

MCB6937 Post-translational Modifications in Microbiology

Course Information

MCB 6937. Post-translational Modifications in Microbiology. Students will learn about post-translational modifications (PTMs) in microbiology. Topics will include: i) the different types, functions, and mechanisms of PTM, ii) the methods used to identify PTMs, and iii) the impact PTMs have on cell biology, human health, and biotechnology.

Delivery Method/Meeting time

ALL ASSIGNMENTS, QUESTION /ANSWER SESSIONS, AND OTHER MATERIALS WILL BE AVAILABLE ONLINE ASYNCHRONOUSLY.

Credit Hours: 2

Contact Information

Instructor

Mariola J Edelmann

Phone Number

352-846-0954

Email

medelmann@ufl.edu

Office Hours

per appointment

For questions about course content, your grade, or other personal issues, use the Canvas mail tool. Expect a response within 24 hours.

Course Description

Goal and detailed description: The overall goal of this class is to enhance student learning in the field of microbiology and to network students with professionals within the scientific community. To this end, the course will take an innovative approach to student learning through interactive group projects and proposal writing. The students will prepare projects that will undergo a scientific review by their class peers and faculty instructors. Projects that pass the scientific review process will be made publicly available through Canvas with the ultimate goal to provide a searchable web portal of post-translational modifications in microbiology. While proteomics and other systems biology approaches have facilitated the identification of a wide variety of novel post-translational modifications, high-throughput data related to these modifications are not well synthesized and readily available to the scientific community (particularly data related to bacteria and archaea). This course will therefore serve as a resource to the scientific community. Students in the group will benefit from being listed as co-authors on the projects (with student permission). In addition to synthesizing published research findings, the group projects will require students to think ‘outside the box’. One unique aspect of this course is the opportunity students have to learn the basics of writing their own research proposals. Students will identify

gaps of knowledge requiring further investigation, elaborate their own research hypotheses, and design experimental approaches to rigorously examine them. The research proposals will be ‘scored’ based on their significance, innovation, impact, and scientific approach, and rigor. We expect the student to take advantage of post-translational modifications to improve human health and food, agricultural, and natural resources. Overall, this course is designed to provide an opportunity for students to not only learn about how post-translational modifications work but also start learning about writing proposals as a method to better understand a specific scientific field, and ultimately fund their own ideas and projects in the future. In this way, students will learn how they can better achieve their professional goals and, subsequently, serve our community.

Course Objectives

By the end of this course, you will be able to:

1. To become knowledgeable on the molecular and cellular biology of post-translational modifications (PTMs)
2. To gain the concepts and skills needed to understand and critically evaluate research articles that address PTMs
3. To creatively apply knowledge of PTMs to current problems (g. controlling pathogenesis, sequestering carbon dioxide, engineering microbial biocatalysts in the production of renewable fuels and chemicals)
4. To improve teamwork skills
5. To utilize knowledge and skills in reviewing peer’s projects

Course Requirements

All required course materials will be available through the Canvas e-Learning site (<http://elearning.ufl.edu/>). Instructions for and submission of assignments will also be through Canvas.

Required Textbook

No textbook is required.

Course Material and Assignments

All required course materials will be available through the Canvas e-Learning site (<http://elearning.ufl.edu/>). Instructions for and submission of assignments will also be through Canvas.

Weekly schedule and more details on grades are available via this link: [Schedule_dates.docx](#)

Assignments/Quizzes	Deadline	Points
Quiz 1	5/15	5 pts
Quiz 2	5/22	10 pts
Quiz 3	5/29	100 pts
Group project – division of work and 1-page draft of proposed project	5/29	25 pts

Group project - preliminary list of references (5 references per student)	6/05	20 pts
Group project - final written report	6/19	100 pts
Individual project – research proposal	7/10	100 pts
Scientific peer evaluation	7/17	100 pts
	Total:	460 pts
Extra credit (optional – resubmission of projects based on the comments)	7/31	25 pts

Written Group Project (100 points for final report):

Students will be assigned to groups by the instructors and tasked with gathering and synthesizing information for a specific type of post-translational modification from the list below (see *List of post-translational modifications for group projects*). The students should focus on the post-translational modifications that occur on **proteins** (and not DNA or lipids) in **ARCHAEA** or **BACTERIA**. Alternatively, the focus of the project could be on the post-translational modifications that occur on host or bacterial proteins that are catalyzed by enzymes from bacterial pathogens.

