Biology 101: Principles of Biology  
Section 002, Spring 2013  
Tuesday and Thursday, 11:00 am to 12:15 pm  
Genome Sciences Building G100

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Office Hours: Monday 1:00pm - 3:00pm and Wednesday 10:00am - 12:00pm or by appointment

Course Description and Goals
Biology is a wonderfully expansive subject that covers all that is pertinent to life, including climate change, heredity and reproduction, animal behavior, plant ecology, and human health and disease, to list just a few topics from the tip of the iceberg. With such a bounty of subjects to choose from, it is impossible to cover absolutely everything in a single semester, but we will still be covering a fair number of topics though that will expose you to the breadth that biology has to offer. Through learning these topics, I hope that by the end of the course you will not only be excited about science and biology, but that you also be able to apply scientific and biologic principles in your daily lives to make more informed decisions (i.e. you will be a more scientific literate citizen). You will also have learned a great deal about biology in the process! Specifically, at the end of this course, you will be able to…

- Explain how the components of the cell work together to support life  
- Explain why we need to eat food and why we need to breathe oxygen  
- Use principles of genetics, cellular reproduction, and molecular biology to discuss the causes of (and possible cures for) cancer and other inherited diseases  
- Apply natural selection and evolutionary theory to predict changes in populations  
- Evaluate the influence that humans have on the earth’s ecosystem and biosphere  
- Use the scientific method to develop and test a hypothesis, make predictions, design experiments, and analyze and interpret scientific data  
- Use critical thinking and problem solving skills to tackle scientific issues  
- Make informed scientific decisions in your daily lives

More specific learning objectives and goals are presented for each unit as described in the course schedule below, and will also be provided at the beginning of each day of class.

Required Textbooks and Materials

Mastering Biology: You are required to purchase a Mastering Biology account (www.masteringbiology.com) in order to complete homework assignments, take quizzes and to access helpful study aids and course materials. You can purchase a Mastering Biology account by itself, with the eText, or with a hard copy of the textbook. The course ID# for Mastering Biology is BIOLOGY101SPRING2013SHAFFER. Internet access is required to use Mastering Biology. Please see the “Mastering Biology Instructions” and the “What do I need to buy for Biology 101?” documents on Sakai for more details.
Course Structure and Components

**Active Learning:** You might be used to taking courses in which the professor simply lectures the entire class period. This course is going to be very different, as it is going to be an active classroom. By active I mean that you will be required to interact with myself and your fellow students to learn the material presented in this course. We will be using activities such as small group work, case studies, class discussions, and Poll Everywhere questions to actively engage in the learning process. In order to have an active classroom, attendance and participation are extremely important. Participation is counted as part of your grade, but will count towards more than that, because through these active learning exercises you will develop critical thinking and problem solving skills that are essential to performing well in this course and others.

**Learning Objectives:** In order to do well in this course, you will need to know exactly what I want you to be able to do, and this is where learning objectives come in. At the beginning of every day of class, in the homework assignments and quizzes, on the study guides, and in the course schedule below, you will be presented with learning objectives that clearly state what I expect you to be able to do. For example, “At the end of this class session, you will be able to compare and contrast cellular respiration and photosynthesis.” Learning objectives are things that you can actually DO, so you will be able to tell whether or not you really know the material. Learning objectives come in all levels, from the very basic to the very complex (see Bloom’s Taxonomy below), and you will be challenged at all levels in this course.

**Bloom’s Taxonomy:** There are many kinds of knowledge, from rote memorization up to critical thinking and the synthesis of new ideas. Memorization is important – you can’t describe biology without knowing biological definitions – but to do well in this course you will have to use the information you have learned to solve problems in new and different ways and to evaluate and weigh multiple solutions to a problem. To test your ability at these different levels of thinking, I will rely on the structure of Bloom’s Taxonomy, a system used to classify levels of knowledge, from lower-level (remembering, understanding) to higher-level (applying, analyzing, evaluating, and creating). Throughout this course, you will be exposed to the levels of learning described by Bloom’s Taxonomy and also will be challenged on exams and in class to solve problems at all levels. Learning objectives (see above) and questions can be categorized at different Bloom’s levels, so as we go through class you will get a feeling for what an “understanding” question is versus an “analyzing” question. I will not simply ask you to memorize facts and regurgitate them on exams; rather, I expect you to be able to think critically and to apply and analyze biology in new and interesting ways. Learning to solve higher-level problems will not only help you succeed in this course, but in your other courses as well.

