

## **BIOL/CHEM 360 Cell and Molecular Biology**

**Spring 2020**

3 Credits

Prerequisites: BIOL 115/116 and CHEM 105/106  
BIOL 260 (Genetics)

Professor: Dr. Kristin O'Brien

[kmobrien@alaska.edu](mailto:kmobrien@alaska.edu); 474-5311

323F Margaret Murie Building

**REQUIRED ITEMS:** *Essential Cell Biology* (5th edition) by Alberts *et al.* with *Smartwork5* for homework assignments

**OFFICE HOURS AND REQUIRED MEETINGS:** I will host office hours **Tuesdays 9 -10 am** and **Thurs 3-4 pm**. I will be available in my office, by phone or Skype during these hours. If these times don't work for you, please don't hesitate to contact me to arrange another time to meet. Homework is due on Sunday. If you need help, please be sure to contact me by Friday. In general, I am unavailable by email on the weekend.

- If you have a grade of 'C' or lower then must arrange a time to meet with me in person or via Skype before each exam.

**COURSE DESCRIPTION:** This is an introduction to cell and molecular biology that will cover cell chemistry, cell architecture, regulation of gene expression, metabolism, signal transduction pathways, the cell cycle, and cells in their social context.

### **STUDENT LEARNING OUTCOMES:**

- (1). Identify and describe the structure and function of the components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- (2). Understand the flow of information in cells from DNA to RNA to protein
- (3). Understand how cells obtain and use energy
- (4). Understand how cells replicate themselves
- (5). Understand how cells communicate with each other within multicellular organisms
- (6). Gain experience in communicating science through written homework assignments and exams

**INSTRUCTIONAL METHODS:** This course will be taught through a combination of lecture videos, problem solving, and reading the scientific literature.

**FORMAT OF THE COURSE:** The course content includes 12 modules. Each module will become available on **Friday by 5 pm** and all assignments are due **9 days later on Sunday by 11:59 pm unless otherwise noted. There are some exceptions to this schedule** and due dates, which are clearly indicated in the schedule for the course below. You will have one "pass" to submit an assignment up to 48 hours late, otherwise **no late assignments will be accepted.**

Each module includes several videos. Some are recorded on a Learning Glass, in which you see me drawing on a board. Others are filmed using Kaltura, in which you see Powerpoint slides

and me. You can adjust the view of these Kaltura videos. When you click on the video to play it, you will see a rectangle on the right side. If you click on this rectangle, 3 rectangles will appear. Select the white rectangle to view only the slides. Select the white rectangle with a grey box in the lower right corner to view the slides with me in the lower right corner. Select the two white rectangles to view a split screen of the slides and me. All slides used in the lectures are posted on Blackboard within the appropriate module.

**Blackboard:** I use Blackboard (BB) to post announcements and email students. Please check the Blackboard site on a regular basis. I use UAF email accounts to contact students. Please check your UAF account on a regular basis. If you use an alternate account, please have your UAF mail forwarded to that account.

**ASSIGNMENTS:** This course uses several on-line platforms for assignments including:

- **Blackboard** for group work, discussions, and some homework assignments.
- **Smartwork5:** Most modules include homework assignments on this site, which is maintained by the textbook company (W.W. Norton & Company). There is a link to the website in “course content” in Blackboard. The access code for the site is bundled with the textbook and instructions for registering are located in “course content” in Blackboard. The multiple-choice questions on these assignments will help you to review content and test your understanding of the material. You will have two chances to select the correct answer but if will receive half-credit for the second answer. Note: although each question in Smartwork 5 is worth 1 point, grading in Smartwork5 will be scaled according to the point value shown in the table below. For example, if you received 27/30 points in Smartwork5 but the assignment is worth 10 points, then your grade is 9 points.
- **Gradescope:** This site will be used for homework assignments that require short answers and data interpretation. There is a link to this site in “course content” in Blackboard. The homework assignment can be downloaded as a Word doc from Blackboard or as a pdf file on Gradescope and must be uploaded to Gradescope. Instructions for how to use Gradescope are posted under course content in Blackboard.
- **Perusall:** This site will be used for reading and discussing of primary literature. Instructions for how to use Perusall are posted under course content in Blackboard.

