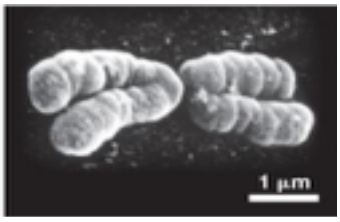


Bi 211 General Biology I: Cells

Information Sheet and Syllabus for Fall Quarter 2015

Instructors: Dr. John Postlethwait & Hannah Wilson

Course Overview

This course deals with the exciting and ever expanding knowledge about the basic cellular and genetic mechanisms that are common to all living things on Earth. We teach from a case-study approach and explore general principles from specific real life examples. The course is designed for both biology majors and for non-biology majors with a professional interest in science who want an overview of the field of biology. This student group includes:

- Biology majors with interests in any area of biology.
- Any major with an interest in fields related to life science or professions in the health field.
- Students who are interested in teaching.

Students beginning the General Biology sequence with Bi 211 need a basic competency in math and chemistry, but should continue their studies in these areas if they want to be able to take Bi 214 and leave open the option of becoming biology majors. Students may also stop the sequence after completing Bi 213 and be eligible to take some, but not all upper division biology courses. Bi211 is the only prerequisite for Bi212 and Bi213. Bi214 requires completion of both Bi212 and a year of general chemistry. Completion of Bi 211-214 will allow students to take any 300-level biology course and major in biology.

Course Prerequisites

Students must have taken Ch111 or higher. If you are going to take only one chemistry course, we recommend that you take Ch111, Ch113 or Ch114 rather than the general chemistry sequence. A year of general chemistry (Ch221-223), with lab, is required for biology majors. **The prerequisites for Bi211-214 will be strictly enforced.**

Course Goals

This course (and the entire Bi211-Bi213 sequence) has three major goals.

Concepts: Because Bi211 is a survey course, we cover all major areas of biology. Biology, however, is a large field, so we concentrate on a few fundamentals rather than covering everything superficially. To pass Bi211, students must demonstrate understanding of the major concepts of cellular biology: how cells carry out the functions of living organisms; the genetic basis of inheritance; and how genes and proteins work.

Skills: Science and technology strongly influences our lives. It is important for all citizens to be scientifically literate, whether or not they are in a science profession. A part of science literacy is the skill to find information, recognize the difference between opinion and fact, appreciate that not all opinions are equally valid, evaluate information, and communicate or act on collected information. In this course we will help you learn to find reliable information related to biology, evaluate the quality of that information, and communicate that information to your peers and instructors.

Science process: Society can function better if everyone, not just scientists, understand the process of science. Science is a special way of learning how our universe functions. To understand how scientists learn about the world, you will read papers from various sources (including original research papers) for your issues project. You will perform the methods of science whenever possible in lab and lecture, including hypothesis testing and modeling.

Course Format

Lectures (Monday, Wednesday and Friday, 8:00-8:50 & 9:00-9:50 in 123 PAC)

Attend the lecture for which you are registered. **Do the assigned readings before coming to class. Each class will begin with 1-3 clicker questions that come from the day's reading**. Some lectures will include activities that help you to actively engage with the material. These activities will often be done collaboratively with a small group of students discussing the problem together for a few minutes before discussing it as a whole class. Your active participation will help you to understand the material and better prepare you for exams.

Your application of two principles will help you learn biology. First**, learning is done by the learner**. In other words, the structure of the class helps identify the important concepts and skills, organize the material, provide practice, and encourage learning, but only students themselves, by putting in effort on a continuing (and not binge) fashion, can actually do the learning. Second, **the speaker is doing the learning.** In a lecture, it is the lecturer who, during preparation, is learning the material, not necessarily the people listening. On the other hand, when arguing one's answer on an iClicker question, the person who is doing the talking is doing the learning about the material.

