MCB 305: Cell and Developmental Biology
Spring 2020

Class: M 3:00 p.m. – 3:50 p.m. Env & Nat Rsrcs Phas2, Rm N120
W and F 3:00 – 4:15 p.m., Env & Nat Rsrcs Phas2, Rm N120
Class website: http://www.d2l.arizona.edu

About the course:

Welcome to Cell and Developmental Biology. This course is part of a three-semester sequence that introduces MCB majors to the most exciting ideas in contemporary molecular and cellular biology. This course focuses on the structure and function of eukaryotic cells through the lens of cell and developmental biology. Key ideas in cell and developmental biology will be presented as working models along with examples of laboratory research used to confirm, refine or expand these models. Students will be asked to actively engage in reasoning with models by solving research-related problems both in and out of class. Examples will be based on health and environmental issues that affect our daily lives.

Instructor Information:

Molly Bolger, Ph.D
Associate Professor, MCB
Office phone: 520-621-7157
Office hours: Wednesdays 10-11, LSS 527A
(Note: office hours will only be held during the weeks Dr. Bolger is lecturing)
Email: mbolger@email.arizona.edu

Lisa Nagy, Ph.D.
Professor, MCB
Office phone: 520-626-2368
Office hours: Thurs 2-3 PM LSS 333 or by appointment
(Note: office hours will only be held during the weeks Dr. Nagy is lecturing)
Email: lnagy@email.arizona.edu

Teaching Assistants:

Sara Carey
sbcarey@email.arizona.edu

Brianca Rocio
bavalos@email.arizona.edu

Luke Kosinski
ljkosinki@email.arizona.edu

Eli Soyfer
esoyfer@email.arizona.edu

Course Preceptors:
Preceptors are available for office hours by appointment.
Additional office hour opportunities will be listed on d2l.

Andrew Alamban; aalamban@email.arizona.edu
Michael Hieu; michaelhieu@email.arizona.edu
Eric Lu; ericlu2000@email.arizona.edu
Alicia Mason; aliciamason@email.arizona.edu
Vito Marino; vitomarino@email.arizona.edu
Shaira Perez; shairaperez@email.arizona.edu
Arielle Tran; thytran@email.arizona.edu
Allyssa Walburn; allyssawalburn15@email.arizona.edu
Juliana Young; julianayoung1997@email.arizona.edu

What to expect from the course: A key component of this course will be presenting concepts and ideas in cell and developmental biology in the context of how biologists think. We will emphasis problem solving, critical thinking and collaborative learning. You will be given many opportunities to practice solving research-related problems in a variety of contexts. You will be asked to actively participate in class, by responding to questions, working in groups, and sharing your ideas and thought processes with others. You will earn points for in-class activities, but most importantly you will also gain in your scientific thinking skills and abilities to design and interpret experiments.

Class Mechanics: MCB 305 is a 4-unit lecture course. We will meet on M for a 50-minute class and on Wednesday and Fridays for 1 hr 15 min. Class participation is expected and in class activities count for roughly 20% of the final grade. **If you aren't there, you can't earn these points.**

Honors section: The class has a 1-unit Honors section that will meet for an additional hour each week and will be led by Dr. Pascale Charest, Associate Professor, MCB. The Honors section will focus on critical reading and discussions of research articles on topics related to those taught in class. Activities in the Honors section will count for 10% of your grade.
For questions contact Dr. Charest at: pcharest@email.arizona.ed

Prerequisites for MCB 305:
MCB 181R, MCB 181L, MCB 182, CHEM 241/243, Math 124 or 125, and **MCB 301 and 304.**
If you have already taken MCB 410, you cannot receive credit for 305.
Students with a prior failed attempt may only retake the course once.

Text and Required Materials:

Textbooks*:* There are **two required textbooks** for this course*:*

1.Cell and Molecular Biology: Concepts and Experiments, 8th edition (Gerald Karp) [7th edition is also acceptable and both sets of page numbers will be available]

> **Karp** 8th edition: https://www.amazon.com/Cell-Molecular-Biology-Experiments-Registration/dp/1119231515/ref=dp_rm_img_0/?tag=mcde-20
> **Karp** 7th edition: https://www.amazon.com/gp/offer-listing/1118206738/ref=dp_olp_used?ie=UTF8&condition=used/?tag=mcde-20

*2. Developmental Biology 12*th edition, by Michael J.F. Baressi and Scott F. Gilbert

eISBN-13: 9781605358239

I strongly recommend the Twelth Edition e-book (www.redshelf.com) as your best bet. The twelth addition is accompanied by an online resource center that has flashcards, multiple choice question banks, and additional online resources. Take a look, you may find it very useful. (The associated online materials are no longer supported for the 11th edition and the website has a lot of materials you will find interesting and useful).