List of possible post-translational modifications for group projects

1. Phosphorylation
 0. Arginine
 1. Serine/Threonine and Tyrosine
 2. Histidine and Aspartic Acid
2. ADP-ribosylation
3. Methylation
4. Glycosylation
5. Acetylation (N α - and N ϵ -acetylation)
6. Lipidation
7. S-Nitrosylation and S-Sulfhydration
8. S-Glutathionylation
9. Methionine oxidation – as a reversible process
10. Uridylation
11. Adenylation
12. Unique modifications of translation elongation factors (including attachment of ethanolamine phosphoglycerol, diphthamide and hypusine)
13. Ubiquitin-like modifications (samylation, pupylation)
14. Ubiquitin modification in Eukaryota catalyzed by bacterial (pathogen) enzymes
15. Targeted proteolysis (select a regulatory protease – g., Clp, Lon, Proteasome)
16. Specific polypeptide cleavage (g., removal of signal peptides)

The students will gather, synthesize, and present information on the post-translational modification in format as outlined below.

Templates (in Excel and MS word) and a PowerPoint lecture are posted in the Modules section of Canvas that provide instructions to guide students on how to properly organize and complete the written portion of the group project. The overall aim of the written project is to assist the student in learning how to properly gather, synthesize, and write a well-rounded summary that provides the reader with a complete understanding of a specific type of post-translational modification in microbiology. The written project includes proposal (XI), to which all students should contribute.

The templates (posted in Canvas and based on the ***“Required aspects of the post-translational modification paper”*** listed below) are designed to aid the student in developing a proper outline that will help guide the writing of a paper that is of high scientific quality. The summary paper should include 15 to 20 pages of material. A title page and appropriate figures/tables are required. Three Supplementary Tables 1-3 are required (see list below) and should include the modified protein name, modified protein Accession Number, modified residue (including amino acid position if known), enzymes which catalyze this modification and appropriate reference(s) (according to the Excel template posted in the Modules section of Canvas). References are required and should be included on additional pages (no page limit). Font requirements are the following: 1-inch margins, font size must be 11 points (smaller text is acceptable in figures, graphs, diagrams, and charts). The paper must be uploaded through Canvas e-learning. This paper will be scanned by TurnItIn for plagiarism. Please see the final page of the syllabus for details on the **UF policy regarding plagiarism**. Contact us if you have doubts what constitutes plagiarism. Each student will be **graded individually** (not as a single group grade) for the contributions they have made to the group project. **Each student must contribute to at least one of the Supplemental Tables listed below.** Students are required to list their name on the portions of the written project (including the supplemental Tables) for which they have contributed.

Required aspects of the post-translational modification paper:

Title

Student Name, *Department of Microbiology and Cell Science, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida, USA.*

1. Definition.
2. Detailed chemistry.
3. Overview of the attachment and removal of the post-translational modification from target proteins.
4. Details on protein factors of the post-translational modification including enzyme(s) catalyzing the addition and removal of the post-translational modification (summarized below and in Supplementary Table 1).
5. General distribution/function of protein modification among the three domains of life (for details on the distribution of protein homologs associated with the post-translational modification pathway see Supplementary Table 2).
6. Detailed list of known protein targets (and affected residues). A detailed list of known protein targets is compiled from references x, y and x and summarized in Supplementary Table 3.
7. Biological function of post-translational modification.
8. Methods used to detect and map the site(s) of post-translational modification.
9. Insight into how this post-translational modification may benefit human health and and/or the food, agricultural, and natural resources.
10. Quote obtained from a scientist about the post-translational modification of choice (**5 bonus points**).