**Mastering Biology:** We will be using the online system Mastering Biology for homework assignments and online quizzes. Mastering Biology is more than just a grading tool, however; it is chock full of extremely helpful tools to help you succeed in this course (hence the name). There are 3D animations, tutorials, study sheets, videos, practice tests, and more to be found within Mastering Biology, and I highly encourage you to take advantage of all of these tools. Please see the “Mastering Biology Instructions” document on Sakai for more details.
**Poll Everywhere:** In order to gauge your level of understanding, improve course participation, earn course points, and to make the classroom more fun and engaging, we are going to be using Poll Everywhere in this course. Poll Everywhere is a web based poll system that you can submit answers to in real time from your cell phones (via texting), smartphones, laptops or tablets. Throughout the course, I will pose questions to the class, and you can respond using your device. This will give me a real-time reflection of your thoughts and views on a certain topic, and can spark interesting discussions in the class. Poll Everywhere is also a fun and engaging way for you to “compete” against your classmates! Please see the Poll Everywhere document on Sakai for how to properly register and for more details.

**Science Seminars:** Do you know how much exciting biological, biomedical, and other scientific research is going on at UNC? As a student here, you should be exposed to these amazing scientists and their fascinating work. Over the course of this semester, you’ll need to attend two scientific seminars on campus. They can be in any subject, ranging from ecology to cancer to tissue engineering, just make sure that you are interested in the topic! Who knows, you might be inspired and find a new career path to follow! A list of UNC seminar calendars and more details are posted on Sakai.

**Sharing Science News:** When you are skimming Google News, checking your Twitter feed, or looking at your friends’ Facebook posts, do you click on science news stories and read more about them? Whether you do it or not already, you’ll get the chance to do just that in this class. As part of being a scientifically literate citizen, you should be aware of the science and biology research that is going on every day and how it can affect you and your family. You’ll be asked to find science and biology news stories, post them to Sakai, and comment on each other’s postings. This is called the Sharing Science News project, and more details can be found in the Evaluation section below as well as in the Sharing Science News document on Sakai.

**Open Topics:** You as the student are an integral part of this course, and what you want to learn about truly matters to me. We will have two “Open Topics” days during the semester, in which you will get to vote to determine what we will learn about. These could be specific areas of biology that we don’t normally have time to cover in detail (e.g. some aspect of animal physiology), applications of biology in medicine (e.g. stem cells, drug design, specific diseases), or an exploration of some interesting topic that might not have an answer (e.g. does extraterrestrial life exist?). Hopefully you will have some personal connection to these topics and will learn a lot about them!

**Supplemental Instruction (SI):** Supplemental instruction (SI) sessions are extra help sessions taught by UNC students who have taken and excelled in Biology 101 in the past. SI sessions will be offered several times a week and each session will be scheduled for one hour. The times and location of these sessions will be posted on Sakai during the first week of class. You are not required to attend SI, but it is highly recommended, since this is your opportunity to get more “one-on-one” attention for this course. I suggest you fit one into your schedule early in the semester and attend weekly as if it is a required class.

**Sakai Website:** Everything that you need to know about this course will be posted on Sakai, so please make sure you are familiar with the system and how to use it. You’ll be required to use Sakai to participate in the Sharing Science News project (see above and below), and take surveys throughout the semester. You can also use Sakai to check your grades, find contact information, and view exam information. For help with Sakai, please check the UNC Student Sakai Blog: http://blog.sakai.unc.edu/students/
Evaluation and Grading
There will be multiple grading opportunities in this course, giving you many chances to do well. A summary of the various grading opportunities is given below.

Poll Everywhere: Attending class and participating is essential to doing well in this course, and you will also have the opportunity to earn course points by participating in Poll Everywhere exercises. Please see Sakai for information about how to register for Poll Everywhere and for the detailed grading breakdown. Participating in Poll Everywhere is worth a total of 50 points towards your final grade.

Science Seminars: During the course of the semester, you have to attend two scientific seminars on campus at UNC. You'll need to provide a brief summary of the seminar and your thoughts on the topic. Each of the two assignments will be worth 25 points, for a total of 50 points. Please see the Science Seminars document on Sakai for more details.