Both textbooks are available in the ASUA Bookstore in the Student Union building under MCB 305.

eBooks: Both textbooks are available as a fully interactive e-booksor CourseSmart e-book for a **significant** discount. The UA Bookstore does not sell the online versions; you must obtain them from the publisher's website, Amazon or other websites. If you plan to use your Bursar's accounts to pay for the book, the e-Book or the CourseSmart versions will NOT be an option for you.

In-Class Polling We will be using clickers (Turning Point Technologies) as voting platform in the class. Clickers are interactive student response systems that allow you to participate in demonstrations, find out whether you understand a particular concept or idea, and examine your preferences and opinions. Clickers also allow us to get a snapshot of whether most students in the class understand particular concepts, and which areas we need to spend more time on or go back over. So the clickers are useful in helping you to learn and in helping us to teach more effectively. Thus, it is important that you remember to bring your clicker with you to class each day, and you participate using your clicker throughout the class.

If you do not have a clicker, a cell phone, or a laptop, we will accept a hard copy of your votes during class (please talk to one of the instructors or TAs the first day of class).

Obtaining a Clicker Device

Follow one of these scenarios for purchase:

1. Buy clicker bundle (device, 5-year subscription and use of mobile app) at the bookstore (allows the use of financial aid). Cost around $78.
2. Buy clicker bundle (device, 5-year subscription and use of mobile app) at Turning Technologies online store (less expensive, requires credit card and is mailed to you). Cost is $59.
3. Buy/Borrow a clicker from a friend or purchase on Amazon/eBay, but you still need to buy a Subscription License from Turning Technologies Online Store. Subscription license for one semester costs $17.99, one year costs $24.99, and on up for more years.
4. Purchase a Subscription License for ResponseWare (Mobile App) from Turning Technologies Online Store. Subscription license for one semester costs $17.99, one year costs $24.99, and on up for more years.

Registering your Clicker

You can follow detailed instructions on registering your clicker at https://help.d2l.arizona.edu/student/new-student-clicker-registration. You will need to log in to **D2L**, access your course and click on **UA Tools** and choose **Clickers**. Then follow steps for creating a Turning Technologies account and entering appropriate codes/IDs.

If you are using the physical clicker device there are 3 steps that you have to complete. Enter in your subscription license code, enter in your clicker device ID, and connect to the Brightspace LMS.

If you are only using the mobile app there are only 2 steps you have to complete. Enter in your subscription license code and connect to the Brightspace LMS.

Tips and FAQs about Use of Clickers

Go to https://help.d2l.arizona.edu/content/students-clicker-tips-and-faqs to read tips on using your Turning Technologies Clicker and a list of frequently asked questions.

Grading:

You will receive "in-class work" points for your votes; so please come prepared.

IF YOU ARE FOUND USING MULTIPLE CLICKERS, YOUR CLICKER(S) WILL BE TAKEN AND ALL INVOLVED PARTIES WILL BE INELIGIBLE TO RECEIVE CLICKER POINTS FOR THE REST OF THE SEMESTER. ADDITIONALLY, YOU WOULD BE IN VIOLATION OF THE UNIVERSITY'S CODE OF ACADEMIC INTEGRITY AND THE INFRACTION WOULD BE HANDLED ACCORDING TO UNIVERSITY POLICY.

Additional readings There will be additional readings posted on the website and provided as links or PDFs.

Important Note: ***We expect you to do the assigned readings***. Don't try to memorize details from the book – use the book to ***prepare for class***, to reinforce what you learned in class, and to make connections between all the pieces as they are taught.

Course Website Course materials and announcements for this section are available on the course website, at http://www.d2l.arizona.edu. Log on using your regular UA e-mail username and password, then click on the appropriate course link.

To access the class website, you must be registered as a student in this section of the course.

