PURDUE
UNIVERSITY

DEPARTMENT OF BIOCHEMISTRY

BCHM 61501
Fall 2016 Syllabus

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Office hours: By appointment only. Please see the TA if you need assistance with assignments or have questions about your grades.

COURSE OBJECTIVES

This is a 3-credit course designed for 1st or 2nd year graduate students. With a specific focus on newly emerging topics, the molecular basis for the major intracellular signaling pathways of eukaryotes will be covered. This course will be taught from current primary literature, using a textbook as a background resource. The following topics will be included: protein kinases and phosphatases, G protein coupled receptors, receptor tyrosine kinases, PI3K pathway, mTOR pathway, PTEN, Wnt/β-catenin pathway, the Hedgehog/Gli pathway, cell cycle control, the p53 pathway, DNA damage checkpoint, regulated proteolysis, programmed cell death and microRNA. Students will learn how to read and interpret scientific literature through regular lectures, seminars and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas.

LEARNING OUTCOMES

Basic knowledge of the molecular mechanisms in signal transduction and cell cycle
An appreciation for how protein modules within signaling molecules impart selective responses, how protein-protein interactions are used to build signaling pathways, and the methods commonly used to analyze signal transduction processes.
An appreciation for cell cycle is carefully regulated to maintain genomic stability.
Enhancement of oral and written communication skills
Mastery of reading and interpreting scientific literature in signal transduction and cell cycle fields
Development of critical thinking and creativity in signal transduction and cell cycle research

TEXTBOOKS

Textbook
Molecular Biology of the Cell, 4th edition
Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter.
New York: Garland Science; 2002. ISBN-10: 0-8153-3218-1

The textbook is **suggested** for this course. This textbook is free on line at http://www.ncbi.nlm.nih.gov/books/NBK21054/. Type the topic of interest, and you can read the basic knowledge about that particular topic. It contains necessary background information for reading and interpreting primary literature. Students should

read the appropriate chapters in this book prior to reading assigned papers.

A significant portion of the material from this course will be covered by reviews from the scientific literature. These are accessible free of charge and electronically through the Purdue Library. Links to these sources and the PDF files can be downloaded from Blackboard.

LECTURE TIME AND PLACE

Tuesdays and Thursdays 9:00-10:15 am
BCHM Room 102

BLACKBOARD

The syllabus for the course, lecture notes, and all other teaching materials will be available via the Purdue University Blackboard site at:
https://blackboard.purdue.edu/webct/logonDisplay.dowebct

ASSESSMENT

Class Participation and Attendance
Attendance will be taken after the first week. 100% attendance is required. **Absence** from class will result in 1) 0 point for the writing assignment associated with that lecture or 2) five-point deduction from the final score if no writing assignment is associated with that particular lecture. Any request to be excused from class must include **official documentation** (doctor's note, request from academic advisor, etc). Students are welcome to inform the instructor if they will be absent, but it will not be excused without a written note.

Late Work Policy
There is **no late work** accepted in this class. The written document-associated with the lecture is due in class one week after the lecture. **Late papers will receive a zero.**

OBTAINING EXTRA HELP

Dr. Liu will be available to answer your questions immediately after class or by appointment (by e-mail). You are highly encouraged to submit questions by e-mail that will be promptly answered by return e-mail.

The lecture TA will hold office hours for at least 1 hour per week, and will be able to answer additional questions by appointment.

GUEST LECTURES

Through the semester, Dr. Liu has arranged guest lectures given by several PIs of the campus and professors outside of Purdue. These PIs are working on different aspects of signaling transduction and cell cycle. The goal of these guest lectures is to exposure you to these PIs with various experts so you know where to get possible help for your own research.

ACADEMIC MISCONDUCT

Academic misconduct of any kind will not be tolerated in any course offered by the Department of Biochemistry. Information on Purdue's policies with regard to academic misconduct can be found at http://www.purdue.edu/ODOS/osrr/integrity.htm.

To provide you with an unambiguous definition of academic misconduct, the following text has been excerpted from "Academic Integrity: A Guide for Students", written by Stephen Akers, Ph.D., Executive Associate Dean of Students (1995, Revised 1999, 2003), and published by the Office of the Dean of Students in cooperation with Purdue Student Government, Schleman Hall of Student Services, Room 207, 475 Stadium Mall Drive West Lafayette, IN 47907-2050.

"Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, *University Regulations*] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

More specifically, the following are a few examples of academic dishonesty, which have been discovered at Purdue University.