**EXAMS:** Exams will be based on content covered in reading assignments, lecture videos and homework. If you anticipate missing an exam for family or work commitments, please let me know in advance so that we can make other arrangements. If you must miss an exam because of unexpected, extenuating circumstances (ie; family death, medical excuse) then you must contact me as soon as possible and within 24 hours of the exam or you will receive a 0 on the exam.

**All exams are proctored and must be completed by 5 pm on exam day. You will be given 90 minutes to complete each exam except for the final for which you will be given 2 hours.** If you are located in Fairbanks, the UAF eCampus Exam Center in the Bunnell Building will provide a proctored exam 8 am – 5 pm. If you are a non-UAF student, email [uaf-ecampus-proctor@alaska.edu](mailto:uaf-ecampus-proctor@alaska.edu) to arrange a proctored exam. More information about obtaining a proctored exam can be found here: <https://ecampus.uaf.edu/arrange-a-proctored-exam/>. The first homework assignment will require you to identify your proctoring site and email me the contact information for it.

**Grading:** Your final grades will be based on the following:

- 1. Exams (450 pts; 61%):** There will be three exams during the semester and one final exam (4 total). Each exam during the semester will be worth 100 points and the final exam will be worth 150 points. 50 points of the final exam will cover the last section of material and 100 points will be cumulative. The purpose of these exams is to assess your understanding of the material and to develop your written communication and critical thinking skills. The exams will be a combination of multiple choice and short answer questions.
- 2. Homework assignments (290 pts; 39%):** Each module will have a set of homework assignments. Most are worth 20 points, although there are some that are longer or shorter and these are worth more (30- 40 points) or fewer points (15 points), respectively. The breakdown of points is detailed in the schedule below. **Late assignments will not be accepted.**

Grades will not be curved and final grades will be determined as follows:

Grade	% of Total Points
A+	97-100
A	90-96
A-	88-89
B+	86-87
B	80-85
B-	78-79
C+	76-77
C	70-75
C-	68-69
D+	66-67
D	60-65
F	0-59

**Tips for succeeding in cell biology:** We will cover a large amount of material during this semester. Some of it may be familiar to you but many topics will be new. Here are some suggestions for doing well in this course.

- Give yourself plenty of time to complete each module. A 3-credit course requires ~ 9 hours of time each week outside of lecture (videos).
- Read the textbook. Read the textbook before and after watching the videos. Reading it before the lecture videos introduces you to the content; reading it afterwards allows you to fill in blanks in your notes that you took while watching the videos.
- Watch the videos and take notes.
- Use the questions in your textbook to test your understanding of the material. The answers are provided in the back of the textbook.
- Complete the homework assignments using your notes and the textbook. This will ensure that you do well on the assignments and will help with reviewing the material.
- Use the objectives as a study guide but don't focus solely on these. It is essential to quiz yourself to identify what you know and what you don't know.

**EMAIL ETIQUETTE:** I will do my best to respond to your email inquiries within 24 hrs. Please be considerate in your letters and use proper English grammar. Think before you send and never write anything you would be uncomfortable saying to me in person. Lastly, please sign your letter; addresses don't always reveal the writer's identity. Keep in mind that I am usually unavailable in the evenings (after 6 pm AK time) and on weekends.

**DISABILITIES:** I will work with the Office of Disabilities Service (203 WHIT, 474-7043) to provide accommodations in both the classroom and laboratory to provide equal access to all materials in this course to all students.

**ACADEMIC INTEGRITY:** As described by UAF, scholastic dishonesty constitutes a violation of the university rules and regulations and is punishable according to the procedures outlined by UAF. Scholastic dishonesty includes, but is not limited to, cheating on an exam, plagiarism, and collusion. Cheating includes providing answers to or taking answers from another student. Plagiarism includes use of another author's words or arguments without attribution. Collusion includes unauthorized collaboration with another person in preparing written work for fulfillment of any course requirement. Scholastic dishonesty is punishable by removal from the course and a grade of "F." For more information go to [Student Code of Conduct](#).

**STUDENT PROTECTIONS AND SERVICES:** Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc to find reasonable accommodations. Students at this university are protected

against sexual harassment and discrimination (Title IX), and minors have additional protections. As required, if I notice or am informed of certain types of misconduct, then I am required to report it to the appropriate authorities. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site:

[www.uaf.edu/handbook](http://www.uaf.edu/handbook)

**SUPPORT SERVICES:** Go to the Student Handbook ([www.uaf.edu/handbook](http://www.uaf.edu/handbook)) for things like: academic advising, tutoring, library and academic support, disability services, computing and technology, veteran and military support, academic complaint and appeals, late withdrawals, “classroom” behavior expectations and more.

