BCMP 234: *Cellular Metabolism and Human Disease*
Spring 2024

Course Director: Thomas Michel, MD, PhD
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Associate Course Director: Emmanuel J. Rivera Rodríguez, MS, PhD
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Meeting Time: **M, W, F: 9 – 10:22am. First meeting: Monday, January 22nd, 2024**

Location: The class will be held live in-person in classrooms in the Tosteson Medical Education Center (TMEC) at HMS; specific classroom venues are noted in the course schedule here.
Please note that because interactive teaching elements are incorporated throughout the course, *attendance is required*.

Day by Day Course Schedule:
For the most recent version of the schedule, please click here.

Course Description, in brief:
BCMP 234 explores the relationships between cellular and organismal metabolism and human disease. Biochemical pathways of carbohydrate-, lipid-, nucleotide-, metal-, and protein metabolism are discussed in the context of their impact on human organ systems in inborn and acquired metabolic derangements, and integrated with analysis of human disease states. The course utilizes a case-based approach combining lectures, discussions, and critical reading conference sections with weekly patient encounters. *BCMP 234 is offered as a semester-long course under the auspices of the Division of Medical Sciences at Harvard Medical School and the Department of Medicine at Brigham and Women's Hospital.*

Prerequisites:

- All HILS graduate students are eligible to enroll in this class
- For Harvard College undergrads, knowledge of introductory biochemistry, genetics, and cell biology (MCB 63 or MCB 60, and MCB 64, or equivalent course work) are required as well as 1 year of organic chemistry

Special requests for this course: Persons with disabilities who would like to request accommodations or have questions may contact the course director and administrator in advance for further assistance. We ask that you kindly come to class on time to avoid any interruptions during our lectures.

Course Website:

The website includes lecture slides, assigned readings, and guides to aid in preparation for lecture and critical reading conference sections. Log into Canvas using your Harvard ID number and PIN at: https://canvas.harvard.edu/courses/115900

Teaching Staff:

Course Director: Professor Thomas Michel, MD, PhD, HMS/Brigham and Women's Hospital
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Associate Course Director, Course Administrator, and LHBTM Curriculum Fellow:
Emmanuel J. Rivera Rodríguez, MS, PhD, emmanuel_riverarodriguez@hms.harvard.edu

Teaching Fellows – all TFs and Emmanuel can also be reached via Slack

- **Alanis Carmona:** alaniscarmona@fas.harvard.edu
- **Isabella Del Priore:** isabelladelpriore@g.harvard.edu
- **Taylor Covington:** tcovington@g.harvard.edu

Additional HMS/BWH faculty lecture on topics of their expertise throughout the course.

Office Hours:

Weekly office hours for core faculty and teaching fellows will be posted on Canvas.

Course Aims and Objectives:

The *learning objectives* of this course are:

- Understand key metabolic pathways in mammalian cells at the molecular level
  - Integrate cellular metabolism with organ homeostasis in human biology
  - Learn the impact of acquired and genetically-determined human diseases on key metabolic pathways, and vice versa
  - Identify targets for pharmacological intervention
- Encounter patients with metabolic diseases and understand approaches to their diagnosis and therapy
- Develop skills in the analysis, assimilation, understanding, and effective communication of knowledge in metabolism
- Understand experimental methodologies in metabolism and how these approaches are applied to acquire new knowledge
- Identify major unanswered questions and experimental challenges in the field

Course Policies and Expectations:

- Students will be responsible for learning the basic material *for the upcoming week* of the course using posted lecture notes, the textbook and its companion website (listed below under "Materials"), and/or assigned readings. Please consult the list of what students should "Know and Understand" for the following Monday's lecture.
- Interactive discussions form a critical part of the course: preparing for and participating actively in class is strongly recommended and will benefit everyone in 234.

