

**MCB 410**  
**Cell Biology**  
**Spring II 2020**

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» *Additional availability: Questions answered regularly via the D2L online Discussion Board*

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» *Availability: Questions answered regularly via the D2L online Discussion Board*

**Course Description:** This course will present concepts critical to our understanding of cell structure and function to intermediate-level students. The course will highlight key molecular processes that determine the organization and function of eukaryotic cells, including membrane structure and synthesis, protein localization and function, cytoskeletal-directed movement, mitochondrial ATP generation, cell signaling, and cell cycle regulation. Students will use the information presented in online lectures, in the required text, and in relevant online videos to answer questions about cellular processes and to interpret data obtained using modern cell biological techniques.

**Expected Learning Outcomes:** This course in Cell Biology will enable students to:

- *Outline the basic characteristics of all cells, the cell structure of prokaryotic and eukaryotic cells, and the chemical structure and function of the major classes of biomolecules found in all cells.*

- *Relate processes governing membrane composition and the movement of molecules across membranes, including protein sorting to membrane-bound compartments, to membrane and cell compartment function.*
- *Describe the major components of the cytoskeleton, cellular trafficking machinery and cell junctions, and explain the importance of these systems to cell organization, communication, and replication.*
- *Interpret diagrams that represent cell regulatory pathways and predict how alterations in these pathways might lead to disease or the uncontrolled growth that is characteristic of cancer.*
- *Interpret data obtained using several standard cell biological techniques: Western blot, fluorescence microscopy, and analysis of mutants, including cells altered using CRISPR techniques.*

**Required Text:** *Essential Cell Biology*, 5<sup>th</sup> Ed., Alberts, Hopkin, Johnson, Morgan, Raff, Roberts, and Walter. W. W. Norton & Company

**Inclusive Access for *Essential Cell Biology*, 5<sup>th</sup> Ed. via The University of Arizona**

**Bookstores:** The Inclusive Access program is a digital textbook model in collaboration with top publishers to reduce the cost of required course materials. Access for all students begins the first day of class, with the option to opt-out of purchasing through the drop/add day.

<https://shop.arizona.edu/textbooks/Inclusive.asp>

**Required Assignments:** Assignments will be listed in the Weekly Calendar posted in D2L under the “content” section and will include:

- (1) reading indicated sections of the required text, *Essential Cell Biology*
- (2) viewing recorded lectures and answering embedded questions (credit upon completion)
- (3) participation in group Discussions (rubric posted in D2L)
- (4) completion of Quizzes (“open book” multiple choice)
- (5) completion of Exams (proctored by *Examity*, multiple choice)

**Grades:** Grades will be determined by student success on the required assignments based on the distribution below:

Assessment Item	Percent of Total	Number Assessed/Total Item
Syllabus Quiz	1%	1/1
Introductions	1%	1/1
Lectures with Questions	20%	23/26
Discussions Lectures 4, 8, 23, 26	20%	4/4

<b>Quizzes</b> “open book” multiple choice highest score of 2 attempts	20%	5/6
<b>Exams</b> proctored multiple choice one attempt	38%	2/2

- A: 90 – 100 %
- B: 80 – 89.9%
- C: 70 – 79.9%
- D: 60 – 69.9%
- E: below 60%

*Incompletes (“I”) will only be given to students who have satisfactorily completed the majority of course work (C or above) and have serious, documented reasons for not completing the course.*

**Makeup policy:** There will be no makeup assignments for this course. However, the lowest quiz score will be dropped, and three lectures can be missed without penalty.

**Exams Proctored by Examity:**

- More info: <https://intech.arizona.edu/tools/examity>
- System requirements:
  - You must take the exam on a desktop computer or laptop (not a tablet or Chromebook).
  - You must have a working built-in or external webcam and microphone.
  - Your internet speed must be at least 3 Mbps download and 3 Mbps upload.  
Determine your internet speed by running a test at: <http://www.speedtest.net>

**Distribution of class materials:** The instructor does **not** give permission to distribute class materials on the internet or any type of social media platform.

**Subject to Change Statement:** The information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.

**Absence and Class Participation Policy:** For this online course, *class participation* is measured by completion of the assessment items listed above: viewing recorded lectures and answering embedded questions, participating in online Discussions, and completion of online Quizzes and Exams.