- **UAF eCampus Student Services**

Helps students with registration and course schedules, provides information about lessons and student records, assists with the examination process, and answers general questions. Our Academic Advisor can help students communicate with instructors, locate helpful resources, and maximize their distance learning experience. Contact the UAF eCampus Student Services staff at 907.455.2060 or toll free 1.800.277.8060 or contact staff directly with our [directory listing](#).

- **UAF Help Desk**

Go to <http://www.alaska.edu/oit/> to see about current network outages and technology news.

For technical questions, contact the Help Desk at:

- e-mail at [helpdesk@alaska.edu](mailto:helpdesk@alaska.edu)
- phone: 450.8300 (in the Fairbanks area) or 1.800.478.8226 (outside of Fairbanks)

- **Effective Communication**

Students who have difficulties with oral presentations and/or writing are strongly encouraged to get help from:

- [UAF Department of Communication’s Speaking Center](#) (907.474.5470, [speak@uaf.edu](mailto:speak@uaf.edu))
- [UAF English’s Department’s Writing Center](#) (907.474.5314, Gruening 8th floor)
- [CTC’s Learning Center](#) (604 Barnette st, 907.455.2860).

## **NOTICE OF NONDISCRIMINATION**

UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: [www.alaska.edu/titleIXcompliance/nondiscrimination](http://www.alaska.edu/titleIXcompliance/nondiscrimination)

## SCHEDULE (subject to change)

IMPORTANT DATES	POINTS	CONTENT
Assignments due Thurs, Jan. 16 by 5 pm	5	<b>INTRODUCTION</b>  <b>Video: Welcome to the course!</b> <b>Assignments:</b> <ul style="list-style-type: none"> <li>Blackboard – add info about yourself to the discussion board (1 point)</li> <li>Blackboard- review about course syllabus (3 points)</li> <li>Email Dr. O’Brien the site and contact information where you will be taking exams (1 point)</li> </ul>
<b>Week of Jan. 13</b>  <b>Assignments due</b> <b>Sunday, Jan 19 by</b> <b>11:59 pm</b>	20	<b>MODULE 1: CELLS</b>  <b>Reading: Pages 1-27 of textbook</b> <b>Videos:</b> <ul style="list-style-type: none"> <li>Cell Theory</li> <li>Common characteristics of cells</li> <li>Prokaryotes &amp; eukaryotes</li> </ul> <b>Assignments:</b> <ul style="list-style-type: none"> <li>Gradescope- Exploring the structure &amp; function of eukaryotic organelles on the Allen Institute website (16 points)</li> <li>Blackboard- review (4 points)</li> </ul>
<b>Week of Jan. 20</b>  <b>Assignments due</b> <b>Sunday, Jan. 26 by</b> <b>11:59 pm</b>	20	<b>MODULE 2: CHEMICAL FOUNDATIONS</b>  <b>Reading: Chapter 2 of textbook</b> <b>Videos:</b> <ul style="list-style-type: none"> <li>Cell chemistry</li> <li>4 Families of organic molecules</li> <li>Carbohydrates</li> <li>Fatty acids &amp; lipids</li> <li>Amino acids &amp; proteins</li> <li>Nucleotides &amp; nucleic acids</li> <li>Water</li> </ul> <b>Assignments:</b> <ul style="list-style-type: none"> <li>Smartwork5-review (5 points)</li> <li>Gradescope- Identifying macromolecules (15</li> </ul>