- substituting on an exam for another student
- substituting in a course for another student
- paying someone else to write a paper and submitting it as one's own work
- giving or receiving answers by use of signals during an exam
- copying with or without the other person's knowledge during an exam
- doing class assignments for someone else
- plagiarizing published material, class assignments, or lab reports
- turning in a paper that has been purchased from a commercial research firm or obtained from the internet
- padding items of a bibliography
- obtaining an unauthorized copy of a test in advance of its scheduled administration
- using unauthorized notes during an exam
- collaborating with other students on assignments when it is not allowed
- obtaining a test from the exam site, completing and submitting it later
- altering answers on a scored test and submitting it for a regrade
- accessing and altering grade records
- stealing class assignments from other students and submitting them as one's own
- fabricating data
- destroying or stealing the work of other students

Plagiarism is a special kind of academic dishonesty in which one person steals another person's ideas or words and falsely presents them as the plagiarist's own product. This is most likely to occur in the following ways:

- using the exact language of someone else without the use of quotation marks and without giving proper credit to the author
- presenting the sequence of ideas or arranging the material of someone else even

though such is expressed in one's own words, without giving appropriate acknowledgment

- submitting a document written by someone else but representing it as one's own”

EMERGENCY PREPAREDNESS

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. To get information about changes in this course consult the class Blackboard site or e-mail or phone the instructor.

If you are ill with flu-like symptoms, please do not attend class. Course materials will be provided to you.

Grading policy of the course:

Part I: Exams (100 points)

October 13, Thursday Mid-term exam in class (50 points)
Covering materials delivered on 8/23, 8/25, 8/30, 9/1, 9/6, 9/8

December 8, Thursday Final exam in class (50 points)
Covering materials delivered on 9/13, 9/15, 10/4, 10/27, 11/1

The goal of these two exams is to enforce you to actually master some very basic cell biology knowledge/technologies, which I believe you will deeply benefit in the future.

Part II: Review comments of the papers I will present (40 points)

I will present the following papers in class, and you are required to read them after the class and write a commentary

Length: 1 page; single space; words: ~800; characters with space: ~ 50000.
Suggested typeface: Arial; suggested font: 11; suggested margin: 0.5 inch

The following papers will be covered
No 1: Li Z. et al., Mol Cell Biol. 2014, 34, 3642-3661.
Presentation date: 9/6, writing assignment due date: 9/13 in class

No 2: Li H et al., EMBO J. 2010, 29, 2953-2965.
Presentation date: 9/13, writing assignment due date: 9/22 in class

No 3: Liu XS, et al., EMBO Reports. 2010, 11, 626-632.
Presentation date: 9/15, writing assignment due date: 9/22 in class

No 4: Yang X. et al., J Biol Chem. 2009, 284, 18588-18592.
Presentation date: 10/27, writing assignment due date: 11/8 in class

Please include the following components in your writing:
- --Brief background of the field, clearly state the important questions need to addressed.
- --A central hypothesis to be tested in the paper.
- --Approaches/methods to be used in the paper.
- --Major findings/results based on the experiments presented.
- --Major conclusions.
- --Significance of the findings.
- --Any potential problems? If yes, please propose alternative or additional experiments?

Grading: 1) TA will give an initial score with his brief justification.
2) Dr. Liu will decide the final score each time.

The goal of these writing practices is to help you to fully understand and deeply appreciate what is involved in a solid publication in signal transduction and cell cycle, such as significance, innovation, and approach etc.

Part III: Review comments of the lectures by 11 guest speakers from Purdue (110 points)

After each lecture, you are required to write a review commentary. We will provide the presentation files of lectures to facilitate your writing.

Length: 1 page; single space; words: ~800; characters with space: ~ 50000.
Suggested typeface: Arial; suggested font: 11; suggested margin: 0.5 inch

Please include the following components in your writing:
- --Brief background of the field, clearly state the important questions to be addressed.
- --A central hypothesis to be tested in the presentation.
- --Approaches/methods to be used in the research.
- --Major findings/results based on the experiments presented.
- --Major conclusions.
- --Significance of the findings.
- --Any potential problems? If yes, please propose alternative or additional experiments?

Writing is due one week after the lecture in class.
10 points per paper, total possible points: 110.

Grading: 1) TA will give an initial score with his brief justification.
2) Dr. Liu will decide the final score each time.

The goal of these writing practices is to help you to fully understand the ongoing research programs on campus, so you know where to ask for help in the future.

Note 1: Starting from the 2nd week, attendance is required. Absence from class will result in 1) 0 point for the writing assignment associated with that lecture or 2) five-point deduction from the final score if no writing assignment is associated with that particular lecture. Any request to be excused from class must include official documentation (doctor's note, request from academic advisor, etc). Students are welcome to inform the instructor if they will be absent, but it will not be excused without a written note.

Part IV: Extra bonus points by attending the course-related seminars organized by Dr. Liu (25 points). This will NOT be used to calculate your final letter grades.

9/19	3:30PM	PULSe seminar by Dr. Hongwu Chen, University of California at Davis
9/29	11:30AM	DDRF lobby, PCCR seminar by Dr. Vivek Rangnekar, University of Kentucky
10/20	11:30AM	DDRF lobby, PCCR seminar by Dr. LuZhe Sun, UT Health Science Center
10/25	3:30PM	PFEN, BCHM seminar by Dr. Natasha Kyprianou, U of Kentucky
11/03	11:30AM	DDRF lobby, PCCR seminar by Dr. JF Hsieh, UT Southwestern Med Center

Please sign your names with TA when attending the seminar and get 5 points each time.