The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

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/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

**Accessibility and Accommodations:** Our goal is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let the instructor know immediately so that options can be discussed. 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>.

**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/codeofacademicintegrity>  
<http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

Note that any plagiarism observed will result in a failing grade for that portion of the class. The University Libraries have some excellent tips for avoiding plagiarism, available at <http://www.library.arizona.edu/help/tutorials/plagiarism/index.html>.

*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 e-mail 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.*

**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>

**Classroom Behavior Policy:** To foster a positive online learning environment, students and instructors have a shared responsibility. Our online classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions without fear of bullying or discrimination by others. To that end please adhere to the "netiquette" policy **outlined below** and found on your course D2L site under Content>Start Here>Strategies for Online Success. Those who consistently disrupt the online learning environment may be reported to the Dean of Students.

Netiquette is an abbreviation for "internet etiquette" – more simply put, guidelines for communicating online to ensure meaningful and polite exchanges. The common standards listed below work well for both the online classroom and beyond in professional online communication:

1. **Behavior.** Maintain the same standard of behavior and ethics that you would follow in a face-to-face context.
2. **Tone.** Treat others with respect. Be mindful of your tone and how that is conveyed in your writing style. **DO NOT USE ALL CAPS.** It is considered shouting and not appropriate in a classroom. Avoid sarcasm and irony as it is easily misinterpreted in an online environment.
3. **Clarity and Content.** Be succinct. Write, reread, and then post. Carefully consider what you have written. Does it make sense? Is it free from errors? Does it add to the conversation? Is it unnecessarily confrontational or offensive?
4. **Contribute.** Online learning is not passive. It is expected that you will share your knowledge and insight. Be an active contributor to the learning community.
5. **Be forgiving.** If someone makes a mistake or does something inappropriate, address it privately and politely. You can always let the instructor know and ask them to address it as well.

**Threatening Behavior Policy:** The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Additional Resources for Students: UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

**Please see MCB 410 Spring II Course Calendar on next page**

## MCB410 Spring II 2020: Course Calendar

	Lectures	<i>Essential Cell Biology</i> Reading & Video Assignments	Assessments
<p>Week 1: <b>Fundamental Properties of Cells</b></p> <p><b>3/15 (6pm) – 3/22 (11:59pm)</b></p> <p>Goals: Review properties that define a cell, basic cell structure, and chemical structure/function of biomolecules. Outline how Western blotting is used to analyze proteins.</p>	<p><b>L1: Cells: Basic Units of Life</b></p> <p><b>L2: Cell Structure &amp; Biomolecules</b></p> <p><b>L3: Proteins</b></p>	<p><b>ECB Ch1:</b> pp 1-15, 27-36 panel 1-2 (p 25) animations: 1.7, 2.3</p> <p><b>ECB Ch1 and Ch2:</b> pp 16-27, 56-63 panel 2-3(pp 70-71) animations: 2.4</p> <p><b>ECB Ch4:</b> (for review: pp 117-136) pp 137-169 Table 4-1 (p 142) animations: 4.5, 4.8, 4.12</p>	<p><b>Quiz 1 (L1-L3)</b></p>
<p>Week 2: <b>Organizing the Cell I</b></p> <p><b>3/20 (6pm) – 3/29 (11:59pm)</b></p> <p>Goals: Understand how membranes define “inside vs outside” and cellular compartments. Describe how molecules move across membranes including energy requirements for the process. Outline how proteins are trafficked to specific compartments and membranes. Recognize that mis-localization of proteins can result in disease.</p>	<p><b>L4: Analyzing the Cell Discussion: Antibodies &amp; Western Blots</b></p> <p><b>L5: Membrane Structure</b></p> <p><b>L6: Crossing Membranes</b></p>	<p><b>ECB Ch4:</b> pp 138-139 panels:4-2 (pp 140-141), 4-3 (p 164), 4-5 (p 167) animations: 4.7 <b>required videos:</b> <i>Western blot cartoon</i> <i>Western blot demo</i></p> <p><b>ECB Ch2:</b> pp 54-55 <b>ECB Ch11:</b> pp 365-386 animations: 11.1, 11.3, 11.4, 11.5</p> <p><b>ECB Ch12:</b> pp 389-410 animations: 11.6, 12.1, 12.2, 12.4, 12.5, 12.6 recommended video: <i>iBiology, Membrane Transport Proteins</i></p>	<p><b>Discussion 1</b> Based on Lecture 4: <a href="#">Antibodies &amp; Western blots</a></p>

