BIOL442:

Self-assembly in cell biology: filaments, gels and droplets in health and disease

Tues/Thur 2-3:15

512 Fordham Hall

Description:

Many biological molecules can spontaneously self-assemble into structures of different shapes and sizes. How cells control and exploit the ability of molecules to take on such varied structures is central to basic cell processes such as cell division and growth as well as diseases such as neurodegeneration and cancer. In this class, we will read and discuss together the primary literature to understand how self-assembly in cell biology is harnessed in normal cells and goes awry in disease. A secondary goal will be for students to develop numeracy in cell biology so as to understand cell processes in a quantitative framework. Prerequisites:205 and ideally one other advanced course in Biology or Chemistry.

Goals for students:

-To become a critical reader of primary literature
-To practice analyzing data and discussing experimental results
-To learn how to extract quantitative information from cell biological experiments
-To learn how understanding basic cell biological mechanisms leads to insights into pathologies

Instructor:

Prof. Amy S. Gladfelter, Ph.D.
amyglad@unc.edu
Office location Fordham 516
Office hours: Tuesdays 3:30-4:30 or as needed

Texts:

Readings will be posted on the course Sakai site.

Grading:

10% written assignment # 1
20% written assignment # 2
25% written assignment # 3
10% Final presentation
15% Final exam
20% class participation

Expectations for assignments and class participation

******Definition of successful assignments:**
Class assignments and final exam will involve reading a primary literature paper and answering questions about the data and interpretations in the paper. Additionally, assignments will involve including suggestions for future experiments that build off of the content in the paper. Successful class assignments and exams will be concise, carefully and clearly written, polished in terms of grammar, and thorough with regard to answering the questions from several viewpoints or interpretations, depending upon the type of question. Assignments will be due by 5pm, printed, at my office on the date they are assigned.

*****Definition of class participation:**
Class participation involves the active engagement in class discussion. This requires careful preparation before class starts, thorough reading of the papers to be discussed, coming to class rested and being fully engaged with the discussion.
Discussion engagement will be defined as answering discussion questions posed by the professor, asking questions, participating in small group activities, and completing an end of class written reflection. Students should come to class with paper copies of any notes, slides and papers as we will only have limited use of laptops so that you can focus completely on discussion and course material. Students can have 3 excused absences throughout the term.

Anticipated schedule of topics

Tues 8/20	Introduction to class	
Thurs 8/22	Techniques overview: Biochemistry	
Tues 8/27	Techniques overview: Microscopy	
Thurs 8/29	How to build a polymer for life?	
Tues 9/3	No class	
Thurs 9/5	How is actin filament assembly controlled?	
Tues 9/10	How do cells use actin to crawl?	**Assignment 1 due**
Thurs 9/12	How cancer cells hijack actin regulation	
Tues 9/17	Microtubules: Machines for moving chromosomes	
Thurs 9/19	Visualizing dynamics of microtubules	
Tues 9/24	Microtubules, force and transport	
Thurs 9/26	Does size matter? Measuring length in the cytoskeleton	
Tues 10/1	Septins: a contrasting component of the cytoskeleton	
Thurs 10/3	Intermediate filaments: complexity brings strength	
Tues 10/7	The origins of the cytoskeleton	**Assignment 2 due**
Thurs 10/9	Bacterial polymer machines	
Tues 10/14	Bacterial division polymers	
Thurs Fall Break 10/17	No class	
Tues 10/22	How to build a cell compartment without a membrane?	
Thurs 10/24	Attend Carolina Biophysics symposium	
Tues 10/29	Using phase separation to organize an embryo	
Thurs 10/31	Building ribosomes from a liquid compartment	
Tues 11/5	Molecular grammar for phase separation	
Thurs 11/7	Phase separation and neurodegenerative disease	
Tues 11/12	Coping with stress using liquid droplets	**Assignment 3 due**
Thurs 11/14	How is the cytosol assembled?	
Tues 11/21	What does it feel like in the cytosol?	
Thurs Thanksgiving	No class	
Tues 11/26	Final presentations	
Thurs 11/28	Final presentations	
Tues 12/3- Last Day	Final presentations	
	Final exam	

The professor reserves to right to make changes to the syllabus, including assignment and presentation due dates. These changes will be announced as early as possible.