Sharing Science News: The Sharing Science News project is worth 50 points towards your final grade. Basically, you will have to post at least one science news story a week and post four comments a week to Sakai, for 10 weeks of the semester (this works out to 5 points per week). Please see the Sharing Science News document on Sakai for more details.

Review Quizzes: Weekly quizzes will be given to emphasize the essential topics from the class as well as to give you practice taking timed assignments. There will be a quiz each week of lecture when there is not an exam (see course schedule below for details) and it will be posted on Mastering Biology each Thursday after class. You will have until Sunday (four days later) at 11:59pm to complete. Once you start the quiz, you will have 30 minutes to complete it, and you are only allowed one attempt to answer each question. There will be 11 quizzes total, but only 10 will count towards your grade – the lowest score will be dropped. Each quiz is worth 10 points, for a total of 100 points.

Homework Assignments: There will be daily, online Mastering Biology homework assignments in this course to encourage you to read the book, keep you up to date, and to help you prepare for each day of class. We will be applying the concepts that you read in the book and encounter in the homework in each class, so it is very important that you do the homework assignments! There will be 23 homework assignments total (one for each day of lecture; none due on exam days), but only 20 will count towards your grade – the lowest three homework scores will be dropped. Each homework assignment is worth 5 points, for a total of 100 points. All homework assignments will be due on Mondays and Wednesdays at 11:59pm (see course schedule for due dates).

Exams: There will be three mid-term exams and a final exam in this course. These exams will assess your in-depth knowledge and mastery of the course material. Each mid-term exam is worth 200 points, and the final is worth 250 points. The mid-term exams only cover certain material, while the final is cumulative. The lowest scoring mid-term exam will be dropped (only 2 of the 3 will count towards your final grade). See the course schedule below for exam dates and the material that they cover.
The breakdown for course points is as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Weight (%)</th>
<th>Points</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poll Everywhere</td>
<td>5%</td>
<td>50 points</td>
<td></td>
</tr>
<tr>
<td>Science Seminars</td>
<td>5%</td>
<td>50 points</td>
<td>(2 at 25 points each)</td>
</tr>
<tr>
<td>Science News</td>
<td>5%</td>
<td>50 points</td>
<td></td>
</tr>
<tr>
<td>Review Quizzes (11)</td>
<td>10%</td>
<td>100 points</td>
<td>(10 points each, drop lowest)</td>
</tr>
<tr>
<td>Homeworks (23)</td>
<td>10%</td>
<td>100 points</td>
<td>(5 points each, drop 3 lowest)</td>
</tr>
<tr>
<td>Mid-term Exams (3)</td>
<td>40%</td>
<td>400 points</td>
<td>(200 points each, drop lowest)</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25%</td>
<td>250 points</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>1000 points</strong></td>
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</tbody>
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Based on the above point structure, you can calculate your grade at any time during the semester (ask for help if you need it), and you should calculate your grade regularly to keep track of how you are doing in the course. The number of points will be converted to letter grades based on the following:

- **A** 925 – 1000 points
- **A-** 895 – 924 points
- **B+** 855 – 894 points
- **B** 825 – 854 points
- **B-** 795 – 824 points
- **C+** 735 – 794 points
- **C** 685 – 734 points
- **C-** 595 – 684 points
- **D** 545 – 594 points
- **F** Less than 544 points

**Course Policies**

*Courteous to Fellow Students*: We are going to have a positive learning environment in this class, so courtesy to your fellow students (and to me!) is imperative. Do you want to be distracted while trying to learn? Probably not, so please treat your classmates as you want to be treated. This includes putting your cell phones on silent before class starts, not using cell phones during class (unless prompted to for a Poll Everywhere question), limiting side conversations and comings and goings during class, not reading newspapers or doing the crossword puzzles, and other possible distractions. You are more than welcome to use your laptop to take notes and answer the Poll Everywhere questions, but please do not surf the web and post on Facebook during class – this is detrimental to your learning and is distracting to other students.

*Attendance*: Attendance is vital to succeeding in this course, as some of the material that you will be tested on will not be found in the textbook. Participation in the active learning activities during class will also help you develop your critical thinking and problem solving skills which will help you on the exams. I expect to see you in class every day.

