

## BIOL 71.01 (and BIOL 171) – Microtubule Dynamics and Motor Functions in Cell Biology

This course will examine how cells use microtubules to establish cell shape, move organelles, and segregate chromosomes during cell division. We will also cover current techniques employed for studying microtubules, microtubule-associated proteins (MAPs), and microtubule-dependent motor proteins. Each topic listed will be introduced and explored via a combination of lectures, review articles, and discussion of landmark paper(s) or papers from current literature. The overriding goal will be to improve your ability to critically analyze and evaluate original research data presented in the form of papers published in the scientific literature. Student participation during the course is critical to ensure that we have an active and productive discussion of the topics. The course will culminate in students working in small groups on the molecular basis of diseases linked to defects in MAPs or motor proteins.

**Discussion and Lecture (LSC 105):** MWF 11:30 AM – 12:35 PM

**Instructor:** Professor Wei-Lih Lee, Life Sciences Center Room 224, Phone: (603) 646-8706  
Email: wei.lih.lee@dartmouth.edu  
Office hour: Tu 12:15-1:05 PM or by appointment

**Textbook:** Cell Biology by TD Pollard, WC Earnshaw, and J. Lippincott-Schwartz (4th edition, 2024). Physical book is available for you at the Baker Circulation Desk. Use this textbook as a reliable and legitimate source of knowledge and information, rather than using the internet. Recommended chapters for readings are listed below.

**Available:** Powerpoint slides and papers for discussion will be posted on Canvas.

**Prerequisites:** BIOL 12 or 19 (Cell Structure and Function) and BIOL 13 (Gene Expression and Inheritance) and one from among BIOL 40, BIOL 41, BIOL 43, BIOL 45, and CHEM 41.

**Class Schedule:** Topics that we will discuss are tentatively planned as below.

Date	Week#	Topic	Readings
M Mar 25	1	Introduction; cell and cellular organization	Chapter 1
W Mar 27		Universal principles of living cells	
F Mar 29		Light microscopy	Chapter 6
M Apr 01	2	Microtubule assembly – role of GTP cap	Mitchison and Kirschner
W Apr 03		Critical concentration and MT organizations	Chapter 34
F Apr 05		Microtubule nucleation <i>in vitro</i> and <i>in vivo</i>	Goodson and Jonasson
M Apr 08	3	MAPs and pharmacologic tools	Westerman et al
W Apr 10		Rings on microtubules; kinetochore biology	
F Apr 12		Discovery of MAPs	Paschal et al (Fig 1)
M Apr 15	4	Techniques for assaying protein-protein interactions	Finkel and Cooper
W Apr 17		Uptake of transferrin receptor and co-IP lesson	Chapter 22
F Apr 19		Discovery of MAP1C (cytoplasmic dynein)	Paschal et al (Fig 4-7)
M Apr 22	5	Advantages and disadvantages: FRET and BiFC	
W Apr 24		Guilty by association	Steuer et al
F Apr 26		Controls for immunoblots; stages of mitosis	

M	Apr 29	6	Differences between microtubule motors	Dixit et al, Chapter 36
W	May 01		Effects of tau and neurodegeneration	
F	May 03		How to build a mitotic spindle	Tanenbaum and Medema
M	May 06	7	RNAi method; forces for spindle bipolarity	
W	May 08		Chromosome-dependent spindle assembly pathway	Tulu et al; Chapter 44
F	May 10		Antibody-mediated inhibition versus RNAi inhibition	
M	May 13	8	Branching microtubule nucleation phenomenon	Petry et al
W	May 15		How and why microtubule branches?	
F	May 17		Microtubule severing enzymes	Vemu et al
M	May 20	9	Lattice GTP-tubulin incorporation	
W	May 22		Student disease presentations	
F	May 24		Student disease presentations	
M	May 27	10	No class (Memorial Day)	
W	May 29		Student disease presentations	

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**Learning Goals:**

1. To improve critical reasoning and thinking. The overarching goal for this course is to improve your ability to read, think about, understand the scientific rationale, and critically analyze and evaluate original research data presented in the form of papers published in the scientific literature. During each class period, we will discuss facts and information with the goal of learning how to interpret and think about scientific data.
2. To improve your knowledge of cell biology. While honing your critical thinking skills, I hope to also expose you to a lot of interesting cell biology, some or most of which you have never heard about before. In particular, we will learn about the myriad roles of microtubules during mitosis and the various functions and mechanisms of regulation of microtubule motors during cellular polarization, differentiation, and division. We will explore techniques commonly used for studying microtubules and microtubule-associated proteins, some of which will be at the single molecule levels.

**Course Mode and Attendance:**

We will meet synchronously in person for lectures and discussions on MWF at the normal meeting times for the Period 11 timeslot. I will use the X-hour for office hours or for appointments as needed. All class meetings will be recorded but will not be simulcast via zoom. All recordings are accessible via Panopto on Canvas. Be sure to read the “Consent to Record” section, since you are agreeing to this by enrolling in the class.