References

Tables. (be sure to state if table is original or include citation and a statement that the table is from a publication)

Figures. (be sure to state if figure is original or include citation and a statement that the figure is from a publication)

Supplementary Table 1. Protein factors of the assigned post-translational modification (PTM) pathway. Note that the protein factors are defined as the enzymes that add and remove the post-translational modifications and the modification if it is a protein modifier such as ubiquitin, SAMP, Pup, etc.

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

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

Be sure to include page numbers at the bottom of each page of your project paper

Outline of research proposal (100 points):

Each student will write a research proposal based on the chosen modification (most likely the one which was a subject of his/her group project) and use the published papers as the basis for a novel grant/research proposal. Each proposal will be **2-3 pages in length** (plus additional pages for references) and consist of the following **sections**:

1. Introduction

A brief review of the relevant literature should be presented (can be synthesis of the written group project but individual input is required).

1. Background and Significance

In this section, the relevant preliminary data from the chosen papers will be described. The major outstanding questions that arise from this work and that will form the basis for the proposed studies should then be stated. The rationale for further studies should be described (i.e. what is the importance of answering the stated questions, including the clinical significance? What new understanding will be gained? How will this impact science and/or medicine?).

1. Central hypothesis

A succinct hypothesis should be formulated and stated which is based on the evidence presented in the Background and Significance section. For example

Based on the evidence host-mediated Asparagine (Asn) hydroxylation of Legionella pneumophila effectors by host asparagine hydroxylase, FIH, is required for their functions in biogenesis of the Legionella-containing vacuole (LCV) and intracellular proliferation of Legionella pneumophila.

1. Specific Aims

You should propose **2-3 specific aims** which each represent a series of experiments which will test aspects of your central hypothesis. For example, possible specific aims arising from the hypothesis stated above:

Aim 1. Asn hydroxylation of AnkH effector and its role in the intracellular infection

Aim 2. Asn hydroxylation of AnkB effector and its role in the intracellular infection

Aim 3. Asn hydroxylation of other Legionella pneumophila effectors and its role in biogenesis of the Legionella-containing vacuole

1. Research Design and Methods

Here you will describe the actual experiments that you will perform in each aim. You will be describing in a logical way experiments you plan to address in each aim. You may need to add alternative approaches (experiments) in case the first set of proposed experiments fail. This section should be broken into three separate sections, one for each aim. What will define the success or failure of your proposal and what metrics need to be considered to determine the significance of your observation

Scientific Peer Evaluation of the written project (100 points):

Each student will provide an independent scientific review (500-700 words) of one of the assigned projects that were written by their peers. The reviews should include: i) a written summary about each modification, ii) a critical evaluation of the strengths/weaknesses of the written project with appropriate scientific rationale (focus on each of the scientific criteria listed below – do not simply comment on the presentation style), and iii) scores (1 highest – 9 lowest) for each of the following criteria:

- Scientific Accuracy
- Approach
- Innovation
- Impact/Significance

Prerequisites

Prereq: CHM 2211 (C) & (MCB 3020 or 3023) (C) & (MCB 3020L or 3023L)

Minimum Technology Requirements

The University of Florida expects students entering an online program to acquire computer hardware and software appropriate to their degree program. Most computers are capable of meeting the following general requirements. A student's computer configuration should include:

- Webcam
- Microphone
- Broadband connection to the internet and related equipment (cable/DSL modem)
- Microsoft Office Suite installed (provided by the university)

Individual colleges may have additional requirements or recommendations, which students should review before starting their program.

Minimum Technical Skills

To complete your tasks in this course, you will need a basic understanding of operating a computer and using word processing software.

Materials/Supply Fees

There is no supply fee for this course.