· **Weekly date book-** the home page of the class website has an orange and red weekly planner. Here you will find everything you need for the upcoming week – reading assignments, homework links, class powerpoints, any additional course materials. The Exam dates are also posted here. The link to the upcoming week will become live on Friday after class. Homework quizzes are solely administered through the site. Paper copies will not be accepted.

· **Announcements -** We post info on the d2l site and send email to your UA email accounts if we need to contact you about a change in plans. If you do not check your email, you will need to check the d2l site more frequently. We recommend that you **check the site daily.**

· **D2L grade book** is the official list of your scores for all of the work in the class. **Check your grades frequently to ensure that the scores recorded in the D2L gradebook are correct.** If you suspect that an error has occurred, please contact us i*mmediately*. Scores are considered final either three weeks after they are posted on D2L or the Thursday before the final exam, whichever comes first. After this, we will not make adjustments to the grade book.

Grades: Grades will be calculated on a points scale. Regular grades are awarded for this course: A B C D E. Final percentages will be used to calculate the final grade. A= 90-100%; B= 80-90%; C= 70-80%; D= 60-70%; E= less than 60%. For example a total of 4,050 points out of 4,500 will equal 90% (an "A" letter grade).

Course Units: The course is divided into four conceptual units and grades are formulated on a per unit basis as shown in the Table.

Unit 1	1000 Points	22% of Final Grade

Cellular Communication

Unit 2 *Cellular Control*	1000 Points	22% of Final Grade
Unit 3 *Conceptual and Experimental Toolkit of Developmental Biology and Stem Cells*	1000 Points	22% of Final Grade
Unit 4 *Developmental Genetics of Model Systems*	1000 Points	22% of Final Grade (Exam given as part of Final Exam)
Final Exam	500 Points (on Cumulative Portion)	11% of Final Grade

<u>Points will be earned in each Course Unit for:</u>
Unit Exam 500 Points (50% of unit grade)
Homework 300 Points (30% of unit grade)
In-Class work 200 Points (20% of unit grade)

With this grading scheme, the highest possible score for a student who does not attend class or complete assignments is 56%. Moreover, students who do not attend class and complete assignments are not expected to perform well enough on exams to achieve this score. For the sake of your grade, as well as your learning, you need to attend class and complete the out-of-class assignments.

Homework: Once a week, you will be required to complete a homework assignment. Homework will be a combination of review and pre-view questions, based on readings—sometimes from your textbook, sometimes from another source— and material covered in class. These assignments are designed to review material you have covered and prepare you for the coming weeks' class time. Some of the questions are designed to parallel the format of the unit exams, so that you will have practice with both instructor's style of exam question prior to

the exams. Each homework will consist of some multiple-choice questions, and some short answer questions. Answers to the short answer questions that are identical (or nearly word-for-word copies) are considered cheating and will receive no credit. Homework questions will be answered within d2l. You are allowed two attempts for homework quizzes, but scores are calculated as the average of both attempts, so try your best both times. Late homework will not be accepted and missed homework cannot be made up without a dean's excuse, within one week of a due date. At the end of the semester, we will drop your lowest homework score. This is to allow grace for life emergencies etc.

In-Class Work: In class, you will participate in-group discussions, examine scientific data, propose experimental designs and think through problems. You will also participate in interactive lectures. It is our goal to make class time as interesting, interactive and experiential as possible. You will receive points each day for work you do in class via clickers and/or materials you turn in. ***Missed in class assignments cannot be made up, but please see instructor TA or classmate to get any in-class notes or activities you may have missed (so that you do not fall behind on learning material).***

Dropping In-Class scores: Your lowest 4 in-class scores will be dropped at the end of the semester. It is in your best interest to reserve these drops for unavoidable misses (eg. If you are off to med/dental school interviews, or get sick).
Bottom line: ***you can miss 4 days of class in the semester, at no consequence***.
You don't even have to tell us! If you know that you will have more than 4 unavoidable misses due to multiple interviews or school trips, please talk to the instructors as soon as possible.

In-Class Exams: An in-class exam will be given at the conclusion of Units 1, 2, and 3. Each exam will be worth 500 points (half of the possible points in each unit). An exam for Unit 4 (worth 500 points) will be given as part of the final exam. The second half of the final exam (also worth 500 points) will be cumulative over the material from the entire course.
All exam dates are scheduled now and the dates will not change.
Friday, February 7; Wednesday, March 4; Friday, April 10
Exams will include multiple- choice and free response questions.