Labs (Wednesdays and Thursdays in 111 & 129 Huestis)

The lab session is a small group of 24 students that meets once a week. In lab, you will explore the diversity and complexities of cells, model major concepts in cellular biology, discuss issues related to cellular biology, and perform scientific investigations to understand the mechanisms of inheritance. You can attend only the section for which you are registered. Attending other sections will only be allowed in extraordinary situations and with *prior* approval from your GTF. **Attendance is mandatory; it is not possible to make up labs.**

Problem Solving Sessions (with Dr. Postlethwait; time & location TBA and Ms. Wilson; time and location TBA)

The single biggest difficulty students have in general biology is solving the kinds of problems presented in homeworks and exams. These are similar to the kinds of questions that biologists ask; they generally can't be solved by memorization of facts, but by the application of facts to novel situations. In problem solving sessions, we will go over practice problem sets and discuss ways to approach the problems. Graded homework problems will not be solved in these sessions. Attendance is not required, but students often want to attend them on a regular basis. In addition, many students find it helpful or essential to regularly attend GTF office hours or visit tutoring sessions of a Biology Tutors for Undergraduates (BTU) to better understand the course material.

GTF Office Hours and BTU Tutor Sessions Times will posted on canvas during week 1.

Problem Sets

Practice Problem Sets Practice problem sets will be made available on canvas (postings will be announced in class and on canvas). While you are not required to turn these in, you are strongly encouraged to work on the practice problems. A good learning strategy is to work on a problem set by yourself for a while to answer or at least try to answer every question, and then compare your solutions with those of a friend who is in the class. For problems that you get a different answer (or even often when you get the same answer), it is important to justify your answer, keeping in mind the dictum that the speaker is doing the learning. In addition, you can get help understanding how to solve these problems in the staff office hours, tutoring sessions, and problem solving sessions. Practice problems are very similar to the types of questions you will see on the exams; in fact, most practice problems are from previous exams. Practice problems are designed to help you master the material needed to successfully solve the graded problem sets.

Graded Problem Sets The course will have eight graded problem sets posted on canvas from Wednesday 5 p.m. until Friday 5 p.m. (except problem set 7; see class schedule for weeks with graded problem sets due). You will submit your answers to these graded questions on canvas. **No late homeworks will be accepted.** Solutions to each problem set will be posted on canvas soon after each due date. In sharp contrast to the practice problems, you must do your own work on these graded questions. Copied work will be treated as academic dishonesty (see *Professional conduct* below)

Laboratory Activities Lab handout reports will be turned in at the end of each lab period or at the beginning of lab the following week as announced in lab. Each lab will be graded on a 5-point scale. For some labs, part of the grade will be based on your active engagement in the lab. Most labs cannot be made up because they involve materials specially prepared and available for the lab periods. **Late lab reports will not be accepted.**

Issues Project Each of you will work on an issue related to cellular or genetic biology. You will choose your issue topic during the 3rd week and work on the project during the entire term. The project, worth 20% of your grade, consists of two parts: A proposal (5%), and a paper (15%). Late work on both parts will be accepted but with a deduction of 3% for each day (including weekends) that it is late. No work will be accepted more than one week late. **If you are retaking this course, you will not be allowed to resubmit issues project work from the previous time you took Bi211. The work you turn in this term must be original and on a different topic.**

iClickers (Personal Response Systems) iClickers will be used in almost every class to encourage active participation and to provide feedback to instructors and students. In fact, most days will begin with a couple of clicker questions from the day's assigned reading. Each student should purchase a clicker for use in this class before the first day of classes. You must register your clicker on the course canvas site. If you've already registered your clicker *this term*, for another class, then you don't need to register it again. Questions during lecture that require clickers will be multiple choice. Points will be earned two different ways: (1) 2-point questions: 2 points will be awarded based on participation alone, not on whether the question is answered correctly; (2) 4-point questions: 4 points for the correct answer, 2 points for an incorrect answer. Total percent for the clicker portion of your grade will be based on 85% of the total possible iClicker points: your clicker grade = (total points earned)/(85% of total points possible). iClicker problems are not a means of taking attendance. They force students to grapple in real time with the material under discussion. Furthermore, they provide an opportunity to exercise the principle that the speaker is the one doing the learning because first, when you answer the iClicker problem you are 'speaking', and second, you will have to verbally argue your answer to either the class or to a student who selected a different solution than yours.

