Biology 453 – Molecular Control of Metabolism and Metabolic Disease

Spring 2023 Syllabus

Class time: 8:00am - 9:15am, Tuesday/Thursday
Location: 1374 Genome Sciences Building

Instructor: Rob Dowen, Ph.D. (dowen@email.unc.edu)
Office: 321 Fordham Hall
Telephone: 919-962-1240
Office hours: Tuesday/Thursday 9:30-11:00am or by appointment

TA: Kylie VanDerMolen, 2nd year BBSP graduate student (kyliev@email.unc.edu)
Office: 312 Fordham Hall
Office hours: Thursday 9:30-10:30am or by appointment

Spring 2023 Course Delivery: As long as it is possible to do so safely, we will be meeting in person this semester. I understand that the ongoing COVID-19 pandemic may require changes to this plan and we will adjust accordingly. If I need to change the format of the course temporarily due to outbreaks of illness, I will announce this via email.

Course Description: This class will cover the small molecules, enzymes, signaling proteins, and pathways that control metabolic processes and those that are altered in metabolic disease. We will often take an experimental approach to explore and understand the fundamental aspects of metabolism. It is assumed that students are familiar with the basic principles of molecular biology and genetics (BIOL 220, required), cell biology (BIOL 240, required), organic chemistry (CHEM 261, recommended), and/or biochemistry (CHEM 430, recommended).

Course Objectives: Students taking this course will:

1) Understand how adjustments are made to energy utilization and identify the pathways that perform these metabolic functions at the molecular and cellular level.
2) Be able to differentiate the unique functions of each mammalian tissue and discuss how endocrine signaling modifies organ function.
3) Recognize how changes in organismal physiology alter metabolic function in healthy and disease states.
4) Synthesize knowledge to predict how alterations in the molecular regulation of metabolic pathways would impact cellular and tissue function.

Course Format: This course is a hybrid lecture and seminar course. The goals of the lectures will to be to introduce you to conceptual frameworks, historical context, and biological information relevant to the week's theme(s). Several times throughout the semester, class meetings will be focused on discussions of classic or recent papers from the scientific literature on the week's theme(s). Early in the semester, I will lead one of these discussions. Later, these discussions will be led by you, the students.

Textbook: Some of the lecture material will be taken from the textbook *Biochemistry with Clinical Correlations* (7th Edition; Thomas M. Devlin). This textbook is NOT required and other Biochemistry textbooks (e.g., Voet, Voet, and Pratt) or online material can be used to supplement the in-class lectures and discussions. All assessments will derived from the material covered in class.

Class Attendance Policy: Students are expected to arrive promptly to every class. Unexcused absences will result in loss of in-class participation points (as much as 6 pts. per class). Students are

also expected to meet all deadlines (assignments, quizzes, exams). Please make me aware of any extenuating circumstances that may prevent you from making these deadlines.

University Attendance Policy: As stated in the University's Class Attendance Policy, no right or privilege exists that permits a student to be absent from any class meetings, except for these University Approved Absences:

1. Authorized University activities
2. Disability/religious observance/pregnancy, as required by law and approved by Accessibility Resources and Service and/or the Equal Opportunity and Compliance Office (EOC)
3. Significant health condition and/or personal/family emergency as approved by the Office of the Dean of Students, Gender Violence Service Coordinators, and/or the Equal Opportunity and Compliance Office (EOC).

Participation: Class participation is required for this course and will be a major component of your final grade. The quality and content of student discussions/questions/answers will demonstrate that you have performed the assigned readings or assignments prior to the class. Class participation may include asking questions, commenting on other student's comments, responding when asked questions directly, and actively participating in small group work. When sharing with the whole class or in small groups, please remember to be courteous and respectful to others, to contribute in a productive and substantial way to the discussion, and to be mindful of the UNC Honor Code.

Readings and Assignments: Assigned readings and other homework materials are expected to be completed before class. Reading or audio/video assignments will be handed out regularly and will be posted electronically on the course site on Sakai. Reading and thinking about the assigned material before you come to class will enable you to participate fully in class discussions and to contribute to small group discussions on a daily basis. I will often distribute short quizzes or writing assignments based on the assignments. These will be completed outside of class and students should complete the assignment on the course website on Sakai (as instructed).

Exams: There will be two midterm exams during the semester and a final exam. The final exam will be cumulative, with an emphasis on any untested material. Exam questions may be taken from the lecture material or the paper presentations.

Student-led Paper Presentation: Throughout the semester there will be 9 student-led discussions of key papers in different fields related to metabolism. Groups of 2-3 students will present a paper from the primary literature that will be posted on Sakai at the beginning of the semester. Students will be able to sign up for their presentation date during the first week of class. EVERYONE will be involved in each presentation; however, your responsibilities will vary, depending on whether or not you are a discussion leader or a discussion participant.