You are *required* to attend class in-person unless you have an illness, a medical reason, or the need to isolate due to COVID-19. For the health and safety of our class community, **please do not attend class when you are sick**, nor when you have been instructed by Student Health Services to stay home. You will be able to view recordings of the class meeting on Canvas if you are unable to attend.

**Discussion and Lectures:**

Class schedule and lecture topics are provided above. Here I would like to explain how I intend to meet the learning goals for BIOL 71.01 and BIOL 171. For each class meeting after week #1,

there will be a discussion of a paper from recent literature or a landmark paper on the topic listed. The paper and its related references that will form the basis for class discussion will be posted on Canvas several days before the paper is slated to be discussed. During class, we will discuss facts and information with the goal of learning how to think about and interpret scientific data. For some papers, we may begin with a detailed discussion of their methods. I will ask you questions in class and expect you to take an active part in the discussion, both by answering questions posed of you, and by asking questions of me when something is not clear to you. It is important that you read the posted paper before class. This is essential for you to *not only* have an active and productive discussion of the topic during each class meeting *but also* for you to be successful in the class participation component that will help determine your grade.

### **Accommodations:**

Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services (SAS; [Apply for Services webpage](#); [student.accessibility.services@dartmouth.edu](mailto:student.accessibility.services@dartmouth.edu); 1-603-646-9900) and to request that an accommodation email be sent to me in advance of the need for an accommodation. Then, students should schedule a follow-up meeting with me to determine relevant details such as what role SAS or its [Testing Center](#) may play in accommodation implementation. This process works best for everyone when completed as early in the quarter as possible. If students have questions about whether they are eligible for accommodations or have concerns about the implementation of their accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

### **Religious Observances:**

Dartmouth has a deep commitment to support students' religious observances and diverse faith practices. Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me as soon as possible – before the end of the second week of the term at the latest – to discuss appropriate course adjustments.

### **Assignments and Grading Policies:**

Grading will be based on 2 written assignments, one disease presentation, one presentation critique, attendance, class participation, and professionalism. The assignments will contain questions for you to answer about a paper (or papers) on a particular topic that we have discussed in class. The presentation critique will contain questions for you to answer about one of the human diseases that you would have learned through student disease presentations.

Assignment #1 (due Apr 12)	graded, but not recorded (i.e., a chance for you to “practice”)
Assignment #2 (due May 3)	20%
Assignment #3 (due May 31)	20%
Disease presentation	20%
Presentation critique	10%
Attendance	10%
Class participation	15% (include collaborative annotation)
Professionalism	5% (see <a href="#">this guide</a> by Patterson for tips on professionalism)

**A final note about grading system:** Your grade is not determined by an enforced median system. You are therefore not competing against each other for grades in BIOL 71 and BIOL 171. Your final grade will be calculated according to the following process:

1. I will sum the percentage scores from each graded component listed above.
2. I will then convert the final percentage to a letter grade according to the following scheme:

- 93.00 – 100 → A
- 88.00 – 92.99 → A-
- 83.00 – 87.99 → B+
- 78.00 – 82.99 → B
- 73.00 – 77.99 → B-
- 68.00 – 72.99 → C+
- 63.00 – 67.99 → C
- 58.00 – 62.99 → C-
- 50.00 – 57.99 → D
- 0 – 49.99 → E

### **The Academic Honor Principle: Specific Expectations for BIOL 71 and BIOL 171**

The [Dartmouth College Student Handbook](#) states "Fundamental to the principle of independent learning are the requirements of honesty and integrity in the performance of academic assignments, both in the classroom and outside. Dartmouth operates on the principle of academic honor, without proctoring of examinations. Students who submit work which is not their own or who commit other acts of academic dishonesty forfeit the opportunity to continue at Dartmouth."

The [Academic Honor Principle](#) as applied to BIOL 71 and BIOL 171 affects the assignments and presentation critique that you must complete during the course. The completed assignments and the disease presentation critique that you will provide must be entirely based on your own work.

### **Use of Generative Artificial Intelligence:**

Utilizing Generative Artificial Intelligence (GenAI) to facilitate learning and overall productivity is becoming more common. While GenAI has shown remarkable potential as a supplementary tool for thinking and problem solving, there are many things it cannot do. There are also real downsides to over-relying on it.

In this course, we will be developing critical thinking skills that are important to practice on your own. We will treat GenAI similarly to other resources that you use, like the internet, to help you develop those skills. Here, then, are our rules:

1. Use of GenAI on assignments and presentation critique is permitted at your discretion, provided that it is judiciously implemented and reviewed, and properly documented at the time of submission. For any assignment or presentation critique on which you use GenAI, *you must turn in a cover letter*, including an explanation of your reasoning for using the technology (one to two paragraphs will suffice), as well as a comprehensive and verbatim list of the prompts you used, and a note on how you checked the accuracy of the output (another paragraph here).
2. Because we will be developing critical thinking skills through class participation (by commenting on, sharing ideas about, and deconstructing a paper together), use of GenAI is not permitted during class period.