- Attendance at all course sessions is important for your success in the course. **Students are allowed 1 excused absence per semester**; however, subsequent absences will detract from the participation grade, because much of the interactive learning in the classroom cannot be replicated without attending class. **Extenuating circumstances will be addressed on a case-by-case basis: please communicate with your TF and Dr. Michel or Emmanuel as far in advance as possible.**
- If you will be absent from any critical reading sections, please let your section TF know (ahead of time, if possible).
- ***Make-up assignments:*** Students who miss class are responsible for authoring a 2-page double-spaced critique and summary of the assigned readings that draw connections to pathways discussed in other sessions of the course. This summary paper must be submitted to the student's TF via email within 1 week of the missed section. If your absence is excused, you will be able to get full credit by submitting the makeup assignment to your TF or Emmanuel. Unexcused absences will be decided on a case-by-case basis but will almost always result in no credit or partial credit.
- Punctuality is a component of the participation grade (see rubric).
- In order to show respect for the patients who have volunteered their time to join us during the course, please *DO NOT* enter clinical correlation sessions late.

Materials:

Textbook (optional and highly-recommended):
"Biochemistry", 9th edition (2018), Berg, Tymoczko & Stryer, WH Freeman, NY. Access it on Canvas on the *Library Reserves* tab on the left. Only two people can access the textbook simultaneously. Once the book is accessed, it will be available to the student for 3 hours. If more than 2 students are seeing the book at the moment, additional people trying to access it will be placed in a queue.

Additional resources: Review articles or texts will be identified for selected topics and posted on the course website.

Components of the course (See course description for details):

● **Pathway of the Week (PoW):** These are lectures from faculty introducing the metabolic pathway of the week and the relevant molecular biology.

● **Clinical Correlation (CC):** Classes by faculty who are usually accompanied by a patient for a patient encounter.

● **Maestros of Metabolism (MoM):** These are usually research talks from faculty conducting metabolism research.

● **Critical Reading Conferences (CRC):** These are discussion sessions led by the TFs centered around a primary literature article.

● **Cell of the Week (CoW):** These are 20-minute lessons aiming to introduce you to a cell type involved in the PoW.

● **Student Presentations:** These are 22-minute presentations given by the students to their classmates and course faculty over the final weeks of the course.

Detailed Course Description:

BCMP 234 explores the relationships between cellular and organismal metabolism and human disease. Biochemical pathways of carbohydrate-, lipid-, nucleotide-, metal-, and protein metabolism are discussed in the context of their impact on human organ systems in inborn and acquired metabolic derangements and integrated with analysis of human disease states. Organismal pathways involved in starvation, satiety and obesity will also be discussed. Student presentations, held during the final 3 weeks of the course, will cover topics including: the roles of vitamins as enzyme cofactors, the impact of metabolic diseases on specific organ-systems, and additional metabolic pathways in human diseases that are not covered elsewhere in the course. BCMP 234 utilizes a case-based approach combining lectures, discussions, and critical reading conference sections with weekly patient encounters.

The course focuses on a different metabolic pathway each week: first examining biochemical mechanisms of the pathway in a molecular and cellular context, and then exploring implications of the pathway in organ function and human disease. The 3 weekly course meetings include an interactive lecture/discussion session (typically on Mondays), classroom-based patient encounters and/or clinical case studies on Wednesdays, and student-led critical reading conferences with faculty on Fridays. This year, due to the integration of wellness days instead of Spring Break, some weeks have an altered layout.

Typically, the first class meeting of the week is a faculty-led discussion focusing on the molecular and cellular details of a specific metabolic pathway **(Pathway of the Week or PoW)** that is implicated in human disease, which is the theme for the week in the course. Some sessions will begin with an interactive **Cell of the Week (CoW)** lecture incorporated with method(s) relevant to the cell type, led by one of the Teaching Fellows, who will present cell biological correlations with the PoW. Then, expert research and clinical faculty will lead an interactive lecture/discussion of the PoW, drawing examples from genetic and acquired diseases that result from perturbation of the PoW.

Clinical correlation (CC) sessions are usually held on Wednesdays. These will include patient interviews and/or interactive reviews of clinical cases that illustrate key principles in metabolism. These course meetings will focus on the application of molecular principles to diagnostic and therapeutic strategies in the management of metabolic disorders.

On some Fridays, the class will meet for **Critical Reading Conference (CRC)** sections in small groups for literature discussion. CRC sections are held in small sections to facilitate discussion of the assigned primary research articles. Students are required to read the assigned publication(s) in detail prior to section and come prepared to critically present and analyze all aspects of the content, context, and implications of these papers. Students may be selected at random to lead portions of the discussion. Your TF will discuss the CRC expectations during the first day of classes. Sections usually include a brief interactive review of the prior weeks' metabolic pathways, to integrate relevant

material presented during prior weeks, followed by critical discussion of the assigned articles and future directions.