		<p>points)</p> <ul style="list-style-type: none"> <li>OPTIONAL assignment in Smartwork5 if you need extra practice with the material (0 points)</li> </ul>
<p><b>Week of Jan 27</b></p> <p><b>*** First part of Gradescope assignment is due Wed. Jan 29 by 11:59 pm. Second part of Gradescope assignment is due Sunday, Feb. 2 at 11:59 pm, along with Smartwork5 homework.</b></p>	20	<p><b>MODULE 3: PROTEIN STRUCTURE &amp; FUNCTION</b></p> <p><b>Reading:</b> Pgs. 117-156 of textbook</p> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>Protein structure</li> <li>Protein folding</li> <li>How proteins work</li> <li>Regulation of protein activity</li> <li>How proteins are studied</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>Smartwork5 – review (10 points)</li> <li>Gradescope- collaborative data analysis with 2 parts (10 points)</li> </ul>
<p><b>Week of Feb 3 &amp; 10</b></p> <p><b>*** Smartworks assignments are due Sunday, Feb 9 at 11:59 pm; reading assignments in Gradescope due Tues. Feb 11 by 11:59 pm</b></p>	35	<p><b>MODULE 4: CHROMOSOME STRUCTURE &amp; GENE EXPRESSION</b></p> <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>Chapter 5</li> <li>Chapter 7 (if you need a review of transcription &amp; translation)</li> <li>Chapter 8: Pgs. 267-284</li> </ul> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>The structure of chromosomes</li> <li>Basics of transcription</li> <li>Packaging of eukaryotic chromosomes</li> <li>Regulation of gene expression</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>2 in Smartwork5- one on chromosome structure and a second on gene expression (10 points each)</li> <li>Perusall- discussion of <i>Waking the sleeping dragon</i> Caparo <i>et al.</i>, 2019. BMC Genomics 20:460. (3 points)</li> <li>Gradescope- questions on <i>Waking the sleeping dragon</i> (10 points)</li> <li>Gradescope- Read the Story of Eve (pgs 280-</li> </ul>

		<p>281) in your textbook and answer questions (2 points)</p> <ul style="list-style-type: none"> <li>OPTIONAL assignment in Smartwork5 if you need extra practice with DNA and chromosome structure (0 points)</li> </ul>
<b>EXAM 1 FRIDAY FEB 14</b>		
<p><b>Week of Feb. 17 &amp; Feb 24</b></p> <p><b>***Smartwork5 homework on Membranes is due Sunday Feb 23 by 11:59 pm; Smartwork5 homework on Membrane Transport AND Gradescope homework is due Sunday, Mar 1 by 11:59 pm</b></p>	<b>40</b>	<p><b>MODULE 5: MEMBRANES &amp; MEMBRANE TRANSPORT</b></p> <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>Chapter 11</li> <li>Chapter 12 (we will not cover pages 420-421 but it is interesting!)</li> </ul> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>Membrane structure &amp; assembly</li> <li>Membrane proteins</li> <li>The fluid mosaic model of cell membranes</li> <li>Membrane transport</li> <li>Ion channels</li> <li>Resting membrane potential</li> <li>The importance of ion gradients</li> <li>Ion channels &amp; nerve signaling</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>2 in Smartwork5 (Membranes &amp; Membrane transport, 15 points each)</li> <li>1 in Gradescope (10 points)</li> </ul>
<p><b>Week of Mar 2</b></p> <p><b>Homework is due Sunday, Mar 15 by 11:59 pm</b></p>	<b>25</b>	<p><b>MODULE 6: ENERGETICS (METABOLISM &amp; OXIDATIVE PHOSPHORYLATION)</b></p> <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>Chapter 3, pages 81-92 &amp; 101-113</li> <li>Chapter 13, pages 427-446</li> <li>Chapter 14, pages 455-477</li> </ul> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>Overview of metabolism I</li> <li>Overview of metabolism II &amp; redox</li> <li>Glycolysis</li> <li>The citric acid cycle &amp; fatty acid oxidation</li> </ul>



		<ul style="list-style-type: none"> <li>• Overview of mitochondria</li> <li>• Oxidative phosphorylation</li> <li>• Chemiosmotic coupling &amp; uncoupling</li> <li>• Measuring cellular respiration</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>• Perusall – discussion of Ghiarone et al., 2019 (3 points)</li> <li>• Gradescope- questions on Ghiarone et al., 2019 &amp; measuring mitochondrial respiration (12 points)</li> <li>• Smartwork5 – review of metabolism, especially oxidative phosphorylation &amp; redox (10 points)</li> <li>• OPTIONAL assignment in Smartwork5 for extra practice with the basics of metabolism (especially chapters 3 &amp; 13) (0 points)</li> </ul>
<b>Week of Mar 9</b>		
<b>SPRING BREAK</b>		
<b>Week of Mar 16</b> (will be released on Mar 6)  <b>Homework is due Sunday, Mar 22 by 11:59 pm</b>	<b>15</b>	<p><b>MODULE 7: PHOTOSYNTHESIS</b></p> <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>• Chapter 14, pages 478-488</li> </ul> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>• Overview of photosynthesis</li> <li>• Chlorophyll</li> <li>• Overview of light &amp; dark reactions</li> <li>• Light reactions</li> <li>• Dark reactions</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>• Smartwork5 review (10 points)</li> <li>• Gradescope (5 points)</li> </ul>
<b>EXAM 2 FRIDAY MAR 27</b>		
<b>Week of Mar 23</b>  <b>Homework is due Sunday, Mar 29 by 11:59 pm</b>	<b>20</b>	<p><b>MODULE 8: PROTEIN SORTING</b></p> <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>• Chapter 15</li> </ul> <p><b>Videos:</b></p>