Exams: This course has three exams: two 50-minute, in-class midterms and a 2-hour final. All exams will use the same short answer format. The final exam is cumulative. Exams will cover material from all aspects of the course including lectures, labs, readings, and homeworks. Exams will probe a deep understanding of the concepts and principles discussed, not merely a recitation of facts, and an ability to apply the concepts to novel situations, rather than a memorization of detail. Exams cannot be made up. Exams are graded by GTFs under the supervision of faculty. To promote consistency, a single person grades each question. Everyone is required to take the final exam, which is scheduled for **Monday 5-7 p.m in STB 156.** This is a combined final exam for both sections of 211. **No early or late exams will be given.** Note the dates of the final and other exams and don't plan to be gone on these days. We will calculate your final course grade automatically two ways and assign you the better grade. Version A uses the score of all three exams. Version B uses the score of your best midterm and the final. If you miss a midterm, **for any reason**, we will use version B to calculate your final grade.

Exam regrade policy: To be fair to all students, it is essential that all exams be graded according to the same criteria. If you wish to submit a midterm for a regrade, you must use the following guidelines. 1) Refer to the exam key available on canvas to compare your answer to the key. 2) If you still wish to have a midterm exam answer regraded, you must submit to your lab GTF a written statement within one week of the return of the exam. 3) You must submit also your original exam, explaining specifically why your answer merits a higher score. Keep in mind that we will regrade the entire exam and a regrade may result in a higher, lower, or unchanged score.

Evaluation

Component	Percent of Grade
Laboratory activities (1% each)	**9%**
Problem Sets (homework) (1% each)	**8%**
Clicker questions	**5%**
Exams Version A	**58%**
Both Midterm Exams (14% each)	
Final Exam (30%)	
Exams Version B	**58%**
Best midterm exam (18%)	
Final Exam (40%)	
Issues Project	**20%**
Proposal (5%)	
Paper (initial paper and final paper) (15%)	

Learning Environment The University of Oregon is working to create inclusive learning environments. Please notify us if there are aspects of the instruction or design of this course that result in barriers to your participation. You may also wish to contact the Accessible Education Center in 164 Oregon Hall at 346-1155 or uoaec@uoregon.edu. If you have a documented disability and anticipate needing accommodations in this course, please talk to your instructors during the first week of class. Please request that the Counselor for Students with Disabilities send a letter verifying your situation.

Professional conduct Please arrive to lab and lecture on time and stay until class is over because late arrivals and early departures make unnecessary noise and disruption that distracts your classmates.

Please do not chat during lectures except when asked to discuss problems with other students. This is disruptive to those around you and inhibits their chance to learn; it's not fair to your classmates. Likewise, using your cell phone, tablet, or computer to check email, facebook, surf the web etc. is disruptive to those around you. While taking notes and following along the lecture notes on your tablet or computer is often helpful for learning, extraneous images on computer screens can be a great distraction for those behind you and simply is not fair to them.

