

03-709

Applied Cell and Molecular Biology

12 units

Fall 2016

Tues and Thurs, 1.30 pm – 2.50 pm

DH 2105

Wed, 4.30pm – 5.50 pm

MI 348

Instructor: **Shoba Subramanian, Ph.D.**
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General Description:

This course will introduce and review key cellular and molecular phenomenon in biological pathways with strong emphasis on latest experimental techniques used in applications including but not limited to disease diagnosis, therapeutics, large scale genomic and proteomic analysis. Knowledge gained from this course will be both conceptual and analytical.

This course will employ “active learning” teaching methodologies, thus making the classroom an interactive place, where back and forth exchange of ideas between students, and an active dialog between students and instructor will not only be essential but will also make learning much more fun and impactful. In addition, students will periodically analyze primary literature and work on an individual case study project, and give oral presentations.

Ultimately, students will cultivate sustained excitement about molecular and cellular aspects of biology and will be adept at applying this knowledge for problem solving.

Learning Objectives/Goals:

1. Describe **molecular mechanisms and regulation** of key cell biological processes.
2. Explain the significance of individual molecules and cellular pathways in **relationship to the big picture** of cell survival, cell division/growth at a tissue and organismal level.

3. Apply the major (classic and newer cutting-edge) **experimental and analytical techniques** in studying molecular details of cellular processes.
4. **Critically analyze scientific data** (primary literature) derived using these experimental techniques.
5. Design intervention strategies using all of the above expertise toward **problem solving** in application-based research for treating human disease and improving quality of life in the global community.

Grading Scheme:

Activity (#Points * #Events)

Pre-class Questions (Turn in on Blackboard) (7*10) = 70; **7%**

In-class Active Learning/Discussion (IALD) (5*11) = 55; **5.5% + Bonus**

3 In-Class Exams (125*3) = 375; **37.5%**

Verbal Final Exam (100) = 100; **10%**

Literature Review (oral.presentation60*1 + class.participation10*3)+(written.40*4)= 250; **25%**

Final Case-Study Project (oral.75*1)+(written.75*1) = 150; **15%**

Pre-Class Questions, PCQ (Turn in on Blackboard):

A week before given class, part of a textbook chapter and/or review article-based reading assignment with an associated set of questions will be posted on Blackboard. On PCQ days (as indicated in the course schedule), the answers associated with the pre-class questions will be graded for credit, and will be worth a total **7%** of the final grade. On other days, although the answers will not count toward course grade, students are required to read posted assignment and encouraged to submit confusing questions to the instructor. All answers must be submitted before *11.59 pm of the day before the scheduled class*. Each student's answers will be reviewed by the instructor prior to class, and these answers will set the tone and pace for each class. Importantly, the In-Class Active Learning and Discussion, IALD, will also be determined based on pre-class questions answered, which will be a reflection of students' understanding of the material. Most importantly, this will also give the instructor the chance to delve deeper into areas of particular confusion.

In-class Active Learning and Discussion (IALD):

In-Class Active Learning and Discussion (IALD) activities will be conducted mostly in small student groups or in student pairs with an occasional individual activity. Most of the exercises will be based on synthesis of biological concepts, explanation of rationale and derivation of application of experimental techniques, and discussion of scientific controversies and in ultimately defending a

scientific viewpoint. At least 11 such activities will be conducted leading to **5.5%** of final grade. There will be some **bonus** activities as well.

In-class Exams:

Exams will be 1 hr. 20 min. long, and will be held during regular class time. The goal of the exam is to test fundamental concepts learned in class with a significant emphasis on problem solving and experimental-design. Sample questions will be posted prior to each exam.

Exam 1 will cover lectures 1-8;

Exam 2 will cover lectures 9-17; and

Exam 3 will cover lectures 18-24.

A 1.5 hr. pre-exam review session will be held on campus 1 day prior to each exam day. Exams will be worth **37.5%** of final grade (12.5% each). The TA will also hold separate review and help sessions before exam.

Verbal Final Exam:

The verbal final will be a closed-door 1:1 exam, lasting ~30 minutes per student. The verbal assessment will be on a firm rubric, and uniform assessment criteria will be based on model building and problem solving with rapid feedback and evolution of follow-up questions. The verbal assessment mainly test a student's ability to communicate the intricacies of cellular process while keeping the big picture in mind at all times. **10%** of the final grade will be determined by performance in the verbal final. Sample questions for verbal final will be posted on blackboard.

Literature Review:

Primary literature papers will be assigned for review and discussion. Discussion will be held during the Wednesday class. Four such assignments will be posted on Blackboard. Students are expected to answer the questions posted for each paper; these will account to **16%** final grade (4% per paper). The other portion of the literature review grade (10 points per paper for discussion and 60 points for 1-time presentation = **9%** final grade) will be for in-class participation. For each paper, a group of students will lead an in-class discussion. For each paper review, all students will **actively participate** by furthering the discussion individually or by breaking into small groups to pose further questions and discuss a particularly difficult concept. This will trigger further analysis of the paper and the particular topic of research. If not participating, the student can be called out to voice their ideas in front of the whole class.

