BIOCHEMISTRY AND MOLECULAR BIOLOGY 802 **Spring 2025**
Metabolic Regulation & Signal Transduction

Faculty:
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Lecture Room: Biochemistry Room 111; M-W-F 10:20 - 11:10

Overall objectives of the course: This course is intended to provide an advanced treatment of key concepts in signal transduction and its intersection with metabolic regulation. Foundational principles will be covered, and general themes that are expected to dominate future research in a particular area will be emphasized. Lecture materials are intended to provide students with an appreciation of the similarities and differences in signal transduction systems found in diverse organisms, including animals, yeast, plants, and bacteria. Lecture material will be composed assuming that students have a solid foundation in basic principles of biochemistry and molecular biology. BMB 801, or a course with equivalent content, is recommended as a background for BMB 802.

General course information: This course will proceed via in-person lecture/discussion, though efforts will be made to record and distribute lecture materials online when possible. The room for lectures will be located in Biochemistry – Room 111. The course utilizes D2L course management system for the distribution of lecture slides, lecture recordings, supplemental materials (*e.g.*, scientific articles), and email correspondence. Registration in the course will enable access to the associated D2L site.

Examinations and Grading: Four take-home examinations will comprise the majority of the grade, each covering one of the 4 units of material. Each take home exam will be due by noon on the Thursday following initial dissemination of the exam, and can be returned via email (~6 days to return). Exam I: Provided Friday, Feb 2nd and covering Unit I (Orlando: **1/13-2/7**). (**110 pts.**); Exam II will cover Unit 2 **(**Orlando; **2/10-2/28 - 90 pts.)**; Exam III will cover Unit 3 (Ducat; **3/10-3/28 - 90 pts.**); Exam IV will cover Unit 4 (Ducat; **3/31 – 4/25 - 120 pts.**). Final grades will be computed by summing grades (total 410 pts) from each examination. The final grade point assigned will be graded based on the curve of total class performance. A fraction of points for a unit (~10%) may be assigned for non-exam class activities, per instructor preferences.

Ethics policy regarding take-home examinations: Take home exams are fully open book and open notes. Take home exams will also permit use of online resources, indeed, some exam material may require online resources and an internet connection. As such, these exams require students to abide by academic and scientific ethical standards. *All answers for take-home exams must be solely the effort of the individual student.* All consulting and collaboration with other members of the class, former students, or scientific colleagues more generally, is strictly prohibited. While some examination materials may encourage referencing to published scientific articles, written responses for questions should be original work of the individual student. If a student wishes to quote text from a published scientific work, the article should be

properly cited, and the relevant text should be clearly marked. Evidence that a student has failed to meet one of these criteria will be treated as academic dishonesty and/or plagiarism and will result in reduced grades, official sanctions, and/or administrative actions.

Policy regarding use of generative artificial intelligence (ie: chatGPT):

In this course, we acknowledge the valuable role that generative artificial intelligence (AI) tools, such as chatGPT, can play in enhancing the learning experience and assisting students in answering questions on examinations. Leveraging such tools to supplement understanding of the course material and improve the quality of examination responses is permissible assuming proper acknowledgment and citation of said tools.

Proper Citation: When utilizing generative AI for answering examination questions, it is essential to adhere to academic and scientific integrity standards. To maintain transparency and acknowledge the use of such technology, students are required to provide proper citations at the end of their answers, indicating the utilization of generative AI. This citation should include the name of the AI tool, such as "chatGPT," and be placed at the conclusion of the response. The following format is recommended for citing AI:

"Answer prepared with assistance from generative artificial intelligence tool: chatGPT."

By following this citation guideline, you demonstrate a commitment to academic honesty and transparency in your use of generative AI. Please remember that while generative AI can be a valuable resource, it is important that your responses reflect your own understanding and knowledge of the subject matter. The use of generative AI should complement your learning and critical thinking rather than substitute for it.