Responsibilities of discussion participants: For the days when you are not leading a discussion, you should come to class prepared to participate actively in the discussion. It's important that you read the material carefully and be prepared to discuss it in class, as 30% of your final course grade will be based on your class participation; this means that you will need to contribute to every discussion. To help you prepare, and to assist the discussion leaders, you will be asked to post at least one question based on each week's reading assignment on the Sakai Forum no later than 5 pm the day before the discussion. Question submission is a component of the participation grade (3pts each).

Responsibilities of discussion leaders: On days when you are leading a discussion, you will be engaged in two types of activities:

First, you (and your teammates) should spend no more than 30 minutes at the outset of the class period presenting an overview of the reading material. During this time, you should tell the class why the material is important and what the central messages of the reading(s) were. In doing so, feel free to use Powerpoint and/or whatever tools will help you make your points effectively. Each team member must present a different aspect of the paper(s) being discussed. A completed presentation should be sent to me no later than 7 am the day of the discussion so that all the students can access your presentation prior to class.

Second, after the overview, the remainder of the class period should focus on your classmates' questions and leading a discussion to explore this material in detail.

How to lead a successful discussion:

1) Use the submitted questions to get the discussion rolling and to keep it rolling. It's a good idea to put these questions into your Powerpoint. It also helps to put basic questions first and the most interesting questions just after them, leaving other questions to the end if time permits.

2) Once the discussion gets started, ease up and let your classmates talk. You do not need to respond to everything that others say; in the best discussions, everyone is speaking to each other rather than solely to the discussion leaders. Be prepared to redirect the conversation if it becomes bogged down on meaningless argumentation, but don't be too eager to shift topics if the class is confused.

3) Be fair to the author's arguments. Present the author's position first before voicing your opinion.

4) Avoid jargon. If it's necessary to use special terms, make sure you define them (a glossary in your presentation is a good idea).

5) Be prepared to support your arguments. The best way to do so is to read the material carefully. It also helps to consult additional, outside readings for opposing views or to clarify points made in the assigned reading. If you find useful outside readings, provide these additional references in your presentation.

After the class period during which the discussion that you are leading takes place, you are required to prepare a written 1 to 2-page synopsis (single spaced) of the reading assignment, in which you summarize (1) the week's reading and (2) the major issues that we discussed and how we resolved these issues. You should also prepare (3) a bibliography of no fewer than 10 references for those who want to read more on the topic (please include a mix of new and old references; be sure to include some references that were NOT cited in the reading). The team needs to submit only one synopsis on behalf of all of its members. After your team has prepared this synopsis, please upload it to Sakai within one week of your presentation date.

Grading: Grades will be based on class preparation and participation, out-of-class assignments, a student-led paper presentation, and three exams. A total of 500 points are available throughout the semester and final grades will be calculated as follows:

30% Class preparation, participation, homework (6 pts. per class)
10% Paper presentation

20% Midterm Exam I
20% Midterm Exam II
20% Final Exam

Grading Scale: Your course grade will be determined as follows:

Final average	Course grade
93+	A
92-90	A-
89-87	B+
86-83	B
82-80	B-
79-77	C+
76-73	C
72-70	C-
69-67	D+
66-63	D
62-60	D-
<60	F

Syllabus Changes: I reserve the right to make changes to the syllabus, including project due dates and test dates (excluding the final exam), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.

Electronic Devices: Please keep laptops, cell phones, or other similar devices away and off during class, except when there is a specific educational reason to use them. This will help you and others focus on discussions occurring in the classroom. Class participation points will be deducted for inappropriate usage of electronic devices.

Copyright Policy: All course materials including the slideshows, your class notes, class assignments, quizzes, and exams are covered by University Copyright Policy, @http://www.unc.edu/campus/policies/copyright%20policy%2000008319.pdf. This means it is both against the law and an honor code violation to share any course materials items with anyone not directly affiliated with this particular class. Uploading material to non-class sharing sites, including online repositories, is prohibited. It is also an honor code violation to access or consult any course documents that may have been deposited by others. Sharing or discussing your notes directly with other individuals in the class is permitted.

Honor Code: I expect that you will abide by the Honor Code of the University of North Carolina at Chapel Hill throughout all activities in this course. This states that students are responsible for governing themselves and are responsible for executing academic integrity. You are prohibited from giving or receiving unauthorized aid during assignments, tests, and quizzes. Plagiarism is prohibited. You must properly attribute and reference your sources when preparing your own written work. I expect you will treat all members of the University community with respect and fairness. Please arrange a time to speak to me if you have any questions or concerns about how the Honor Code pertains to this course.