	<b>L7: Protein Sorting</b>	<b>ECB Ch15:</b> pp 495-511, 516-518 animations: 15.2, 15.4, 15.6	<b>Quiz 2 (L4-L7)</b>
<p>Week 3: <b>Organizing the Cell II</b></p> <p><b>3/27 (6pm) – 4/5 (11:59pm)</b></p> <p>Goal: Describe how the cytoskeleton maintains cell organization, shape, and polarity. Differentiate between the major types of cytoskeletal polymers. Gain an initial understanding of the role of the cytoskeleton in communication between cells and the extracellular environment.</p>	<p><b>L8: Analyzing the Cell Discussion: CFTR &amp; Protein Sorting</b></p> <p><b>L9: Vesicular Transport</b></p> <p><b>L10: Microtubule Highways</b></p> <p><b>L11: Cytoskeletal Filaments</b></p> <p><b>L12: Cell Junctions</b></p>	<p><b>refer to ECB Ch15:</b> pp 516-519</p> <p><b>ECB Ch15:</b> pp 511-528 animations: 15.5, 15.8, 15.10, 15.12 <b>required video:</b> iBiology Youreka Science: <i>Familial Hypercholesterolemia and LDL receptors</i></p> <p><b>ECB Ch17:</b> pp 573-574, 580-589 animations: 17.2, 17.3, 17.4, 17.5</p> <p><b>ECB Ch17:</b> pp 575-579, 592-596 animations: 4.3, 17.1</p> <p><b>ECB Ch20:</b> pp 701-708 animations: 20.2</p>	<p><b>Discussion 2</b> Based on Lecture 8: <b>CFTR &amp; Protein Sorting</b></p> <p><b>Quiz 3 (L8-L12)</b></p>
<p><b>Exam 1</b> <b>4/3 (6pm) – 4/6 (11:59pm)</b></p> <p>Week 4: <b>Moving the Cell</b></p> <p><b>4/3 (6pm) – 4/12 (11:59pm)</b></p>	<p><b>L13 (Self-guided): Introduction to Fluorescence Microscopy</b></p>	<p><b>required videos:</b> iBiology: <i>Introduction to Fluorescence</i></p>	<p><b>Exam 1 (L1-L12)</b></p>

<p>Goal: Describe the basis for various types of cell movement, specifically cell crawling, movement of cilia/flagella, and muscle cell contraction. Distinguish between the filaments and structures used for each.</p> <p>Week 4: <b>Powering the Cell I</b></p> <p>Goal: Outline how cells convert the energy in food to usable energy for the cell. Relate mitochondrial structure to function in energy generation. Understand that mitochondria and chloroplasts retain a small number of critical genes and the capacity to synthesize the encoded proteins.</p>	<p><b>L14: Cytoskeletal-Driven Cell Movement</b></p> <p><b>L15: Mitochondrial Structure and The Endosymbiotic Hypothesis</b></p>	<p><i>Microscopy</i> (to minute 6:18) <i>What Is Fluorescence Microscopy?</i> animations: 15.13, 17.6</p> <p><b>ECB Ch17:</b> pp 590-593, 596-606 animations: 12.3, 17.7, 17.8, 17.9, 17.10, 17.11, 17.12, <b>recommended video:</b> <i>Skeletal Muscle Contraction: The Sliding Filament Mechanism</i></p> <p><b>ECB Ch13:</b> pp 427-431, 438 <b>ECB Ch14:</b> pp 455-469, 474-475 animations: 14.1, 14.3, 14.4, 14.5</p>	
<p>Week 5: <b>Powering the Cell II</b></p> <p><b>4/10 (6pm) – 4/19 (11:59pm)</b></p> <p>Goal: Relate protein localization to mitochondrial function. Describe how mitochondrial defects can affect human health.</p> <p>Week 5: <b>Regulating the Cell</b></p> <p>Goal: Outline the major signaling pathways in cells. Describe several signals that elicit a cellular response and several ways in which</p>	<p><b>L16 (Self-Guided): Mitochondrial-associated Disease</b></p> <p><b>L17: Cell Signaling I: General Principles &amp; G-protein-Coupled Receptors</b></p> <p><b>L18: Cell Signaling II: G-protein-Coupled Receptors</b></p> <p><b>L19: Cell Signaling III: Enzyme-Coupled Receptors</b></p>	<p><b>required video:</b> iBiology: <i>Mitochondrial Pyruvate Carrier</i></p> <p><b>ECB Ch16:</b> pp 533-545 animations: 12.7, 12.8</p> <p><b>ECB Ch16:</b> pp 545-557 animations: 16.2, 16.3, 16.4, 16.5, 16.6 <b>required video:</b> <i>Cholera Toxin Mode of Action</i></p> <p><b>ECB Ch16:</b> pp 557-569 animations: 16.7</p>	