*Academic Integrity*: Enrollment in this class means that you agree to abide by the expectations of the University of North Carolina regarding academic integrity and the honor code. For specific information, please refer to the UNC Office of Student Conduct website (http://studentconduct.unc.edu/). The University’s Honor Code will be strictly enforced. Your responsibilities in the area of honor include, but are not limited to, avoidance of cheating, plagiarism and improper or illegal use of technology. Your assignments are expected to be your own work. If you have questions, please ask. Integrity is an important characteristic that should be exemplified in the lives of all UNC students. Dishonesty will not be tolerated in any form in this class. Any student caught cheating on an examination or any other class assignment will be given a grade of zero for that examination or class activity and reported to University officials for further disciplinary actions.
**Late Work:** No late work will be accepted. The homework assignments and quizzes on Mastering Biology have a due date and time (see above for details), and if they are not completed by then, you will get a zero on the assignment, no exceptions.

**Make-up Work:** No make-up work will be allowed in this course. If you don’t complete a homework assignment, don’t take a quiz, or miss an exam, these will count towards your dropped assignments for the course (lowest three homework assignments, lowest quiz, and lowest exam dropped). The only exception to this rule is the final exam. If you have an official university excuse for missing the exam (death in the family, sickness, university activity), then a make-up will be possible. Please see me ahead of time if you know you will miss the final exam.

**How to do well in this course**
There is no one single best way to succeed in this course that works for everyone, but I can offer you some tips that have been proven to help. Check Sakai for more study resources.

- **Read your book and do your homework before class!** The textbook and Mastering Biology assignments will prepare you for class and get you ready to learn more. Take the homework assignments seriously as they really will help you “master biology.”
- **Come to class and participate!** Coming to class is very important, but if you just play Angry Birds the whole time you might as well not have come. Paying attention, taking notes, asking questions, answering Poll Everywhere questions, and working with your classmates is essential to learning the most that you can during this course.
- **Review your notes after class!** Don’t wait until the night before the exam to look over your notes for the first time – I guarantee that you won’t do well and you won’t learn much at all. Make reviewing your notes a daily activity. Spend 15 - 30 minutes in the afternoon after each class going over your notes and the lesson slides and make sure to write down anything that is confusing or any questions that you may have. Doing this will help you learn the material while also preparing you for the weekly quizzes and exams.
- **Start early!** When you are preparing for exams, don’t wait until the night before to cram! Start a week before the exam with daily, rigorous study sessions of about an hour or more. Set a goal for each study session, and do more than just re-read your notes or the textbook. Take time to re-draw diagrams, write out concepts in your own words, summarize topics, re-do Mastering Biology assignments, take practice exams, etc.
- **Ask yourself – do I really understand this?** Think about what you are learning and if you really are learning and understanding each concept. Ask yourself questions about how you are studying and if what you are doing is effective. This is called *metacognition* and has been shown time and time again in the research literature to be an effective studying and learning tool.
- **Work in groups!** Working with each other both in and out of class is highly encouraged, and peer-teaching can be more effective in helping you learn than studying the material on your own. Ask each other questions, make up practice tests for each other, and use each other for support and help throughout the semester.
- **Attend supplemental instruction!** SI is a valuable tool that is provided for you to help you learn and do well in this course. Make it a habit to attend the same SI session once a week. Our own research at UNC tells us that the average of students that go to SI perform a half a grade better than the average of students that don’t attend SI.
- **Come to office hours!** I’m here to help you as much as I can in any way possible. Please come to office hours if you have questions or concerns about the course material, your major, careers, or life in general. Don’t wait until the end of the semester to come see me, as I won’t be of much help if it is too late!
• Get peer tutoring help! Free peer tutoring is available at Dey Hall on Tuesday and Wednesday evenings from 6-9 PM. There are not usually too many people there and you can often get one-on-one attention. http://www.unc.edu/depts/lcweb/

• Get one-on-one tutoring help! If you feel you need scheduled tutoring and one-on-one attention with a fulltime tutor, don’t wait too long. See Robin Blanton at the Learning Center. She is the biology specialist and is wonderful. However, her time fills up fast because she is popular! http://learningcenter.unc.edu/

Course Schedule
The following is the schedule for the course. The assigned chapters are intended to be read before that day of class (e.g. read Chapter 1 before class on January 15). More detailed reading assignments will be given with the homework assignments on Mastering Biology. All homework assignments are due each Monday and Wednesday at 11:59pm. Quizzes will be posted on Thursday and will be due by 11:59pm on Sunday night (four days later). The exams will cover the material that precedes them (stated in parentheses). The schedule is subject to change.