- No electronic devices will be allowed during the exams
- University policy regarding ethical conduct during examinations will be strictly enforced (see below).
- Missed exams will not be rescheduled. ***If an exam falls on a recognized holiday or event that you observe, contact the instructors within the first two weeks of class to arrange an alternate exam on another day.***

- If your absence from an exam has been pre-approved by the Dean of Students (or the Dean's designee), we will arrange for you to take an alternate exam at another time.
- Exam scores will be posted on the course D2L site as soon as they are available.

Exam regrades: The keys for the exams will be posted after all students have taken the exam. A scan of your exam will be viewable through d2l. After looking at the key, if you believe your grade is incorrect, you may submit a written description of your request to the d2l dropbox that will be provided. Regrade requests are due **one week** after your exams have been returned. All regrades will be done by either Dr. Bolger or Dr. Nagy, at which time, the entire exam may also be re-evaluated for points.

Final Exam: The date for the final examination is Tuesday May 12, 2020 at 3:30-5:30 in our regular classroom. This date is based on university policy and is subject to any changes made by the university.
Please check the registrar for any changes: https://registrar.arizona.edu/courses/final-examination-schedule-spring-2020?audience=students&cat1=10&cat2=31
Further information regarding the final exam will be given during the semester.
The final exam is worth 500 points.
- The final exam will be CUMULATIVE and include questions from both Dr. Bolger's and Dr. Nagy's sections.
- The final exam will be closed-book and closed-note.
- If the final exam conflicts with a final exam for another class, contact an instructor more than two weeks before the final exam to make arrangements.
- Unless arranged due to conflict with another final exam, **NO EARLY EXAMS WILL BE GIVEN**. Please make your travel arrangements so you travel AFTER the final. •
- Final exam scores will be posted on the course D2L site as soon as they are available.

Do not contact the course staff asking about your exam score before it has been posted.

Additional information about attendance from the university:
The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrativedrop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religiousaccommodation-policy.
Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences.

Incompletes: In accordance with university policy, the grade of "I", or incomplete, will only be given to a student whose circumstances prevent course completion. If a student is expected to repeat the entire course, a grade of "E" must be given. We must approve any "I" grades **before the last week of classes**. Incompletes that are not removed by the instructor within one year are converted to "E" grades. For undergraduate courses, the one-year limit may be extended with the approval of the instructor and the dean of the college in which the student is registered.

Audit Grades and Pass/Fail: Students registered for Audit will receive "O" grades. This course is not offered as Pass/Fail.

Withdrawals
1/19/2020: Last day to drop without a grade.
2/15/2020: Last day to withdraw in UACCESS.
See Dates and Deadlines https://registrar.arizona.edu/dates-and-deadlines/non-standard-start-dates
for additional deadlines.

Questions? If you have any questions about lecture or course material, please contact us. The best way to contact us is through email. We will check our email regularly throughout the day during the week and at least once during the weekend, barring unusual circumstances. We will do our best to respond to you as quickly as possible, but please realize that if you send us an email entitled "URGENT" late on a Saturday evening, we may not respond until Monday.

Accessibility and Accommodations: Our goal in this classroom is that all learning experiences are accessible to all students. If you anticipate or experience physical or academic barriers based on disability, please let Dr. Bolger or Dr. Nagy know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit http://drc.arizona.edu.

If you already have reasonable accommodations in place from the DRC, please plan to meet with us by appointment or during office hours to discuss your accommodations, how our course requirements and activities may impact your ability to fully participate, and what we can do to help. Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity. *Important: It is considered cheating to write someone's name on an in-class worksheet if they are not present, or if they slept through the class or did not participate in any way on the worksheet activities, or to turn in the same responses (word for word) on homework.*

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA email to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

Classroom Behavior Policy: to foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. The collaborative learning environment is intended to foster student interactions, but not those that disrupt the learning of others. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, sleeping, noisily coming or going from class outside the designated class time; etc.). When participation in any of these "extraneous activities" interferes with or obstructs the teaching or learning process in the context of the classroom setting, participating students will be asked to stop. This includes engaging in conversations with people sitting around you, or sharing content on electronic devices when the instructor or a student is talking to the whole class. Those who continue to disrupt the class will be asked to leave lecture or discussion. If the student or students refuse to leave after being requested to do so, the instructor may summon the University Police. For involuntary removal for more than one class period, involuntary withdrawal from class, or more serious sanctions, the disciplinary procedures set forth in section C, as defined by University policy http://policy.arizona.edu/education-and-student-affairs/ disruptive-behavior-instructional-setting will be utilized.