Cheating devalues the reputation of our institution, its faculty, its students, and the significance and value of your academic degree. Academic misconduct is particularly unfair for students who do their work with integrity and honor. The University Student Conduct Code (https://uodos.uoregon.edu/StudentConductandCommunityStandards/AcademicMisconduct.aspx) defines academic misconduct. Students are prohibited from committing or attempting to commit any act that constitutes academic misconduct. For example, students should not give or receive (or attempt to give or receive) unauthorized help on assignments or examinations without express permission from the instructor. Students should properly acknowledge and document all sources of information (e.g. quotations, paraphrases, ideas) and use only sources and resources authorized by the instructor. If you have any question about whether an act constitutes academic misconduct, it is your obligation to clarify the question with the instructor before committing or attempting to commit the act. Additional information about a common form of academic misconduct, plagiarism, is available at http://library.uoregon.edu/guides/plagiarism/students/index.html

We want you to learn and to do well in the course, but we will not tolerate academic dishonesty. Sanctions for academic dishonesty will be a lowering of the final grade or failure. If you find yourself in trouble, or if you are aware of academic dishonesty occurring, please talk to one of the instructors.

Personal crises do happen. If you are having difficulties that are interfering with your ability to do well in the class, please tell an instructor as soon as possible. We may be able to refer you to someone for help or to make special arrangements if the need is real and if you have done your best to deal with the situation in a timely manner. Don't hesitate to call the campus crisis center (541 346-3227) if you or a friend need assistance. Finally, we promise to respect you as students and as individuals, and ask that you return that respect to us and to your fellow classmates.

We support Title IX and have a duty to report relevant information. The UO is committed to providing an environment free of all forms of prohibited discrimination and sexual harassment, including sexual assault, domestic and dating violence and gender-based stalking. Any UO employee who becomes aware that such behavior is occurring has a duty to report that information to their supervisor or the Office of Affirmative Action and Equal Opportunity. The University Health Center and University Counseling and Testing Center can provide assistance and have a greater ability to work confidentially with students.

Course Materials

Textbook The text, *Biological Science* by S. Freeman, 4rd **or** 5th edition, will be used as a general reference throughout the first three quarters of General Biology. Readings include background material useful to prepare you for lecture and to study for exams. We don't expect you to memorize all details in this material. A good strategy is to skim over the entire chapter first, concentrating on the major concepts, then to read more carefully the assigned pages, focusing on the ideas discussed in lecture and lab. Copies of both editions of the textbook are on reserve in the Science Library.

Course Packet. There is NO course packet for this class. All materials are provided on the Canvas website. Please print needed materials before coming to lab.

iClickers Each student will need to purchase a clicker (available at the Duck Store). iClicker-2 (not -1) will be used in this course. You must register your clicker (see link available on canvas for clicker registration).

Course Schedule

Note that every lecture session will have some points associated with it (iClicker or exam) and every week has graded material to be handed in (lab reports and graded homework or exams). It is important to not let yourself get behind; make-up points do not exist.