<p>cells might respond changing conditions.</p>			<p><b>Quiz 4 (L14-L19)</b></p>
<p>Week 6: <b>Replicating the Cell</b></p> <p><b>4/17 (6pm) – 4/26 (11:59pm)</b></p> <p>Goal: Summarize the phases of the cell cycle and the processes that occur during each. Discuss major regulators of the cell division cycle and provide an example of experiments that led to this current understanding. Outline the apoptotic pathway. Relate normal growth control mechanisms to dysregulation in cancer cells. Describe proteins/protein complexes that drive mitosis and cytokinesis.</p>	<p>L20: (Self-Guided) <b>Overview of the Cell Division Cycle</b></p> <p>L21: <b>The Cell Division Cycle II: Growth Control Mechanisms &amp; Cancer</b></p> <p>L22: <b>Mitosis and Cytokinesis</b></p>	<p><b>ECB Ch18:</b> pp 609-627 required video: iBiology, <i>Controlling the Cell Cycle</i></p> <p><b>ECB Ch18:</b> pp 627-639 panel 18-1 animations: 18.2, 18.5, 18.7, 18.8, 18.9, 18.10</p> <p><b>ECB Ch20:</b> pp 718-729 animations: 20.7, 20.8</p> <p><b>ECB Ch18:</b> pp 639-646 also, pp 32, 518, 561 animations: 18.1, 18.3, 18.11</p>	<p><b>Quiz 5 (L20-L22)</b></p>
<p>Week 7: <b>Development at the Cellular Level</b></p> <p><b>4/24 (6pm) – 5/3 (11:59pm)</b></p> <p>Goal: Describe how CRISPR is used to genetically modify cells; analyze CRISPR-generated data related to cell cycle regulation. Summarize for a non-biologist the notable characteristics of stem cells. Outline the Wnt pathway and how differences in pathway regulation relate to cell fate. Relate neuronal function to cellular</p>	<p>L23: (Self-Guided) <b>Analyzing the Cell Discussion: Using CRISPR</b></p> <p>L24: <b>Stem Cells</b></p>	<p><b>ECB Ch10:</b> pp 358-359 required video: iBiology Youreka Science: <i>CRISPR: A Word Processor for Editing the Genome</i></p> <p><b>ECB Ch20:</b> pp 711-718, Fig 8-21 animations: 20.5, 20.10 required video: iBiology: <i>Discovery and Characterization of Adult Stem Cells in the Gut</i> (to minute 11:30)</p>	<p><b>Discussion 3</b> Based on Lecture 23: <i>Using CRISPR</i></p>

<p>processes such as signal transduction, ion channel regulation, cell organization and vesicle trafficking, and regulated endocytosis. Understand how apoptosis contributes to the development of an organism.</p>	<p><b>L25: Bringing it Together: Cell Organization and Signal Propagation in Neurons</b></p>	<p><b>ECB Ch12:</b> pp 409-422 animations: 12.10, 12.11, 12.12, 12.13, 12.14</p>	<p><b>Quiz 6 (L23-L25)</b></p>
<p>Week 8: <b>Final Discussion and Prepare for Exam 2</b></p> <p><b>5/1 (6pm) – 5/7 (11:59pm)</b></p> <p>Goal: Reflect on cellular processes that lead to the amazingly adaptive characteristics of different cell types. Prepare for final exam.</p> <p><b>Exam 2</b></p> <p><b>5/8 (8am) – 5/11 (11:59pm)</b></p>	<p><b>L26: (Self-Guided): Amazing Things Cells Can Do</b></p>	<p><b>required video:</b> iBiology: <i>Ten Craziest Things Cells Do</i></p>	<p><b>Discussion 4</b> Based on Lecture 26</p> <p><b>Exam 2 (L13-L25)</b></p>