Foundations in Biology I (BIOL-105/115) Summer 2023

Welcome to Foundations in Biology I!

What is this course?
This course is titled 'Foundations' on purpose, because we want to help you build a strong foundation for future learning. It is intensive because building a good foundation takes hard work. You will learn more than you thought possible and emerge with usable knowledge, well-developed scientific skills, improved writing and arguing skills, and a more in-depth approach to learning science.

Who is the course for?
While this course is required for some students, it is meant for anyone with an interest in exploring how life works. We assume you have basic high school biology and chemistry knowledge to build on. We provide ample help for anyone struggling… and we all struggle at times!

We are a community. Science is a team sport, and this course is too!

Course Information

Contact Information: Professors: Dr. Shauna Bennett: sb1949@georgetown.edu, Regents 357
Dr. Jeanetta Floyd: jf1605@georgetown.edu, Regents 375

Lectures/Recitation: MTWR 10:50 am - 12:45pm, Regents 353

Laboratory:* MTWR 8:30 am - 10:25 am, Regents 353

Office Hours: After class, or by appointment

** Although there is separate registration for Biol-105 and Biol-115, we highly suggest you take both. We view the lecture and lab as one integrated whole (as it is during the typical semester)*

Materials

For Lecture: Textbook is **Biology: How Life Works, 1st, 2rd or 3rd edition, by Morris, Hartl, Knoll, Lue.** We recommend buying it with the "LaunchPad Portal" (ISBN#: 978-1464126093) to get access to e-text (it's in the bookstore, but cheaper through Amazon). Older editions of the book are also OK if necessary. Some of the chapters are rearranged, but the information should be the same.

We don't use the book for assignments, but you will need it for reference and to provide some different context to the lecture material. We will cover topics in class that are not covered explicitly in the texts, and you will read about different examples that we will not discuss in detail. So, to do well, attend lectures *and* do readings.

For Lab: You will be provided with a lab manual.

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Course Expectations

I expect you to: be engaged, come to each class prepared, treat all members of the class with respect, and turn assignments in on time. (You can expect the same from us!)

Lectures
The schedule of lecture topics is listed in the calendar below. Review textbook content before class so you're ready to discuss. You should be able to spend class time in active learning and productive discussions.

Attendance is important and expected. Active engagement is also expected. We will work in small groups each day to discuss the day's content and work on questions. The questions will follow the same format as in the exams.

Quizzes
We will have short quizzes as assignments each evening to review your understanding of the material and to help you think of the topics in the way that will be discussed during recitations and tested during the exam.

You CAN work together on the quiz – and it's good for you to do so. You can use your notes, the textbook, or lecture slides. Can you use the internet? No. Answers through Google are likely to confuse you at our level of learning. Quizzes will taken on Canvas and will be available from the end of the prior class until midnight. Late quizzes will not be accepted.

Laboratory
Each lab has been designed to teach and achieve the following two goals:

i. To think and write critically in a Biology context and on Biology content.
ii. To learn to work together with other students, as being able to work with others, and to form a cohesive community, is key for success in biology, medicine and STEM related fields.

If you are enrolled in Biol 115 laboratory, your attendance and active involvement in all labs is required. It is not possible to make up a missed lab during Summer. You will receive more detailed information about the expectations during lab time. Please note: 2 or more unexcused absences from lab will result in failing the entire course.

Read through your lab manual before class. You will have pre-lab and post-lab assignments. No late pre-labs are accepted. Late post-lab assignments will result in loss of points (details below).

Getting your Questions Answered.
There are many people that can help you get your questions answered. During class time, laboratory time, after class, or by appointment or email. ALL questions are valid. Don't let yourself fall behind—just ask!

Late Policy – assignments and exams
Assignments are due on their due dates. All due dates will be available on the Course Schedule and on Canvas. Late Post-Lab and Research Paper assignmentswill lose 10% per day; nothing will be

accepted after 2 days. Note that the last Postlab cannot be late. Doing things on time is extremely important for your learning in this accelerated summer course, but it's also imperative so we can provide you feedback in a timely way.

There will be no unexcused make-up exams or quizzes, regardless of circumstances. To be excused from an exam due to a documented family emergency or illness, you must notify me before the exam and provide appropriate documentation. A replacement assignment might be assigned in these circumstances and will be expected to be completed by the deadline.

Unexpected circumstances sometimes come up. Talk to me early if there is a possibility you will miss something. Don't wait until it's after-the-fact, or too late. Let's work together to finish the course.

If you miss an exam for any other reason or fail to notify me in advance, you will receive a zero.

