IMPORTANT: This syllabus form should be submitted to OAA (gsbs_academic_affairs@uth.tmc.edu) a week before the start of each semester.

NOTE to STUDENTS: If you need any accommodations related to attending/enrolling in this course, please contact the Graduate School's 504 Coordinator, Natalie Sirisaengtaksin, PhD. We ask that you notify GSBS in advance (preferably at least 3 days before the start of the semester) so we can make appropriate arrangements.

Term and Year: Spring 2026 Course Number and Course Title: **GS13 1024: Molecular Basis of Cell Signaling** **Credit Hours:** 4 **Prerequisites:** Background in Biochemistry and Cell Biology **Meeting Location:** UT-McGovern Medical School **Building/Room#:** MSB B.603 & MSB B.610 (Feb 9, Feb 18, Mar 25)	**Program Required Course:** Yes **Approval Code:** No **Audit Permitted:** Yes **Classes Begin:** January 12, 2026 **Classes End:** Apr 27, 2026, **Final Exam Week:** May 4, 2026

Class Meeting Schedule

Day	Time
Monday, Wednesday, Friday	1:00-2:30 pm

Course Director Name and Degree: **Guangwei Du, Ph.D.** Title: Professor Department: Integrative Biology & Pharmacology Institution: UTHealth Houston Email Address: Guangwei.Du@uth.tmc.edu Contact Number: (713)500-7055 **NOTE:** Office hours are available by request. Please email me to arrange a time to meet. **Teaching Assistant**: **N/A** Name and Email Address	**Instructors** (See attached class schedule)

Course Description:

Signal transduction is one of the most active fields in biomedical research. Precisely controlled activation of signaling molecules is essential for development, normal tissue homeostasis, tissue repair, and immunity. Dysregulation of cellular signaling pathways are responsible for diseases such as cancer, diabetes, cardiovascular disease. Accordingly, therapeutic strategies designed to specifically target altered signaling pathways in disease would achieve better outcomes.

The goal of Molecular Basis of Cell Signaling is to provide graduate students with an in depth understanding of the molecular mechanisms of signaling. The broad purview of signaling provides the fundamentals essential to many fields, and traditionally has served students from multiple disciplines such as cell biology, biochemistry, neurobiology, physiology, pharmacology, cancer and systems biology, and provides fulfillment of the GSBS molecular requirement. The prerequisites are a solid background in cell biology and biochemistry. This course includes the following topics:

1) mechanism of ligand activation and desensitization of G protein coupled receptors and other types of receptors, G proteins and second messengers;
2) fundamentals of ion channel structure, activation, function and control by ligands;
3) membrane lipid signaling;
4) intercellular communications;
5) basic structure, function and localization of protein phosphorylation cascades and their role in growth factor regulation through the small G protein Ras family;
6) some key intracellular signaling cascades such as lipid signaling molecules, unfolded protein responses, proteolysis, inflammatory signaling, calcium, mTOR, AMPK, and autophagy;
7) state of the art studies of the network of transcriptional regulators including the steroid family of ligand-induced transcriptional factors, the complexity of transcriptional complexes, transcriptional control by cAMP/PKA and the circadian clock, and involvement of the cell cycle;
8) RNA modification and noncoding RNAs.

Topics covered are introduced by first providing access to a broad perspective with suitable reviews, followed by a focus on the primary literature. Student presentations will involve group discussions of a classic publication in each block in journal club style. Exams are take-home which provides a means of minimizing memorization and stimulating creativity, while in the process, driving home important concepts.

Textbook/Supplemental Reading Materials

- N/A

<u>Course Objective/s</u>:

Upon successful completion of this course, students will understand the basic principles of signal transduction mechanisms and major experimental approaches used in cell signaling studies.

***Specific Learning Objectives*:**

1. Have basic knowledge of the major signaling pathways.
2. Understand how different types of signaling molecules, e.g., GPCRs, RTKs, kinases, phosphatases, lipids, and transcriptional regulators, transduce signals and mediate cellular responses.
3. Develop a basic knowledge of methods used to study different signaling pathways.
4. Learn to design experiments related to cell signaling.

Student responsibilities and expectations:

Students enrolled in this course will be expected to perform the following activities:

1. Prepare for and attend courses.
2. Attend and participate at the journal club review session.
3. Participate in and contribute to course discussions during lectures and journal clubs.
4. Prepare for and take take-home examination based on lecture and some reading material.

Students are expected to complete all assigned reading material (reviews and research literature) prior to class. While you may work and discuss all course materials and assignments in groups, all writing assignments must be your own. Plagiarism and failure to properly cite scientific literature and other sources will not be tolerated and are grounds for dismissal from the course and further GSBS disciplinary action. Cheating or engaging in unethical behavior during examinations (quizzes and final) will be grounds for dismissal from the course without credit and further GSBS disciplinary action.