Introduction to Biology
BIG QUESTION: What is biology and how is science done?
At the end of this unit, you will be able to…
• Describe the scientific method
• Use the scientific method to develop a hypothesis, make predictions, and analyze data

Thursday January 10  Course introduction and overview
Tuesday January 15  The scientific method  Chapter 1  HW 1

Unit 1: Molecules and Cells
BIG QUESTION: Why do we need to eat food and breathe air?
At the end of this unit, you will be able to…
• Describe the properties of the macromolecules of life
• Evaluate the nutritional properties of food and interpret nutrition facts labels
• Draw an ideal cell and explain each organelle’s function
• Explain how molecules can be transported across cell membranes
• Compare and contrast cellular respiration and photosynthesis
• Draw the path of a CO$_2$ molecule through the carbon cycle

Thursday January 17  Carbohydrates & Fats  Chapter 3  HW 2  Q 1
Tuesday January 22  Proteins  Chapter 3  HW 3
Thursday January 24  Nutrition  Chapter 21  HW 4  Q 2
Tuesday January 29  Cell Structure & Function  Chapter 4  HW 5
Thursday January 31  Cell Membranes & Transport  Chapter 5  HW 6  Q 3
Tuesday February 5  Energy & Cellular Respiration  Chapter 6  HW 7
Thursday February 7  EXAM 1 (on Jan 10 – Jan 31)
Tuesday February 12  Photosynthesis & Carbon Cycle  Chapter 7  HW 8
Thursday February 14  OPEN TOPICS # 1  TBA  Q 4
Unit 2: Genetics and Biotechnology

BIG QUESTION: How can changes in your DNA lead to cancer and other genetic diseases?

At the end of this unit, you will be able to...

- Compare and contrast mitosis and meiosis
- Explain how disruptions in the cell cycle can lead to cancer
- Use a Punnett square to predict the traits of offspring
- Use the central dogma to determine a protein sequence given a DNA sequence
- Explain why cells can be very different even though they all have the same DNA
- Evaluate the ethical implications of biotechnology, forensic science, and GMOs

Tuesday February 19  Mitosis & Cancer  Chapter 8  HW 9
Thursday February 21  Meiosis & Sex Determination  Chapter 8  HW 10  Q 5
Tuesday February 26  Inheritance  Chapter 9  HW 11
Thursday February 28  DNA to RNA to Protein  Chapter 10  HW 12  Q 6
Tuesday March 5  Gene Regulation  Chapter 11  HW 13
Thursday March 7  EXAM 2 (on Feb 5 – Feb 28)
March 11 – 15  SPRING BREAK
Tuesday March 19  Human Genome  Chapter 12  HW 14
Thursday March 21  DNA Profiling & Forensics  Chapter 12  HW 15  Q 7
Tuesday March 26  Genetically Modified Organisms  Chapter 12  HW 16

Thursday March 28  OPEN TOPICS # 2  TBA  Q 8

Unit 3: Evolution, Diversity, and Ecology

BIG QUESTION: How did we get to where we are today?

At the end of this unit, you will be able to...

- Explain Darwin’s theory of evolution
- Use natural selection to predict the evolution of populations
- Compare and contrast prokaryotes and eukaryotes
- Describe the diversity of prokaryotic and eukaryotic life
- Explain the impact of human interactions on the biosphere
- Evaluate the evidence for and against climate change

Tuesday April 2  Evolution & Natural Selection  Chapter 13  HW 17
Thursday April 4  Origin of Species  Chapter 14  HW 18  Q 9
Tuesday April 9  Prokaryotic Diversity  Chapter 16  HW 19
Thursday April 11  EXAM 3 (on Mar 5 – Apr 4)
Tuesday April 16  Eukaryotic Diversity  Chapter 18-19 HW 20
Thursday April 18  Human Population Growth  Chapter 36  HW 21  Q 10
Tuesday April 23  Climate Change, Part 1  Chapter 38  HW 22
Thursday April 25  Climate Change, Part 2  Chapter 38  HW 23  Q 11

Saturday May 4 at 12pm  FINAL EXAM (cumulative)