MCB 480 – MOLECULAR BASIS OF CELL SIGNALING

Time: Friday 1:00pm-2:50pm  
Location: 140 Burrill Hall  
Instructor: Jie Chen (jiechen@illinois.edu)

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: learn.illinois.edu – MCB 480
- 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.

Recommended textbooks on signaling:
1) Molecular Cell Biology by Lodish et al., Chapters 15 & 16, “Signaling I, II”.  
   (Good for basic concepts; 8th edition preferred but 6th or 7th will be fine, too.)  
   (Best textbook on general principles of signal transduction)  
   (Relatively complete collection of pathways)  
4) Handbook of Cell Signaling, Edited by Ralph A. Bradshaw and Edward A. Dennis  
   (Comprehensive collection of all signaling pathways and proteins, 2nd Edition, 2009)

Additional readings:
Optional readings: original research and review articles associated with each lecture.  
Required readings: original research articles to be discussed during some lectures and/or for exams.

Grading:
Two exams, 70% – mid-term (take-home) and final (open-book) weighted equally.  
Four assignments, 20% – not graded, full credit for completing on time.  
Class attendance, 10% – up to 4 absences can be excused if requested by email before the class to be missed for acceptable reasons, no pro-rating (you get either all or none of this 10%).

Final grade:  
A ≥ 85%  
   (Average ≥ 78/100 on exams, completing all assignments, and satisfactory attendance)  
A- = 82-84.5%  
   (Average ≥ 74/100 on exams)  
B+ = 77-81.5%  
   (Average ≥ 67/100 on exams)  
B = 72-76.5%
(Average ≥ 60/100 on exams)

**Honors credits:**
If you are interested in earning honors credits as a James Scholar please speak with the instructor as soon as possible.

**Office hours:**
Wednesday 4:30 – 5:30 pm, C526 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. ([jiechen@illinois.edu](mailto:jiechen@illinois.edu))

**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^{++}; 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

**Tentative schedule:**

January 19   Lecture 1: Introduction and RTK
January 26   Lecture 2: RTK and modular domains
February 2   Lecture 3: Ras and the small G protein superfamily
February 9   Lecture 4: MAPK and protein phosphorylation
February 16  Lecture 5: Regulation of MAPK signaling, kinases
February 23  Lecture 6: Kinases, scaffolds, phosphatases
March 2      Lecture 7: Cytokine receptor, T cell receptor, and TGFb receptor signaling
March 9      Lecture 8: Common cytoplasmic pathways, lipid signaling
EXAM 1:      Distributed by 5pm, March 9 (Friday); due by noon, March 14 (Wednesday)
March 16     Lecture 9: Methodologies in deciphering spatial and temporal regulation
March 23     SPRING BREAK
March 30     Lecture 10: GPCR
April 6      Lecture 11: Signaling into the nucleus
April 13     Lecture 12: Signaling pathways regulating the cell cycle
April 20     Lecture 13: Signaling pathways regulating cell death
April 27     Lecture 14: Additional pathways; review
EXAM 2:      Distributed by 9 pm, May 4 (Friday); due by midnight, May 9 (Wednesday).