Grading

The grade for each course is determined by the following algorithm:

Biol-105 lecture (3 credits)

100 points – Exam #1
100 points – Exam #2
100 points – Exam #3
200 points – Final Exam (Cumulative)
100 points – Research Paper
110 points –16 Quizzes (worth 7+ points each)
40 points – Participation (-5 pts per unexcused absence)
750 points – COURSE TOTAL

Biol-115 lab (2 credits)

200 Points – 4 Post-Lab papers
40 Points – Pre-Labs
10 Points – Participation
250 points – COURSE TOTAL

There are typically **no** opportunities for extra credit work in the very short intensive course. Please focus on the assignments and exams given here.

The following guideline is used to calculate end-of-semester grades. If you take both courses, Iwill take the time to consider at the end of the semester if your grades will be for the entire course, or separate for the two courses, depending on which works to your advantage.

$A \geq 93.0\%$
$90.0\% \leq A- < 93.0\%$
$87.0\% \leq B+ < 90.0\%$
$83.0\% \leq B < 87.0\%$
$80.0\% \leq B- < 83.0\%$
$77.0\% \leq C+ < 80.0\%$
$73.0\% \leq C < 77.0\%$
$70.0\% \leq C- < 73.0\%$
$67.0\% \leq D+ < 70.0\%$
$65.0\% \leq D < 67.0\%$
$F < 65.0$

Learning Goals

The Department of Biology has set scientific content, process, and communication learning goals for the 4-yearcurriculum (biology.georgetown.edu). The two semesters of Foundations of Biology share responsibility for introducing each of the ten learning goals as a means to build your biological 'foundation'. Thus, this course isnot just about building your scientific knowledge. Much more importantly, it is about deepening your understanding of the epistemology of science and your ability to effectively communicate your scientific ideas. Ultimately we'd like you to think about yourself as a scientist, not just a student of science.

Georgetown Biology Department Learning Goals (and how material from this course relates)

Insight into the Process and Product of Science

We begin our learning goals with a focus on process to emphasize our belief that the goal of a biology education is to enable students to make creative and careful use of their knowledge. Only then will they be scientists.

1. Integrate New Knowledge into Existing Intellectual Frameworks
   Material for this course is foundational through the semester, and to a degree in the Biological Sciences. In addition, you will be expected to write a literature review.
2. Engage with Scientific Inquiry
   The labs and literature review will help you engage in and understand research science. Most labs will be inquiry-based learning labs.
3. Represent and Interpret Data in Quantitative and Statistically Meaningful Forms
   Lab 3,4 and 5 will engage specifically in using and understanding quantitative data.
4. Communicate Scientific Understanding in Oral and Written Forms
   Through lab reports, you will have a chance to engage in scientific writing
5. Appreciate the Epistemology of Science
   Throughout the course, we will focus on the systems of knowledge that makes up Science, and understand how this system differs from other knowledge systems.

Fundamental Biological Concepts

Two themes relate to the five categories of fundamental biological concepts that we describe below and we list them here:

- Our understanding of chemistry, mathematics, and physics enables us to understand biological phenomena. It is therefore essential that Biology students have a strong foundational understanding of these fields – of both their concepts and their "ways of knowing".
- Evolutionary mechanisms create and profoundly affect organisms and their characteristics. It is therefore essential that Biology students have a strong foundational understanding of the theories, evidence, and mechanism of evolution.

6. Organization of Molecular, Cellular, Organismal and Ecological Systems
   The first quarter of the course focuses on molecules and a biochemical approach tounderstanding biology, while the second quarter focuses on cells.
7. Evolution as a framework for understanding biological systems\
   This core theory is implicit in all discussions and labs.
8. The Flow of Biological Information
   The third quarter of the course will focus on the central dogma and understanding material related to molecular biology
9. Flow of Energy and Matter in Biological Systems
   Metabolic pathways are a key portion of the second quarter.
10. Interdependence and Interactions within Biological Systems and Their Emergent Properties
    For the last quarter of the course, we will focus on integrated physiology.