Week	Date	Lectures	Lab Activity
1	9/28 9/30 10/2	L1: Macromolecules: carbs & lipids (case: Gaucher) L2: Macromolecules: proteins & nucleic acids (case: Gaucher) L3: Cell Structure & Function (case: Gaucher) ***Problem set #1 due by 5:00 p.m. (canvas)**	Lab 1: Discovering Molecules
2	10/5 10/7 10/9	L4: Cell Structure & Function L5: Energy and ATP L6: Enzymes ***Problem set #2 due by 5:00 p.m. (canvas)**	Lab 2: Discovering Cells
3	10/12 10/14 10/16	L7: Harvesting Chemical Energy (case: Kristine) L8: Harvesting Chemical Energy (case: Kristine) L9: Harvesting Chemical Energy (case: Kristine) ***Problem set #3 due by 5:00 p.m. (canvas)**	Lab 3: Introduction to Issues Project & Finding References
4	10/19 10/21 10/23	L10: Photosynthesis L11: Photosynthesis L12: DNA Structure ***Problem set #4 due by 5:00 p.m. (canvas)**	Lab 4: Modeling Cellular Respiration & Fermentation ***Issues project proposal due in lab**
5	10/26 10/28 10/30	**Midterm 1 on lectures 1-9 and labs 1-4** L13: Cell Cycle: introduction, DNA replication L14: Cell Cycle: mitosis	Lab 5: Modeling Photosynthesis
6	11/2 11/4 11/6	L15: Cell cycle and cancer L16: Transcription L17: Translation ***Problem set #5 due by 5:00 p.m. (canvas)**	Lab 6: Cell Cycle in Onion Root Tips and Introduction to *Drosophila* Genetics
7	11/9 11/11 11/13	L18: Mutation & Regulation L19: Meiosis & Sexual Life Cycle (case: Down syndrome) L20: Meiosis & Transmission Genetics ***Problem set #6 due by 5:00 p.m. (canvas)**	Lab 7: Protein Synthesis: Analyzing the human beta-globin gene sequence
8	11/16 11/18 11/20	**Midterm 2 on lectures 10-18 and labs 5-7** L21: Genetics: Mendel's 1st Law L22: Genetics: Mendel's 2nd Law	Lab 8: *Drosophila* Genetics, peer review exercise, introduction to Virtual Genetics Lab (VGL) ***Initial issues paper due in lab**
9	11/23 11/25 11/27	L23: Genetics: Recombination and Gene Mapping L24: Genetic Basis of Sex (case: Maria Patino) ***Problem set #7 due by 5:00 p.m. (canvas)** NO CLASS: HAPPY THANKSGIVING	No labs this week ***Final issues paper due Wednesday by 4 p.m.**
10	11/30 12/2 12/4	L25: Sex-linked Traits and Pedigrees L26: Incomplete Dominance, Codominance & Multiple Alleles L27: Complex Traits (case: BRCA genes) ***Problem set #8 due by 5:00 p.m. (canvas)**	Lab 9: Modeling Genetic Traits (VGL)
final	12/7	**Monday 5-7 p.m in STB 156: Combined Final exam on entire course**	Issues paper returned at final exam

Lectures	Readings (Freeman 4th edition)
1	• Ch 1: read quickly to get an overview of the book and the overall structure of the field of biology. Pay particular attention to the sections on cells (p. 2-4), classification (p. 5-8), and science as a process (p. 8-12). It is highly recommended that you review basic chemistry principles in Ch 2. • Ch 5: read the entire chapter on carbohydrates • Ch 6: focus on pgs. 82-88 (types, structure of lipids); skim pgs. 89-91 to review diffusion and osmosis
2	• Ch 3: read pgs. 38-51 to focus on protein structure and function • Ch 4: read pgs. 59-62 for an introduction to nucleic acid structure and function
3 & 4	• Ch 28-32: skim over the chapters to answer questions about domains and Lab #1 • Ch 7: read the entire chapter on cells; focus on characteristics of prokaryote and eukaryote cells and organelles (p. 103-114); read pgs. 115- 122 to gain a deeper understanding of cell dynamics. • Ch 6: read about cell membranes and membrane proteins on pgs. 92-94
5 & 6	• Ch 2: read pgs. 27-33 to focus on chemical reactions and energy • Ch 3: read pgs. 51-56 to focus on enzymes, effects of temperature and pH on enzymes • Ch 9: read pgs. 149-152 for basic understanding of ATP and redox reactions
7, 8 & 9	• Most students will have to carefully read Ch 9 on cellular respiration several times. Read the entire chapter fairly quickly the first time to get the general ideas and vocabulary. Then read again more carefully the specific pages that are listed. You must gain a basic understanding of the following material but don't need to memorize all of the chemicals. Pgs. 153-154 provide a nice overview of cellular respiration, pgs. 155-166 provide more detail of the processes of cellular respiration, and pgs. 166-168 discuss fermentation.
10 & 11	• Most students will have to carefully read Ch10 on photosynthesis several times. Read the entire chapter fairly quickly the first time to get the general ideas and vocabulary. Then read again more carefully the specific pages that are listed. Pgs. 173-174 provide a brief overview of photosynthesis, pgs. 179-184 (light reactions) and pgs. 184-186 (Calvin Cycle) cover the details of photosynthesis. • The Big Picture: pgs. 192-193 provides a nice overview of energy concepts
12	• Ch 4: read pgs. 62-66 on DNA structure and function
13, 14 & 15	• Ch 11: read pgs. 194-196 for an introduction to the cell cycle; pgs. 197-200 for details of mitosis; pgs 202-205 for control of the cell cycle; pgs. 206-209 for cancer and the cell cycle • Ch 14: read pgs. 258-263; focus carefully on pgs. 263-268 (DNA synthesis); read pgs. 271-274 (correcting mistakes in DNA synthesis)
16, 17 & 18	• Ch 15: read pgs. 277-285 for an introduction to genes, the central dogma, and the genetic code; pgs. 285-286 discuss mutations • Ch 16: read the entire chapter for the details of protein synthesis • Ch 4: read pgs. 66-68 for RNA structure and function
19 & 20	• Ch 12: read pgs. 211-223 for details of meiosis; pgs. 225-227 discuss mistakes in meiosis
21 & 22	• Ch 13: read pgs. 230-239; pgs. 232-236 discuss Mendel's 1st Law; pgs. 236-238 discuss Mendel's 2nd Law; pg. B19 (Bioskills 13) discusses some simple rules of probability that are useful for understanding Mendelian genetics
23	• Ch 13: read pgs. 239-241; 243-245 and Box 13.1 on pg. 246
24 & 25	• Ch 13: read pgs. 241-242 to focus on sex chromosomes and sex-linked inheritance; pgs. 250-252 discuss human genetics and pedigrees
26 & 27	• Ch 13: read pgs. 245-247 to focus on incomplete dominance, codominance and multiple alleles

