

## (SP19) MCB 480 – MOLECULAR BASIS OF EUKARYOTIC CELL SIGNALING

Time: Friday 1:00pm-3:00pm  
Location: 140 Burrill Hall  
Instructor: Jie Chen ([jiechen@illinois.edu](mailto:jiechen@illinois.edu))

*[Note: this class was previously taught at two lectures/3 hours a week; the condensed version is created to accommodate the instructor's administrative duties.]*

### Course objectives:

- Emphasis on principles and molecular mechanisms of mammalian cell signaling
- Coverage of major classes of transmembrane receptors and signaling pathways
- Contemporary methods of investigation and the principles of identifying and solving problems related to signal transduction
- Importance of understanding cell signaling illustrated by examples of targeted anti-cancer therapies

### Course Moodle at [learn.illinois.edu](http://learn.illinois.edu):

- Lecture slides are available the night before lecture, together with all relevant references.
- Other materials including assigned readings, assignments (homework), and discussion questions are posted as needed.

*No textbook is used for this class.*

### These textbooks are recommended for those interested:

- 1) *Molecular Cell Biology* by Lodish et al., Chapters 15 & 16, "Signaling I, II".  
(Good for basic concepts; 8<sup>th</sup> edition preferred but 6<sup>th</sup> or 7<sup>th</sup> will be fine, too.)
- 2) *Cell Signaling – principles and mechanisms*, by Lim, Mayer & Pawson, 2015.  
(**Best textbook on general principles of signal transduction**; available on reserve at the ACES library and Biology library)
- 3) *Signal Transduction: Principles, Pathways, and Processes*, edited by Cantley et al., 2014.  
(Relatively complete collection of pathways)

### Readings for the class:

*Optional readings: original research and review articles associated with each lecture, PDFs available on class Moodle.*

*Required readings: articles to be discussed during some lectures and/or for exams.*

### Honors credits:

A variety of projects are available for those interested in earning honors credits as a James Scholar. Arrange a meeting with the instructor early in the semester to discuss selection of projects.

### Office hour:

Tuesday 3:30 – 4:30 pm, B126 Chemical and Life Sciences Laboratory  
Questions are also welcome before/during/after each class, and any time by e-mail. All questions by e-mail will be answered within 24 hours.

## Topics:

### ***Transmembrane receptor activation***

Receptor tyrosine kinases (RTK); cytokine receptors; TGFbeta receptors; T cell receptors; G protein coupled receptors (GPCR)

### ***Intracellular and nuclear signaling pathways***

Ras-Erk and other MAPKs; modular domains and adaptors; small-molecule and lipid second messengers; Jak-STAT; Smads; PI3K-Akt; PLC, PKC, Ca<sup>++</sup>; phospholipid signaling pathways; mTOR; Hippo; Hedgehog; Wnt; Notch; NF-kB; NF-AT; p53; DNA damage response pathways; Cell cycle signaling; Cell death signaling

### ***Principles of signaling and experimental approaches***

Protein-protein interactions; Post-translational modifications; G protein switches; Spatial and temporal regulation

### ***Signaling and cancer***

Mechanisms of pathology; design of targeted anti-cancer drugs

January 18	Lecture 1: Introduction; RTK
January 25	Lecture 2: RTK; modular domains
February 1	Lecture 3: Ras; small G protein superfamily
February 8	Lecture 4: MAPK; protein phosphorylation
February 15	Lecture 5: Regulation of MAPK signaling; kinases
February 22	Lecture 6: Kinases and regulation; scaffolds; phosphatases
March 1	Lecture 7: Cytokine receptor/Jak-Stat; TGFβ receptor/Smad
March 8	Lecture 8: T cell receptor signaling; common cytoplasmic pathways
EXAM 1:	Distributed by 5 pm, March 8 (Friday); due by 11:59 pm, March 13 (Wednesday)
March 15	Lecture 9: Lipid signaling
March 22	SPRING BREAK
March 29	Lecture 10: Methodologies in deciphering spatial and temporal regulation
April 5	Lecture 11: GPCR
April 12	Lecture 12: Signaling pathways regulating cell growth and proliferation
April 19	Lecture 13: Signaling pathways regulating apoptosis, necroptosis, and autophagy
April 26	Lecture 14: Additional pathways; cancer immunotherapy; review
EXAM 2:	Distributed by 10 am, May 3 (Friday); due by 11:59 pm, May 8 (Wednesday).