Maestros of Metabolism seminar series **(MoM)** will be led by investigators who work on cutting-edge research projects relevant to the course. During MoM sessions, instead of breaking into small groups, the assigned critical reading papers will be discussed at the conclusion of the seminar, in conjunction with discussing material presented by the guest speaker.

Slack participation (optional but recommended)

We have integrated Slack in our Canvas website (click on the Slack panel and you'll be directed to the BCMP234 Slack channel).
We are going to use slack to:

- Enable you to communicate in groups to get to know each other and discuss course-related topics
- Get to know your CRC group and your TF
- Ask questions (your TFs and your classmates)
- Send you reminders regarding upcoming deadlines and events
- Useful information such as links and resources
- Fun: We can get to know each other better and create a community

Please note that we are making your participation on Slack **optional**. This means that you'll not be missing out on announcements and important resources should you choose to not join Slack. However, we strongly encourage that you join and take advantage of the BCMP 234 Slack community.
Important Note: While Slack removes some of the barriers of email, please note that the HMS email terms of use policy apply to ALL messages (private or group) sent on Slack.

Assignments and Grading Procedures:

Summary of evaluation method:

Class Participation	35%
Final Presentation	35%
Case Responses (6 at 4.5% each)	27%
Practice student presentations	3%

The majority of your grade is based on your class participation (see participation rubric here) and your final presentation (see final presentation guidelines here for details).

- Students are also evaluated based on 6 problem-based papers, known as "Case Responses" (each worth 4.5%). **Case Responses** are designed to probe the individual student's understanding of core concepts in cellular metabolism and human disease, and students are encouraged to discuss their case responses with their teaching fellow. The first 5 case responses pertain to faculty presentations. **For the sixth case response,** each student will select a topic from one of their student colleagues' final presentations, and then prepare and answer his or her own case response question. **This final case *response is due on May 6.*** *All other case responses (#1-5) are due on Fridays by 11:59 PM EST.* Case responses will be graded on a ✓+, ✓, ✓- scale*. Responses submitted after midnight on Friday, Saturday, or on Sunday will lose one increment, two increments, or receive no credit, respectively.* Outstanding responses that thoroughly address all of the questions posed in the case response prompt with critical molecular detail and connections to pathways discussed in the course, and more from external peer-reviewed cited sources will receive ✓+'s. Responses that fulfill many of the above requirements, but are lacking some essential details and/or key molecular mechanisms will receive ✓ 's. Responses that are missing many key details and/or inadequately address the questions posed will receive ✓-'s. If your work receives a ✓-, please meet with your TF to address any misconceptions and brainstorm strategies to improve.

- Lastly, students will complete and submit **Post-lecture surveys.** These will be posted on Canvas and in the chat box on Zoom (if applicable) and must be completed by 11:59 P.M. on the day of each class. The post-lecture surveys are optional.

Case Response #6 guidelines:

For the final case response, students will prepare their own "case response" **question prompt *and answer*** based on one of their classmates' presentations delivered during the final weeks of the course. **This final case response is due on Monday, May 6, 2024**. When preparing your final case response, please adhere to these guidelines:

- Be sure that your question asks the responder to ***apply*** the information from the corresponding presentation and to think critically and/or creatively (i.e., check that simple regurgitation of presented information would not answer your question prompt).

- The overall answer to the question should require a ~1 page or less response, double-spaced. ***Remember to include the answer!***

- The question can be a multi-part question (but it doesn't have to be).

- The question should be integrative whenever possible (i.e., draws connections with material from other student presentations or previous lectures in 234, in addition to the presentation that you chose).

- Try to model your case response on case responses #1-5, from earlier in the semester.

- Your TFs are available to review a draft of this assignment (especially your designed case response question, to make sure that you are on track) if it is submitted to them well in advance of the assignment deadline. If you would like advance feedback, please submit your case response draft by 9am on **Sat, April 27**, and your TF will do their best to accommodate you.

Day by Day Detailed Course Schedule
For the most recent version of the schedule, please click here.