Lectures	Readings (Freeman 5th edition)
1	• Ch 1: read quickly to get an overview of the book and the overall structure of the field of biology. Pay particular attention to the sections on cells (p. 2-4), classification (p. 6-9), and science as a process (p. 9 -14). It is highly recommended that you review basic chemistry principles in Ch 2. • Ch 5: read the entire chapter on carbohydrates • Ch 6: focus on pgs. 84-90 (types, structure of lipids); skim pgs. 91-93 to review diffusion and osmosis
2	• Ch 3: read the entire chapter on protein structure and function • Ch 4: read pgs. 57-64 for an introduction to nucleic acid structure and function
3 & 4	• Ch 29-33: skim over the chapters to answer questions about domains and Lab #1 • Ch 7: read the entire chapter on cells; focus on characteristics of prokaryote and eukaryote cells (p. 107-110) and organelles (p. 110-127); skim the remainder of the chapter to gain a deeper understanding of cell dynamics • Ch 6: read about cell membranes on pgs. 88-90
5 & 6	• Ch 8: read pgs. 137-144 to focus on chemical reactions and energy; for a basic understanding of ATP and redox reactions; read pgs. 144-150 to focus on enzymes, effects of temperature and pH on enzymes
7, 8 & 9	• Most students will have to carefully read Ch 9 on cellular respiration several times. Read the entire chapter fairly quickly the first time to get the general ideas and vocabulary. Then read again more carefully the specific pages that are listed. You must gain a basic understanding of the following material but don't need to memorize all of the chemicals. Pgs. 155-158 provide a nice overview of cellular respiration, pgs. 158-172 provide more detail of the processes of cellular respiration, and pgs. 172-173 discuss fermentation.
10 & 11	• Most students will have to carefully read Ch10 on photosynthesis several times. Read the entire chapter fairly quickly the first time to get the general ideas and vocabulary. Then read again more carefully the specific pages that are listed. Pgs. 176-184 provide a nice overview of photosynthesis, pgs. 184-190 (light reactions) and pgs. 190-192 (Calvin Cycle) cover the details of photosynthesis. • The Big Picture: pgs. 198-199 provides a nice overview of energy concepts
12	• Ch 4: read pgs. 58-65 on DNA structure and function
13, 14 & 15	• Ch 12: read pgs. 219-223 for an introduction to the cell cycle; pgs. 223-228 for details of mitosis; pgs 229-232 for control of the cell cycle; pgs. 232-234 for cancer and the cell cycle • Ch 15: read pgs. 284-301; focus on pgs. 289-295 (DNA synthesis)
16, 17 & 18	• Ch 16: read pgs. 304-312 for an introduction to genes, the central dogma, and the genetic code; pgs. 313-315 discuss mutations • Ch 17: read the entire chapter for the details of protein synthesis • Ch 4: read pgs. 65-68 for RNA structure and function
19 & 20	• Ch 13: read pgs. 237-246 for details of meiosis; pgs. 249-251 discuss mistakes in meiosis
21 & 22	• Ch 14: read pgs. 256-267; pgs. 261-263 discuss Mendel's 1st Law; pgs. 263-266 discuss Mendel's 2nd Law; B8 discusses some simple rules of probability that are useful for understanding Mendelian genetics
23	• Ch 14: read pgs. 269-271; read Quantitative Methods 14.1 on pg. 274 for creating genetic maps
24 & 25	• Ch 14: read pgs. 267-269 to focus on sex chromosomes and sex-linked inheritance; pgs. 277-279 discuss pedigrees
26 & 27	• Ch 14: read pgs. 271-272 to focus on incomplete dominance, codominance and multiple alleles

