BIOCHEMISTRY AND MOLECULAR BIOLOGY 802 **Spring 2021**
Metabolic Regulation & Signal Transduction

Faculty:

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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 be online-accessible. Due to the ongoing restrictions and precautions related to COVID-19, the course will be conducted predominantly as an asynchronous model, however real-time lecture/discussion options will be explored to increase instructor-student interactivity. Synchronous content will be delivered via Zoom, with appropriate classroom links provided. Students will be expected to provide feedback and work with instructors to find a balance of virtual classroom options that work best for all. 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 examinations will comprise the majority of the grade, each covering one of the 4 units of material. Exam I: Monday, Feb. 8 will be a timed exam that covers Unit I (Ducat, Wang: 1/11-2/5) that is delivered online 7:00-9:00 p.m. (**110 pts.**); Exams II-IV will be take-home, open-book exams that will be distributed on Friday 2/26, 3/26, and 4/23, respectively. Each take home exam will be due the next Thursday by noon and can be returned via email. Exam II will cover Unit 2 **(**Howe; **2/8-2/26 - 90 pts.)**; Exam III will cover Unit 3 (Ducat; **3/1-3/26 - 110 pts.**). Exam IV will cover Unit 4 (Martinez-Hackert &

Howe; **3/29-4/23 - 120 pts. total**). Final grades will be computed by summing grades (total 430 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.

BIOCHEMISTRY 802 Spring 2021
Metabolic Regulation & Signal Transduction
Instructors: Ducat, Howe, Martinez-Hackert, Wang (Content provided mostly asynchronously)

Date	Instructor	Topic
		UNIT I
M 1/11	**Ducat**	**10:20am – Synchronous - Class Objectives, Meet-n-Greet, & Overview**
W 1/13	**Ducat**	**Common Themes of Signal Transduction**
F 1/15	**Ducat**	**Physical features of lipid membranes**
M 1/18	**----**	***Martin Luther King, Jr. Day - no classes***
W 1/20	**Ducat**	**Classes of Lipids and Signaling Lipids**
F 1/22	**Ducat**	**Membrane proteins and receptors**
M 1/25	**Ducat**	**Journal Club: Membranes and/or Transmembrane Receptor Structure**
W 1/27	**Wang**	**Phospholipases**
F 1/29	**Wang**	**Synthesis of eicosanoid hormones**
M 2/1	**Wang**	**Leukotrienes and prostaglandins**
W 2/3	**Wang**	**Prostacyclins and thromboxanes**
F 2/5	**Wang**	**Nitric oxide signaling**
First Exam	**Timed online exam Monday, February 8 -- 7:00-9:00 p.m. Room TBD (covering 1/11 through 2/5 material)**	
		UNIT II
M 2/8	**Howe**	**Ligand-receptor interactions**
W 2/10	**Howe**	**G protein-coupled receptors I**
F 2/12	**Howe**	**G protein-coupled receptors II**
M 2/15	**Howe**	**Structure and function of trimeric G proteins I**
W 2/17	**Howe**	**Structure and function of trimeric G proteins II**
F 2/19	**Howe**	**Regulation of G protein signaling I**
M 2/22	**Howe**	**Regulation of G protein signaling II**
W 2/24	**Howe**	**Nuclear receptors**
F 2/26	**Howe**	**NK-kB signaling**

Second Exam	**<u>Take home</u> exam due Thursday, March 4 by noon (2/8 through 2/26 material)**	
		<u>UNIT III</u>
M 3/1	**Ducat**	**Quorum sensing I**
W 3/3	**----**	**"Break Day"**
F 3/5	**Ducat**	**Quorum sensing II**
M 3/8	**Ducat**	**PII and Carbon/nitrogen balance I**
W 3/10	**Ducat**	**PII and Carbon/nitrogen balance & Light Integration**
F 3/12	**Ducat**	**Journal Club: Carbon and nitrogen metabolism**
M 3/15	**Ducat**	**Circadian rhythms**
W 3/17	**Ducat**	**Receptor evolvability and modularity**
F 3/19	**Ducat**	**Conservation and modularity in signal transduction pathways**
M 3/22	**Ducat**	**Journal Club: Modularity in evolution of virus mechanisms**
W 3/24	**Ducat**	**Engineering through modularity of signal transduction pathways**
F 3/26	**Ducat**	**Journal Club: Modularity in engineering**
Third Exam	**<u>Take home</u> exam due Thursday, April 1 by noon (3/1 through 3/26 material)**	
		<u>UNIT IV</u>
M 3/29	**Martinez-Hackert**	**TGF-β signaling I**
W 3/31	**Martinez-Hackert**	**TGF-β signaling II**
F 4/2	**Martinez-Hackert**	**TGF-β signaling III**
M 4/5	**Howe**	**Kinases in signal transduction I**
W 4/7	**Howe**	**Kinases in signal transduction II**
F 4/9	**Howe**	**Plant receptor kinases**
M 4/12	**Howe**	**Histidine kinases and two-component signaling pathways**
W 4/14	**Howe**	**Photoreceptors**
F 4/16	**Howe**	**Phosphatase-linked receptors**
M 4/19	**Howe**	**Ubiquitin ligase-linked receptors I**
W 4/21	**Howe**	**Ubiquitin ligase-linked receptors II**
F 4/23	**Howe**	**Engineering small-molecule sensors**
Fourth Exam (Final)	**Take-home exam; due Thursday, April 29 by noon (4/5 through 4/23 material).**	