Final Case-Study Project:

At the end of the semester, each student will be asked to present a case study and submit a written report on his/her analysis. The student should: a) choose a biomedical product that is already in the market or is being considered as something that will be marketed (a drug, a vaccine, a gene therapy technique, a diagnostic kit), b) extensively study the history of the product including how the product was discovered/invented, c) describe the biological pathway targeted, d) how the product was tested, and e) why it was or can be successful. The student is expected to defend why the product works/can work, as well as to critique the product in the context of alternative methods that are or can become available. This has to be done as a short 10-12 minute presentation in front of the whole class (**7.5%** final grade); a third of the oral presentation grade will be determined by students serving as peer reviewers. In addition, a written report worth **7.5%** final grade (4-5 pages, single spaced) has to be submitted to the instructor. More details of the

report and presentation and the grading rubric will be posted later in the semester. Thus case study counts for 15% of final grade. Note that you need to pick out the topic, write an outline, and have it approved by Dr. Subramanian **at least three weeks before the final presentation**. Failure to do so will result in loss of 25 points off of the written report grade.

Required reading and Class Attendance:

Textbook chapters, manuscripts, review articles, slides, custom notes, key vocabulary words will be posted on Blackboard for student reading. Students are expected to use this material in combination with notes taken during lectures as a study guide for exams. **Attendance will be critical to performing well in this class.**

Text Book (Online free with CMU Andrew login at CMU library)

“Molecular Biology –Understanding the Genetic Revolution”, 2nd Edition, 2012 by David Clark and Nanette Pazdernik

<http://search.library.cmu.edu/vufind/Record/1481249>

<http://CM.ebib.com/patron/FullRecord.aspx?p=861227>

Other Good Texts for Reference:

[On Reserve for this course in the Sorrells (Engineering and Science) library, Wean Hall, 4th Floor]

1. “Molecular Biology of the Cell”, 6th Edition, 2015, Bruce Alberts *et al.*

2. “Biotechnology –Academic Cell Update Edition” 2012, David Clark and Nanette Pazdernik

*Older editions of textbooks 1 and 2 are available for free at <http://www.ncbi.nlm.nih.gov/books/>

Use of laptops and mobile devices:

Please silence all laptops and mobile devices when class is in session. Use of mobile device during class is prohibited. This is not only distracting to you but also disrespectful to other people around you.

Note Taking in Class:

It is highly recommended that you handwrite class notes. Such note-taking is proven to have better outcomes for course material retention and in boosting strength of understanding.

If you need scientific backing for the above, a recent article about this topic can be found here-
<http://www.scientificamerican.com/article/a-learning-secret-don-t-take-notes-with-a-laptop/>

Course Expectations:

In order to create a strong classroom environment and to enable a productive semester for the students and the instructor -

Students can expect the instructor -

- To design course material and assessment aligned well with the course learning outcomes
- To reply to emails in a timely fashion – typically within a day on weekdays and within 2 days on weekends

- To be punctual and to not go over time
- To be respectful to all students

The instructor can expect students-

- To be punctual
- To pay attention in class and be engaged in class discussions
- To not use mobile devices or laptops in class
- To make an effort to understand and solve problems within and outside class
- To get help when needed
- To be respectful to peers, to the TA, and to the instructor.

Academic Integrity and Plagiarism:

Professional communication (written and oral) is integral part of your training. Communication involves elements of style and integrity. For ethical reasons, it is not acceptable to copy phrases verbatim from other students or from textbooks, review articles, online sources like Wikipedia and use those in your answers. You need to assimilate information from different sources and resynthesize the material in your own words to convey your message. If there is an absolute need to use exact words from a published source, you should do this within quotes giving due credit to the source (for more details on proper quoting, refer to Strunk and White, *The Elements of Style*).

Turnitin or other online resources will be utilized to detect originality of your writing for most assignments in this class.

Note: During collaboration for paper reviews and discussions, the powerpoint will be a group effort, but the written answers should be individual work for all four paper assignments.

Any cases of plagiarism or breach of academic integrity will be reported to relevant authorities as per the Carnegie Mellon University policy on cheating.

Please visit <https://www.cmu.edu/academic-integrity/> for more information.

Take care of yourself:

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website at <http://www.cmu.edu/counseling/>. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

If you or someone you know is feeling suicidal or in danger of self-harm, call someone immediately, day or night: **CaPS: 412-268-2922** **Re:solve Crisis Network: 888-796-8226**

If the situation is life threatening, call the police:

On campus: CMU Police: 412-268-2323
Off campus: 911