Grading System: Letter Grade (A-F)

Student Assessment and Grading Criteria: *(May include the following:)*

Percentage	Description
Take-home exams (80 %)	There will be 3 take-home exams
Participation and Attendance (20 %)	Include attendance, participation of journal clubs and discussion during lectures.

CLASS SCHEDULE

Class time: 1:00-2:30 pm

Location: MSB B.603 and MSB B.610 (for Feb 9, Feb 18, Mar 25)

Date	Duration (Hour(s) taught by lecturer)	Lecture Topic	Lecturer/s
I. Membrane Receptor Signaling			
Jan 12	1.5	Structural aspects of G protein signaling Covalent modifications; Oncogenic mutations and disease alpha & βγ subunit structure/function/effectors; adenylyl cyclase	C. Dessauer
Jan 14	1.5	GAPs: regulators of G-protein signaling (RGS)	C. Dessauer
Jan 16	1.5	Additional complexities of G protein regulation GDI/Goloco motifs; Downstream effectors	C. Dessauer
Jan 21	1.5	Wnt signaling in development and disease	R. Miller
Jan 23	1.5	Localization/feedback of cAMP signals PKA anchoring proteins (AKAPs)	C. Dessauer
Jan 26	1.5	Receptor tyrosine kinases	R. Zhao

Jan 28	1.5	Ion channels; overview of structure/function/regulation	J. Cordero-Morales
Jan 30	1.5	Ion channels in epithelium	O. Pochynyuk
Feb 2	1.5	Ion Channels and Neuronal Plasticity	A. Bavencoffe
Feb 4	1.5	Lipids as signaling molecules	G. Du
Feb 6	1.5	Lipid regulation of the Ras-MAPK signaling pathway	G. Du
Feb 9	1.5	Intercellular communication: from physiology to disease	Y. An
Feb 11	1.5	Strategies to target membrane receptors for therapy: from small molecules to antibody-based therapeutics	K. Carmon
Feb 13	1.5	**Student presentations**	Drs. An & Du, Students
Feb 16		**Exam I**	
II. Intracellular Signaling Cascades			
Feb 18	1.5	RAS GTPases: structure, dynamics, and function	A. Gorfe
Feb 20	1.5	RAS GTPases: therapeutic targets	A. Gorfe
Feb 23	1.5	Overview of protein kinases and phosphatases	J. Frost
Feb 25	1.5	Rho GTPases	J. Frost
Feb 27	1.5	Ca^{++}compartmentation and signaling	K. Venkatachalam
Mar 2	1.5	mTOR	K. Venkatachalam
Mar 4	1.5	AMPK	D. Frigo
Mar 6	1.5	Autophagy	Y. Liu
Mar 9-13		**Spring Break (no class)**	
Mar 16	1.5	The unfolded protein response signaling in health and diseases	H-E. Kim
Mar 18	1.5	Cell death	X. Wu
Mar 20	1.5	cAMP-mediated cell signaling Autophagy	X. Cheng
Mar 23	1.5	Intramuscular signaling regulating skeletal muscle proteolysis	Y-P. Li
Mar 25	1.5	Inflammatory signaling	K. Sun
Mar 27	1.5	**Student presentations**	Drs. Liu & Du, Students
Mar 30		**Exam II**	
III. Regulation of Transcription and Translation			
Apr 1	1.5	Overview of transcription regulation and epigenetics	W. Li
Apr 3	1.5	Enhancers: The Ultimate Genomic Executor of Many Signaling Events on Chromatin	W. Li
Apr 6	1.5	Nuclear Receptors: Steroid Sisters & Orphan Brothers I	V. Narkar
Apr 8	1.5	Nuclear Receptors: Steroid Sisters & Orphan Brothers II	V. Narkar
Apr 10	1.5	p53 signaling in cancers and stem cells	D. Lee
Apr 13	1.5	Growth, cell cycle and transcription	C. Denicourt
Apr 15	1.5	Regulation of gene expression by posttranscriptional modification of cellular RNA	C. Denicourt
Apr 17	1.5	Non-coding RNAs and epigenetic regulation of gene expression	J. Wang
Apr 20	1.5	Epigenetic regulation of transcription	K. Mahan
Apr 22	1.5	Transcriptional regulation of circadian rhythms	K. Mahan
Apr 24	1.5	The Hypoxia-Inflammation Link	H. Eltzschig
Apr 27	1.5	**Student presentations**	Drs. Narkar & Du, Students
Apr 29, May1		**Exam III**	