		<ul style="list-style-type: none"> <li>• Overview of protein sorting</li> <li>• Protein sorting to the nucleus and mitochondria</li> <li>• Transport into the ER</li> <li>• Insertion of membrane proteins</li> <li>• Secretory pathway &amp; vesicle-mediated transport</li> <li>• Endocytic pathways</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>• Smartwork5 part 1 (7 points)</li> <li>• Smartwork5 part 2 (7 points)</li> <li>• Gradescope (6 points)</li> </ul>
<p><b>Week of Mar 30</b></p> <p><b>Homework is due Sunday, Apr 5 by 11:59 pm</b></p> <p><b>**Reading assignment (Waldhoer, 2004) and information in presentation will be available Friday, Mar 20</b></p>	30	<p><b>MODULE 9: CELL SIGNALING</b></p> <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>• Chapter 16, pages 533-567 only</li> <li>• Waldhoer et al., 2004</li> </ul> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>• Overview of cell signaling</li> <li>• Signaling molecules</li> <li>• Transmembrane receptors</li> <li>• G-coupled protein receptors</li> <li>• Enzyme-linked receptors</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>• Smartwork5 (10 points)</li> <li>• Recorded presentation on one aspect of opioid receptors (from Waldhoer et al., 2004) and evaluations of 2 student presentations (20 points)</li> </ul>
<p><b>Week of Apr 6</b></p> <p><b>Assignments due Sun., April 12 by 11:59 pm</b></p>	20	<p><b>MODULE 10: CYTOSKELETON</b></p> <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>• Chapter 17</li> </ul> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>• Overview of the cytoskeleton</li> <li>• Intermediate filaments</li> <li>• Microtubules and dynamic instability</li> </ul>

		<ul style="list-style-type: none"> <li>• Motor proteins</li> <li>• Actin filaments, treadmilling &amp; cell crawling</li> <li>• Muscle contraction</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>• Smartwork5 (15 points)</li> <li>• Gradescope (5 points)</li> </ul>
<b>EXAM 3 FRIDAY APRIL 17</b>		
<b>Week of Apr 13</b>  <b>Assignments due Sun., Apr 19 by 11:59 pm</b>	20	<b>MODULE 11: THE CELL DIVISION CYCLE</b>  <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>• Chapter 18</li> </ul> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>• The cell cycle</li> <li>• Cell-cycle control system</li> <li>• S-phase and M-phase</li> <li>• Important structures for division of chromosomes</li> <li>• Mitosis &amp; cytokinesis</li> <li>• Apoptosis</li> </ul> <p><b>Assignments: TBA</b></p>
<b>Week of Apr 20</b>  <b>Assignments due Sun., Apr 26 by 11:59 pm</b>	20	<b>MODULE 12: CELL COMMUNITIES &amp; CANCER</b>  <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>• Chapter 20, pages 691-708 (excluding plants), 718-732)</li> <li>• <i>Cancer's Invasion Equation</i> by S. Mukherjee</li> </ul> <p><b>Videos:</b></p> <ul style="list-style-type: none"> <li>• Cell communities</li> <li>• Cell junctions</li> <li>• Cancer</li> </ul> <p><b>Assignments:</b></p> <ul style="list-style-type: none"> <li>• Smartwork5 (7 points)</li> <li>• Perusall- discussion of <i>Cancer's Invasion Equation</i> (3 points)</li> </ul>

		<ul style="list-style-type: none"> <li>Gradescope – questions about <i>Cancer's Invasion Equation</i> (10 points)</li> </ul>
<b>FINAL EXAM THURSDAY APRIL 30</b>		