Any failure to follow these rules will constitute a violation of the Academic Honor Principle. If you're unsure about whether or not a specific AI tool is permitted for use on any assignments in this course, please contact me.

### **Wellness Concerns:**

I recognize that academic terms at Dartmouth are challenging and intensive, and that classes are not the only demanding part of your life. There are a number of resources available to you on campus to support your wellness, including:

- [Primary Care and Dartmouth College Health Service \(Dick's House\)](#)
- [Counseling Center at Dick's House](#), call 603-646-9442, available 24/7
- [Student Wellness Center](#) in Berry Library
- [Pastoral Counseling](#) through the William Jewett Tucker Spiritual Center
- [Dartmouth Student Mental Health Union](#) if you would like to speak to a peer support listener
- Your [Undergraduate Dean](#)

Your well-being is very important to me. Please make me aware of anything that will hinder your success in this course.

### **Title IX Safety and Inclusivity:**

At Dartmouth, we value integrity, responsibility, and respect for the rights and interests of others, all central to our Principles of Community. We are dedicated to establishing and maintaining a safe and inclusive campus where all have equal access to the educational and employment opportunities Dartmouth offers. We strive to promote an environment of sexual respect, safety, and well-being. In its policies and standards, Dartmouth demonstrates unequivocally that sexual assault, gender-based harassment, domestic violence, dating violence, and stalking are not tolerated in our community.

The Sexual Respect Website (<https://sexual-respect.dartmouth.edu>) at Dartmouth provides a wealth of information on your rights with regard to sexual respect and resources that are available to all in our community.

Please note that, as a faculty member, I am obligated to share disclosures regarding conduct under Title IX with Dartmouth's Title IX Coordinator. Confidential resources are also available, and include licensed medical or counseling professionals (e.g., a licensed psychologist), staff members of organizations recognized as rape crisis centers under state law (such as WISE), and ordained clergy (see [https://dartgo.org/titleix\\_resources](https://dartgo.org/titleix_resources)). Should you have any questions, please feel free to contact Dartmouth's Title IX Coordinator or the Deputy Title IX Coordinator for the Guarini School. Their contact information can be found on the sexual respect website at: <https://sexual-respect.dartmouth.edu>.

### **Consent to Recording**

Given that COVID is still around us at low levels, there may be a situation that entails a switch to remote instruction. If that is the case, please be mindful of the following:

- (1) Consent to recording of lecture and group meetings
  - a) By enrolling in this course, you affirm your understanding that this course and any associated group meetings involving students and the instructor, including but not limited to scheduled and ad hoc office hours and other consultations, may be recorded within any digital platform used to offer in-person or remote instruction for this course.
  - b) You further affirm that the instructor owns the copyright to their instructional material, of which these recordings constitute a part, and distribution of any of these recordings in whole or in part without prior written consent of the instructor may be subject to discipline by Dartmouth up to and including expulsion.
  - c) You authorize Dartmouth and anyone acting on behalf of Dartmouth to record your participation and appearance in any medium, and to use your name, likeness, and voice in connection with such recording.
  - d) You authorize Dartmouth and anyone acting on behalf of Dartmouth to use, reproduce, or distribute such recording without restrictions or limitation for any educational purpose deemed appropriate by Dartmouth and anyone acting on behalf of Dartmouth.

- (2) Requirement of consent to one-on-one recordings

By enrolling in this course, you affirm that you *will not* under any circumstance make a recording in any medium of any one-on-one meeting with the instructor without obtaining the

prior written consent of all those participating, and you understand that if you violate this prohibition, you will be subject to discipline by Dartmouth up to and including expulsion, as well as any other civil or criminal penalties under applicable law.

### **Access to Campus Resources**

Many of you may be facing greater challenges than usual given the post-pandemic impacts to your living and learning environment, public health concerns, and a host of other factors (e.g., housing or food insecurity, new or changing caregiving responsibilities, visa and accessibility concerns, access to health and mental health support, and so on). I want you to be aware of the campus resources available to support your needs. While the situation is constantly evolving, many offices are prepared to meet with you via phone or zoom or in-person. For concerns about health and wellness, you may reach out to the [Dartmouth Health Service](#) (603-646-9400 or Secure Message in DartHub), [Counseling Services](#) (603-646-9442), and the [Student Wellness Center](#). For academic needs, you may contact your [Undergraduate Dean](#) (603-646-2243), [Student Accessibility Services](#) (603-646-9900), and the [Academic Skills Center](#) (603-646-2014). Students with concerns related to campus employment may connect with the [Student Employment Office](#) (603-646-3641). Those with visa-related concerns may reach out to the [Office of Visa and Immigration Services](#) (603-646-3474). I encourage you to take advantage of these resources, and to speak with me if you need support in the class.