Part V: Final score of the course (275 total possible points, but we will use 250 as total points to calculate your final letter grades as 25 points are bonus points for you by attending the five seminars given by external speakers)

The cutoff values for letter grades are as follows:

Points	Grades
250-275	A+
225-249	A
200-224	B
175-199	C
150-174	D
<149	F

BCHM61501 course schedule for 2016 Fall

Week 1				Topic
1	8/23	Tu	Lecture 1	Class organization, Antibody Introduction
2	8/25	Th	Lecture 2	Major Techniques in Signal Transduction and Cell Cycle

Week 2

3 8/30 Tu Lecture 3 Receptor tyrosine kinases and Ras
Review: Lemmon and Schlessinger, Cell signaling by receptor tyrosine kinases, *Cell* 2010, 141, 1117-1134.

4 9/1 Th Lecture 4 G protein coupled receptors/ The Wnt pathway
Review: Clevers and Nusse, Wnt/β-catenin signaling and disease. *Cell,* 2012, 149, 1192-1205.

Week 3

5 9/6 Tu Lecture 5 The PI3K/AKT pathway
Review: Song MS et al. The functions and regulation of the PTEN tumor suppressor, *Nature Reviews Molecular Cell Biology,* 2012, 13, 283-96.

Writing assignment paper No 1: Li Z. et al., Mol Cell Biol. 2014, 34, 3642-3661.

6 9/8 Th Lecture 6 The MTOR pathway
Review: Laplante M, Sabatini DM., mTOR signaling in growth control and disease. *Cell.* 2012, 149, 274-93.

Week 4

7 9/13 Tu Lecture 7 Mammalian cell cycle

Writing assignment paper No 2: Li H et al., EMBO J. 2010, 29, 2953-2965.

8 9/15 Th Lecture 8 The p53 pathway

Review: Ak & Levine, p53 and NF-κB: different strategies for responding to stress lead to a functional antagonism. *FASEB J*, 2010, 24, 3643-3652.

Writing assignment paper No 3: Liu XS, et al., EMBO Reports. 2010, 11, 626-632.

Week 5

9 **9/19 M** ***Special time and Location***

3:30PM PULSe seminar by Dr. Hongwu Chen, University of California at Davis

9/20 Tu No class

10 9/22 Th Lecture by Dr. Sandy Rossie Ca2+ signaling

Week 6

11 9/27 Tu Lecture by Dr. Sandy Rossie Protein phosphatase

12 9/29 Th ***Special time and Location***

11:30AM DDRF lobby Cancer Center seminar by Dr. Vivek Rangnekar, University of Kentucky

Week 7

13 10/04 Tu Lecture 9 DNA damage checkpoint

Review: Reinhardt & Yaffe, Phospho-Ser/Thr-binding domains: navigating the cell cycle and DNA damage response. *Nature Reviews/Molecular Cell Biology*, 2013, 14, 563-580

14 10/06 Th Lecture by Dr. Shihuan Kuang The Notch pathway in cancer

Week 8

10/11 No class, Celebrating Fall break!

15 10/13 Th **Mid-term Exam in class**

Week 9

16 10/18 Tu Lecture by Dr. Andrea Kasinski microRNA in cancer

17 10/20 Th ***Special time and Location***

11:30AM DDRF Lobby, PCCR seminar by Dr. Luzhe Sun, Univ of Texas Health Science Center

Week 10

18 10/25 Tu ***Special time and Location***

3:30PM PFEN, BCHM seminar by Dr. Natasha Kyprianou, University of Kentucky

19 10/27 Th Lecture 10 Regulated proteolysis

Review:
Bassermann F et al The ubiquitin proteasome system — Implications for cell cycle control and the targeted treatment of cancer. *Biochimica et Biophysica Acta*, 2014, 1843, 150-162.

Writing assignment paper No 4: Yang X. et al., J Biol Chem. 2009, 284, 18588-18592.

Week 11

20	11/01	Tu	Lecture 11	Programmed cell death

Review:
Wong R. Apoptosis in cancer: from pathogenesis to Treatment J Exp. Clin & Cancer Res. 2011, 30, 87.

21	11/03	Th	***Special time and location***	

11:30AM DDRF Lobby, PCCR seminar by Dr. Jer-Tsong Hsieh, UT Southwestern Medical Center

Week 12

22	11/08	Tu	Lecture by Dr. Mark Hall	Cell cycle in yeast
23	11/10	Th	Lecture by Dr. Ourania Andrisani	Polo-like kinase 1 in liver carcinogenesis

Week 13

24	11/15	Tu	Lecture by Dr. Andy Tao	Mass Spec to study protein phosphorylation
25	11/17	Th	Lecture by Dr. Jer-Yen Yang	The Hedgehog/Gli pathway

Review: Brechbiel J. Crosstalk between hedgehog and other signaling pathways as a basis for combination therapies in cancer. *Cancer Treatment Reviews*, 2014, 40, 750-759

Week 14

No class, Happy Thanksgiving!

Week 15

26	11/29	Tu	Lecture by Dr. Alice Chang	Cancer stem cells
27	12/1	Th	Lecture by Dr. Kavita Shah	Aurora kinases in cancer

Week 16

28	12/06	Tu	Lecture by Dr. Tony Hazbun	Genomic instability
29	12/08	Th	Final exam in class	