Student Learning Outcomes for BI 211 General Biology I: Cells

In this first course of the general biology sequence, we study biological processes from a molecular and cellular prospective. These concepts are central to understanding all other areas of biology. All organisms must accomplish two major functions: 1) extract energy from their environments to build and maintain their bodies, and 2) reproduce themselves. We start by studying the four types of biological macromolecules that build organismal bodies: carbohydrates, lipids (e.g., fats), proteins and nucleic acids (e.g., DNA). We then examine how cells obtain from the environment the building blocks for constructing these macromolecules and the energy for manipulating them to carry out body functions. Next we examine reproductive functions, beginning with the two types of cell division, mitosis and meiosis. From there we study genetics, how traits pass from parent to offspring, starting with the structure and replication of DNA followed by how genes code for proteins. Finally we look at the genetic basis of inheritance, including Mendelian genetics, pedigree analysis and the genetics of complex traits. Many of these topics are taught using a case-study approach, mostly using examples of genetic diseases in humans. BI 211 is a prerequisite for all the other general biology courses in the sequence (BI 212, BI 213, and BI 214).

The goals for BI 211 fall into two general categories: (1) to learn the foundational concepts related to cellular and molecular biology and (2) to develop skills in analytical thinking that will serve students in subsequent biology classes (and courses in other subjects) and scientific research experiences as they progress through their academic program.

Concept-based goals:

1. To describe the chemical structures and major functions of the four major types of large biological molecules that make up all living organisms.
2. To understand energy harvest pathways, including cellular respiration, fermentation and photosynthesis, and their relevance to human disease.
3. To describe and illustrate chromosomal and cellular events during the various stages of both mitosis and meiosis, with a focus on their roles in cancer and Down Syndrome.
4. To understand and describe the major processes involved in gene action, including the mechanisms of protein synthesis, comprising transcription and translation, and how they are controlled to propel embryonic development.
5. To understand the basis of transmission genetics and solve problems using Mendel's first and second laws; to analyze genetic pedigrees.

Skill-based goals:

1. To develop competency in the basic terminology and methodologies used in the biological sciences.
2. To learn the process of scientific inquiry and its applications.
3. To learn how to learn about biology.
4. To learn to communicate knowledge, ideas and reasoning clearly and effectively in oral and written forms appropriate to the biological sciences.
5. To become familiar with the use of science relevant search engines, and learn to identify primary work and understand the merits of the peer review process; to develop the ability to think critically about information, evaluate the validity of arguments, and weigh the merits of disparate scientific conclusions.