Electronic Devices in the Classroom: The use of devices such as cell phones, tablets and laptop computers is a possible disruption to class. We request that that the use of these devices be limited to class participation, such as note-taking and voting on in-class questions. Students who are using devices for other purposes leading to class disruption as outlined above may be

asked to power them off. If for some reason you are required to have your cell phone on alert at all times, eg. you are sole caretaker to family member, please let the instructors know.

Threatening Behavior: "Threatening behavior" means any statement, communication, conduct or gesture, including those in written form, directed toward any member of the University community that causes a reasonable apprehension of physical harm to a person or property. In the event of threatening behavior by one of the students in the course, official policies and procedures will be followed as described at http://policy.web.arizona.edu/educationand-student-affairs/threatening-behavior-students

UA Nondiscrimination and Anti-harassment Policy: The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy
Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Changes to this syllabus: Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

Course goals: The course aims for students to practice thinking like biologists and to become comfortable applying current experimental techniques in cell and developmental biology to biological datasets. We also aim for students to learn:

· how to apply model-based reasoning to cell and developmental biology data sets
· how to distinguish between correlation vs. necessity vs. sufficiency in experimental datasets
· to use public databases relevant to cell and developmental biology, eg. PubMed and Flybase.
· how to transfer methods learned in one experimental setting to another
· how cells interact with their environment and with each other through the use of specific molecules.
· how the plasma membrane and proteins within it serve important biological functions.
· the intricate mechanisms that cells use to direct the transport of proteins.
· how the cytoskeleton functions in the motility and structure of cells.
· the general features (proteins and cells) of the innate and adaptive immune system.
· some of the cellular abnormalities that can lead to development of cancer.
· how identical (or nearly identical) sets of genetic instructions produce hundreds of different cell types.
· how the cells in our body organize themselves into functional structures.

· how cell division is regulated and how body size is determined.
· how stem cells retain the capacity to generate new structures and cure debilitating diseases.
· how changes in development create new body forms in evolution.
· how the development of an organism is integrated into the larger context of its environment.

Learning Outcomes: In this course, you will gain experience with the following learning outcomes for MCB majors.

1. Demonstrate understanding of the ways that chemical principles govern the ability of biological molecules to form cellular structures, tissues, organs, and organisms, and the energy transformations that make these steps possible.
2. Explain mechanisms and outcomes of the ability of cells to sense and respond to internal and external cues.
3. Explain the role of and mechanisms by which the genome and its products generate biological structures and phenotypes, including human disease, including:
   • Differentiate among replication, transcription, and translation with regard to mechanisms and biological roles.
   • Analyze mechanisms of inheritance and their consequences for phenotypes.
   • Differentiate among various types of mutations and predict their outcomes at the molecular, cellular, and organismal level.
4. Describe how evolution affects molecules, cells, and organisms and shapes the diversity of life on Earth.
5. Explain how the properties of biological systems emerge from the interactions among individual components of those systems.
6. Describe ways that research in different experimental organisms sheds light on the important biological processes described in #1-5.
7. Communicate effectively about scientific ideas and methods.
   • This includes oral and/or written presentation.
   • This includes appropriate choice of data presentation modes (tables, diagrams, graphs, etc.).
8. Read and interpret primary scientific literature in cell and molecular biology, linking the results to prior understanding of biological processes. Evaluate the reliability of sources of information about biology.
9. Apply analytical thinking to biological problems:
   • Understand and/or build models that generate testable hypotheses about biological processes.
   • Critique experimental design in existing research and apply principles of experimental design to new research problems.
   • Apply quantitative strategies to analyze and understand biological processes.

10. Demonstrate ability to analyze the role of biology in societal decisions and to apply ethical decision making to evaluate existing and new scientific approaches.