Zoom

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.

You can find resources and help using Zoom at the [University of Florida's Zoom](#) website.

Course Policies

Requirements for make-up exams, assignments, and other work in this course are consistent with university policies that can be found on [UF's Attendance Policies](#) website.

As this is an online class, you are responsible for observing all posted due dates and are encouraged to be self-directed and take responsibility for your learning.

Course Evaluations

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available on the GatorEvals [Providing Constructive Feedback](#) FAQ page. Students will be notified when the evaluation period opens and can complete evaluations 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 Public Results](#) page. More information about UF's course evaluation system can be found at the [GatorEvals Faculty Evaluations](#) website.

Grading Policy

I will make every effort to have each assignment graded and posted within one week of the due date.

Course Grading Policy

Assignment	Points
Quiz 1	5 pts
Quiz 2	10 pts
Quiz 3	100 pts
Group project – division of work and 1-page draft of proposed project	25 pts
Group project - preliminary list of references (5 references per student)	20 pts
Group project - final written report	100 pts
Individual project – research proposal	100 pts
Scientific peer evaluation	100 pts
TOTAL	460 pts
Extra credit (optional – resubmission of projects based on the comments)	25 pts

Grading Scale

Percent range		Grade	Grade Points
100 %	to 95.0%	A	4.00

Percent range		Grade	Grade Points
< 95.0 %	to 90.0%	A-	3.67
< 90.0 %	to 87.0%	B+	3.33
< 87.0 %	to 84.0%	B	3.00
< 84.0 %	to 80.0%	B-	2.67
< 80.0 %	to 77.0%	C+	2.33
< 77.0 %	to 74.0%	C	2.00
< 74.0 %	to 70.0%	C-	1.67
< 70.0 %	to 60.0%	D+	1.33
< 60.0 %	to 59.0%	D	1.00
< 59.0 %	to 55%	D-	0.67
<55		E	0.00

See the [current UF grading policies](#) for more information.

UF Policies

University Policy on Accommodating Students with Disabilities

Students with disabilities requesting accommodations should first register with the [Disability Resource Center](#) (352-392-8565) by providing appropriate documentation. Once registered, students will receive an accommodation letter that must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

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 honesty 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 [Student Honor Code and Student Conduct Code](#) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in 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."

Netiquette and Communication Courtesy

It is important to recognize that the online classroom is in fact a classroom, and certain behaviors are expected when you communicate with both your peers and your instructors. These guidelines for online behavior and interaction are known as netiquette.

Security

Remember that your password is the only thing protecting you from pranks or more serious harm.

- Don't share your password with anyone.
- Change your password if you think someone else might know it.
- Always log out when you are finished using the system.

General Guidelines

When communicating online, you should always:

- Treat the instructor with respect, even via email or in any other online communication.

- Always use your professors' proper title: Dr. or Prof., or if you are unsure use Mr. or Ms.
- Unless specifically invited, don't refer to a professor by their first name.
- Use clear and concise language.
- Remember that all college-level communication should have correct spelling and grammar.
- Avoid slang terms such as "wassup?" and texting abbreviations such as "u" instead of "you."
- Use standard fonts such as Times New Roman and use a size 12 or 14 point font.
- Avoid using the caps lock feature AS IT CAN BE INTERPRETED AS YELLING.
- Limit and possibly avoid the use of emoticons like :) .
- Be cautious when using humor or sarcasm as tone is sometimes lost in an email or discussion post and your message might be taken seriously or be construed as being offensive.
- Be careful with personal information (both yours and others).
- Do not send confidential information via email.

Email

When you send an email to your instructor, teaching assistant, or classmates, you should:

- Use a descriptive subject line.
- Be brief.
- Avoid attachments unless you are sure your recipients can open them.
- Avoid HTML in favor of plain text.
- Sign your message with your name and return email address.
- Think before you send the email to more than one person. Does everyone really need to see your message?
- Be sure you REALLY want everyone to receive your response when you click, "Reply All."
- Be sure that the message author intended for the information to be passed along before you click the "Forward" button.