Date	Instructor	Topic
		UNIT I
M 1/13	**Orlando**	**Class Objectives & Course Overview**
W 1/15	**Orlando**	**Common Themes of Signal Transduction**
F 1/17	**Orlando**	**Features of Membranes and Cellular Compartments**
M 1/20	**----**	***Martin Luther King, Jr. Day - no classes***
W 1/22	**Orlando**	**Classes of Lipids and Signaling Lipids**
F 1/24	**Orlando**	**Membrane proteins and receptors**
M 1/27	**Orlando**	**Journal Club: Membranes and/or Transmembrane Receptor Structure**
W 1/29	**Orlando**	**Eicosanoid signaling I**
F 1/31	**Orlando**	**Eicosanoid signaling II**
M 2/3	**Orlando**	**Endocannabinoid signaling**
W 2/5	**Orlando**	**Lipid signaling in bacteria**
F 2/7	**Orlando**	**Journal Club: Lipid signaling**
First Exam	**Take home exam due Thursday, February 14 -- by noon (covering 1/13 - 2/7 material)**	
		UNIT II
M 2/10	**Orlando**	**G protein-coupled receptors**
W 2/12	**Orlando**	**Structure and Function of Trimeric G-proteins**
F 2/14	**Orlando**	**Regulation of GPCR signaling**
M 2/17	**Orlando**	**Kinase cascades in signal transduction**
W 2/19	**Orlando**	**Ligand-receptor interactions**
F 2/21	**Orlando**	**Hands-On Practical: Exploring key protein databases**
M 2/24	**Orlando**	**Hands-On Practical II: 3D receptor visualization and modelling**
W 2/26	**Orlando**	**Protein scaffolding**
F 2/28	**Orlando**	**Journal club: Improved biosynthesis through scaffolds**

Second Exam	**<u>Take home</u> exam due Friday March 7 by noon (2/10 through 2/28 material)**	
		<u>UNIT III</u>
3/3-3/7	**---**	**Spring break**
M 3/10	**Ducat**	**Yeast Mating Response**
W 3/12	**Ducat**	**Yeast Mating Response II/Quorum Sensing I**
F 3/14	**Ducat**	**Quorum Sensing II**
M 3/17	**Ducat**	**<u>Journal Club</u>: Secrete & sense as a signaling strategy**
W 3/19	**Ducat**	**PII and Carbon/nitrogen balance I**
F 3/21	**Ducat**	**PII and Carbon/nitrogen balance II**
M 3/14	**Ducat**	**Two-component signaling systems: Histidine kinases structure/function**
W 3/26	**Ducat**	**Two-component signaling systems: Photoreceptors**
F 3/28	**Ducat**	**<u>Journal Club</u>: Class-selected article on signaling system**
Third Exam	**Take home exam due Thursday, April 4 by noon (3/10 through 3/28 material)**	
		<u>UNIT IV</u>
M 3/31	**Ducat**	**Circadian rhythms**
W 4/2	**Ducat**	**Ligand-gated ion channels**
F 4/4	**Ducat**	**Evolution of signal transduction pathways**
M 4/7	**Ducat**	**Adaptation of yeast mating to mammalian signaling**
W 4/9	**Ducat**	**Modularity and Receptor evolvability**
F 4/11	**Ducat**	**Engineering to gain insight into native pathways**
M 4/14	**Ducat**	**<u>Journal Club</u>: Modularity in signaling**
W 4/16	**Ducat**	**Engineering Signaling: Synthetic Biology & Circuits**
F 4/18	**Ducat**	**Emergent complexity in signaling systems**
M 4/21	**Ducat**	**Advanced Synthetic Signaling Circuits I**
W 4/23	**Ducat**	**Advanced Synthetic Signaling Circuits II**
F 4/25	**Ducat**	**<u>Journal Club:</u> Applications of Synthetic Circuits**
Fourth Exam (Final)	**Take-home exam; due Thursday, May 1st by noon (3/31 through 4/25 material).**	