Diversity and Inclusion: I and the Department of Biology believe that diversity is crucial to our pursuit of academic excellence and is deeply committed to creating a diverse and inclusive community. We support UNC's policy, which states that "the University of North Carolina at Chapel Hill is committed to equality of opportunity and pledges that it will not practice or permit discrimination

in employment on the basis of race, color, gender, national origin, age, religion, creed, disability, veteran's status, sexual orientation, gender identity or gender expression."

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

Policy on Non-Discrimination: The University is committed to providing an inclusive and welcoming environment for all members of our community and to ensuring that educational and employment decisions are based on individuals' abilities and qualifications. Consistent with this principle and applicable laws, the University's Policy Statement on Non-Discrimination offers access to its educational programs and activities as well as employment terms and conditions without respect to race, color, gender, national origin, age, religion, creed, genetic information, disability, veteran's status, sexual orientation, gender identity or gender expression. Such a policy ensures that only relevant factors are considered and that equitable and consistent standards of conduct and performance are applied.

If you are experiencing harassment or discrimination, you can seek assistance and file a report through the Report and Response Coordinators (see contact info at safe.unc.edu) or the Equal Opportunity and Compliance Office, or online to the EOC at https://eoc.unc.edu/report-an-incident/.

Title IX Resources: Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance (Adrienne Allison – Adrienne.allison@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.

Acceptable Use Policy: By attending the University of North Carolina at Chapel Hill, you agree to abide by the University of North Carolina at Chapel Hill policies related to the acceptable use of IT systems and services. The Acceptable Use Policy (AUP) sets the expectation that you will use the University's technology resources responsibly, consistent with the University's mission. In the context of a class, it's quite likely you will participate in online activities that could include personal information about you or your peers, and the AUP addresses your obligations to protect the privacy of class participants. In addition, the AUP addresses matters of others' intellectual property, including copyright. These are only a couple of typical examples, so you should consult the full Information Technology Acceptable Use Policy, which covers topics related to using digital resources, such as privacy, confidentiality, and intellectual property.

Additionally, consult the University website "Safe Computing at UNC" for information about the data security policies, updates, and tips on keeping your identity, information, and devices safe.

Accessibility Resources & Service (ARS): The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities. Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: https://ars.unc.edu or email ars@unc.edu.

Counseling and Psychological Services (CAPS): Counseling and Psychological Services (CAPS) is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: https://caps.unc.edu/ or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more. Students can also call CAPS 24/7 at 919-966-3658 for immediate support.

Course Schedule:

Class	Date	Topic
1	January 10	Introduction to Molecular Metabolism
2	January 12	Carbohydrate Metabolism
3	January 17	Paper Example: Carbohydrate Metabolism
4	January 19	Mitochondrial Metabolism
5	January 24	Paper 1: Mitochondrial Metabolism
6	January 26	Lipid Metabolism I
7	January 31	Lipid Metabolism II Guest Speaker: Kylie VanDerMolen Ph.D. Student in BBSP
8	February 2	Paper 2: Lipid Metabolism
9	February 7	Amino Acid Metabolism
10	February 9	Exam I
	February 14	Well-being Day
11	February 16	Adipocyte Biology, β-cell Biology, and Diabetes
12	February 21	Insulin Signaling and Insulin Resistance
13	February 23	Paper 3: Obesity and Diabetes
14	February 28	AMPK, mTOR, and Autophagy Guest Speaker: Kylie VanDerMolen Ph.D. Student in BBSP
15	March 2	Paper 4: mTOR Signaling
16	March 7	Cancer Metabolism
17	March 9	Paper 5: Cancer Metabolism
	March 14	Spring Break

	March 16	Spring Break
18	March 21	Sympathetic Nervous System Metabolism
19	March 23	Hormones
20	March 28	Paper 6: Hormones
21	March 30	Exam II
22	April 4	Epigenetics
	April 6	Well-being Day
23	April 11	Metabolism in Aging
24	April 13	Paper 7: Metabolism in Aging
25	April 18	Microbiome and Metabolism Guest Speaker: Rachel DuMez Ph.D. Student in BBSP
26	April 20	Paper 8: Microbiome and Metabolism
27	April 25	Exercise Metabolism and Nutrition Guest Speaker: Dr. Abbie Smith-Ryan, Department of Exercise and Sport Science
28	April 27	Paper 9: Exercise Metabolism
	May 8	Final Exam 8:00AM

How to Succeed in this Class:

1) Attend all classes and *actively* participate in the discussions.

2) While reading papers for the student-led presentations, summarize the question being addressed and the take-home message of each paper *in your own words*.

3) For the student-led presentations, before you come to class, consider the readings in light of questions posted by your classmates so you will be prepared to talk about them.

4) Make connections with your classmates, so you can work together to understand the assigned readings.

5) Dig deep into one or more topics/systems/approaches that excite you.

6) Help me (and the rest of the class) help you! Bring your questions about the material to class, and if they go unanswered, speak up during the class or come talk to me during office hours.