Discussion Boards

When posting on the discussion board in your online class, you should:

- Check to see if anyone already asked your question and received a reply before posting to the discussion board.
- Remember your manners and say please and thank you when asking something of your classmates or instructor.
- Be open-minded.
- If you ask a question and many people respond, summarize all posts for the benefit of the class.
- When posting:
 - Make posts that are on-topic and within the scope of the course material.
 - Be sure to read all messages in a thread before replying.
 - Be as brief as possible while still making a thorough comment.
 - Don't repeat someone else's post without adding something of your own to it.
 - Take your posts seriously. Review and edit your posts before sending.
 - Avoid short, generic replies such as, "I agree." You should include why you agree or add to the previous point.
 - If you refer to something that was said in an earlier post, quote a few key lines so readers do not have to go back and figure out which post you are referring to.
 - Always give proper credit when referencing or quoting another source.
 - If you reply to a classmate's question make sure your answer is correct, don't guess.
 - Always be respectful of others' opinions even when they differ from your own.

- When you disagree with someone, you should express your differing opinion in a respectful, non-critical way.
- Do not make personal or insulting remarks.
- Do not write anything sarcastic or angry, it always backfires.
- Do not type in ALL CAPS, if you do IT WILL LOOK LIKE YOU ARE YELLING.

Zoom

When attending a Zoom class or meeting, you should:

- Do not share your Zoom classroom link or password with others.
- Even though you may be alone at home, your professor and classmates can see you! While attending class in your pajamas is tempting, remember that wearing clothing is not optional. Dress appropriately.
- Your professor and classmates can also see what is behind you, so be aware of your surroundings.
- Make sure the background is not distracting or something you would not want your classmates to see.
 - When in doubt use a virtual background. If you choose to use one, you should test the background out first to make sure your device can support it.
 - Your background can express your personality, but be sure to avoid using backgrounds that may contain offensive images and language.
- Mute is your friend, especially when you are in a location that can be noisy. Don't leave your microphone open if you don't have to.
- If you want to speak, you can raise your hand (click the "raise hand" button at the center bottom of your screen) and wait to be called upon.

Getting Help

Technical Difficulties

For help with technical issues or difficulties with Canvas, please contact the UF Computing Help Desk at:

- <http://helpdesk.ufl.edu>
- 352-392-HELP (4357)
- Walk-in: HUB 132

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

Health and Wellness

- **U Matter, We Care:** If you or someone you know is in distress, please email umatter@ufl.edu, call 352-392-1575, or visit [U Matter We Care](#) to refer or report a concern, and a team member will reach out to the student in distress.
- **Counseling and Wellness Center:** Visit the [UF Counseling & Wellness Center](#) website or call 352-392-1575 for information on crisis services and non-crisis services.

- **Student Health Care Center:** Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the [UF Student Health Care Center](#) website.
- **University Police Department:** Visit the [UF Police Department](#) website or call 352-392-1111 (or 9-1-1 for emergencies).
- **UF Health Shands Emergency Room/Trauma Center:** For immediate medical care in Gainesville, call 352-733-0111, or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the [UF Health Shands Emergency Room/Trauma Center](#) website.

Academic and Student Support

- **Career Connections Center:** For career assistance and counseling services, visit the [UF Career Connections Center](#) website or call 352-392-1601.
- **Library Support:** For various ways to receive assistance concerning using the libraries or finding resources, visit the [UF George A. Smathers Libraries Ask-A-Librarian](#) website.
- **Teaching Center:** For general study skills and tutoring, visit the [UF Teaching Center](#) website or call 352-392-2010.
- **Writing Studio:** For help with brainstorming, formatting, and writing papers, visit the [University Writing Program Writing Studio](#) website or call 352-846-1138.