting a document, assignment, or material that, in whole or in part, is identical or substantially identical to a document or assignment the Student did not author."

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing a course evaluation online via GatorEvals. The university has provided guidance on how to give feedback.

Students will be notified when the evaluation period opens and can complete the evaluation either through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via the GatorEvals website.

Summaries of course evaluation results are available to students at the GatorEvals results page.

Etiquette and Netiquette

All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions, and chats. UF has provided a netiquette guide.

Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course.

A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services.

A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Policy on Course Syllabi 3 UF, Academic Affairs, August 5th, 2021, Honor Code and Student Conduct Code.

Copyright

All course materials posted on the Canvas course website are assembled and intended for students taking MCB5205 **only**, and only available for student use from our secure Canvas

course website. Reposting any of these materials and sharing them via such resources as StudySoup, Course Hero, YouTube, Quizlet, Facebook, etc. is not permitted by the instructor. Unauthorized re-posting of course materials (including textbook PDFs) may infringe on UF's copyright policies and the Fair Use Act.

GETTING HELP AND ADDITIONAL RESOURCES

For issues with technical difficulties for e-Learning, please contact the UF Computing Help Desk. The phone number is (352) 392-HELP (4357).

Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from the Help Desk when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST email your instructor within 24 hours of the technical difficulty if you wish to request a make-up.

More Technical Resources

- UF Licensed Software Students can access software programs like Office 365 and Adobe at free or reduced rates.
- UF All Access The University of Florida's digital course materials program. Selected courses are available through UF All Access to provide students with the lowest prices on their eBooks and courseware products.
- UF Apps Provides access to software applications from any computing device--laptops, tablets, desktops, and smartphones—from any location, at any time.
- VPN The Gatorlink VPN service provides secure remote access to the University of Florida network and makes it appear as if your computer were physically attached to the campus network. By using the Gatorlink VPN client, you may access resources on the UF network that are not typically available over an Internet path.
- Canvas Quickstart Guide This short guide will get you started with using Canvas.
- Training and Safety UFIT offers free software and other technical training sessions for students, teachers, and staff.
- Safe Computing Practices Learn how to protect your computer from threats regardless of brand, model, and operating system.
- Zoom is an easy-to-use video conferencing service available to all UF students, faculty, and staff that allows for meetings of up to 100 participants.

More Resources for Online Students

Available at the Distance Learning website. These include:

- Counseling and wellness resources
- Disability resources
- Resources for handling student concerns and complaints
- Library Help Desk support

HEALTH AND WELLNESS

If you or someone you know is in distress, please visit the U Matter, We Care website or call 352-392-1575 to refer or report a concern. A team member will reach out.

Visit the Counseling and Wellness Center website or call 352-392-1575 for information on crisis services and non-crisis services.

Visit the Student Health Care Center website or call 352-392-1161 for 24/7 information on finding the care you need.

For safety and support, visit the University Police Department website or call 352-392- 1111 (or 9-1-1 for emergencies).

For immediate medical care, call 352-733-0111 or go to the UF Health/Shands Emergency Room and Trauma Center at 1515 SW Archer Road.

For prevention services focused on optimal wellbeing, including wellness coaching for academic success, visit the GatorWell website or call 352-273-4450.

COVID-19

In response to COVID-19, UF has established practices to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

UF COVID Information

UF Guidance on Health and Wellness

ACADEMIC RESOURCES

- Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.
- Library Support: Various ways to receive assistance with respect to using the libraries or finding resources. Distance student resources are also available.
- Teaching Center: Broward Hall, 352-392-2010 or to make an appointment, 352-392-6420. General study skills and tutoring.
- Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.
- Student Complaints and Grievances Information is available in the Student Honor Code and Conduct Code.
- University Registrar Find information on records, data, and enrollment.
- Academic Deadlines and Calendar Consult for all important upcoming events.
- UF Online Resources Access to many services to help you achieve your goals.

ACCESSIBILITY AND PRIVACY POLICIES

For information about the privacy policies of the tools used in this course, see below:

- Adobe
  - Adobe Privacy Policy
  - Adobe Accessibility
- Instructure (Canvas)
  - Instructure Privacy Policy
  - Instructure Accessibility
- Microsoft
  - Microsoft Privacy Policy
  - Microsoft Accessibility
- PlayPosit
  - PlayPosit Privacy Policy
  - PlayPosit Accessibility
- Perusall
  - Perusall Privacy Policy
  - Perusall Accessibility
- Sonic Foundry (Mediasite Streaming Video Player)
  - Sonic Foundry Privacy Policy
  - Sonic Foundry Accessibility (PDF)
- YouTube (Google)
  - YouTube (Google) Privacy Policy
  - YouTube (Google) Accessibility
- Zoom
  - Zoom Privacy Policy
  - Zoom Accessibility

DISCLAIMER

Information contained in this syllabus is, to the best knowledge of this instructor, considered correct and complete when distributed to students. The instructor reserves the right, acting within the policies and procedures of the University of Florida, to make necessary changes in course content or instructional techniques with notification to students.