Schedule and Curriculum*

Date	Lecture Topic	Lecture Reading	Quizzes and Exams	Paper	Lab Exercise	Lab Assignments
Mo July 10th	**Biochem 1**: **Chemistry foundations** Atoms, Bonding, Water, Organic Molecules	2.1 - 2.4 6.1 - 6.4	Quiz 1: Chemistry		Lab 01: Intro to Inquiry based labs	Read: Flexner; Methods reading; Lab manual intro; Due: Prelab 1_01 (in class)
Tu July 11th	**Biochem 2**: **Proteins** Biomolecules, Proteins and Amino acids, Protein Structure	2.5, 4.1 6.1 - 6.4	Quiz 2: Proteins		Lab 01: Enzyme Lab: Practical aspects of Experimental design	Read: Enzyme lab background and protocols **Due**: Prelab 1_02
We July 12th	**Biochem 3**: **Enzymes** Chemical Reactions, Reactions and Free Energy, Enzymes and Active Sites, How Enzymes Work	2.5, 4.3, 6.5	Quiz 3: Enzymes		Lab 01: Enzyme Lab: Experimentation	Review: Enzyme lab background **Due**: Prelab 1_03
Th July 13th ***[Last day to drop class. See schedule.]***	**Biochem 4**: **The other 3 macromolecules** Carbohydrates, Nucleic Acids, Lipids	2.5, 3.1 - 3.2, 5.1	Quiz 4: Macromolecules	*Assigned*	Lab 01: Workshop: Lab meetings and Writing Lab Reports	Read: Postlab Guidelines **Due**: Prelab 1_04
Fr July 14th						
Weekend						
Mo July 17	**Genetics 1: Genes and genomes** ***Exam 1 Review***	13.1, 13.3 – 13.4	Quiz 5: Genomes		Research Paper Workshop: Scientific papers and Literature searches	Read: Research paper description **Due: Postlab 1**
Tu July 18	**Genetics 2: DNA replication** Replication machinery, Polymerase chain reaction	12.1 - 12.3	**Exam 1: Biochemistry**		**[Exam 1]**	
We July 19	**Genetics 3: Gene expression** - Transcription machinery**,** Regulation of gene expression	3.3 – 3.4, 18.1	Quiz 6: Gene expression		Lab 02: Mol Bio Lab: Microbe genes and primer design.	Read: MM Lab intro, Protocols, PCR background **Due**: Prelab 2_01
Th July 20	**Genetics 4: Genetic code** Translation machinery**,** The Genetic Code, Mutations	4.1 – 4.2, 18.2	Quiz 7: Genetic Code	*Topics due (11:59pm)*	Lab 02: Mol Bio Lab: PCR theory and practice.	Read: MM Lab bacteria background, PCR protocol **Due**: Prelab 2_02
Fr July 21						
Weekend						

Mo July 24	**Genetics 5: Genotype to phenotype** Genetics Meiosis	14, 17.1	Quiz 8: Genotype to phenotype		Lab 02: Mol Bio Lab: Gel Electrophoresis and Lab Meeting.	Read: Gel electrophoresis background and protocol **Due**: Prelab 2_03
Tu July 25	**Genetics 6: Cell cycle** Mitosis, Cell Cycle regulation	11.1 – 11.3, 11.5, 15.3 – 15.4	Quiz 9: Cell cycle		Lab 03: Cell Lab: Intro to microscopy and protists	Read: Cell lab Introduction, background on microscopes and cells **Due**: Prelab 3_01
We July 26	**Cell Bio 1**: **Cell membranes** Membrane transport, Gradients ***Exam 2 Review***	5.1 – 5.2	Quiz 10: Cell membranes		Lab 03: Cell Lab: Protist observations	Read: Cell lab background on protists, protocol for day 2 **Due**: Prelab 3_02
Th July 27	**Cell Bio 2**: **Metabolism** - Glycolysis and fermentation, Aerobic respiration	7.1 – 7.7	**Exam 2: Genetics**		**[Exam 2]**	
Fr July 28						**Postlab 2**
Weekend						
Mo July 31	**Cell Bio 3: Movement and trafficking** Cytoskeleton, Secretory pathway	5.3 – 5.4	Quiz 11: Metabolism and Movement	*Rough Draft due (11:59pm)*	Lab 03: Cell Lab wrap up	Read: Cell lab postlab guidelines **Due**: Prelab3_03
Tu Aug 1	**Cell Bio 4: Cell Bio Overview** Organelles and microscopy	10.2	Quiz 12: Cell Bio Overview		Lab 04: Frog lab: Introduction to development. Peer Review of Rough Draft.	Read: Frog development lab introduction, background, protocols **Due**: Prelab 4_ 01
We Aug 2	**A&P 1: Signaling** Principles of signaling ***Exam 3 Review***	9	Quiz 13: Cell Signaling		Lab 04: Frog development Lab	Review: Frog development background **Due: Postlab 3**
Th Aug 3	**A&P 2: Development** - Fertilization and embryogenesis	26.2 – 26.3,	**Exam 3: Cell Biology**		**[Exam 3]**	
Fr Aug 4						
Weekend						

Mo Aug 7	**A&P 3: Cell Connections** Signaling part 2, Extracellular connections	10.1, 10.3 – 10.4	Quiz 14. Development and Cell connections		Lab 04: Frog development lab	Read: Frog development postlab guidelines Due: Prelab 4_03
Tu Aug 8 ***[Last day to withdrawal / do P/F.]***	**A&P 4: Immune System** Innate and Adaptive immunity	41	Quiz 15: Immune system	***Final Paper Due*** *(11:59pm)*	Lab 05: Dissection lab	Read: Rat anatomy and physiology background
We Aug 9	**A&P 5: Nervous System** - Neurons, Nervous system	34.1 – 34.6	Quiz 16. Nervous system		*Exam Review*.	**Due: Postlab 4**
Th Aug 10	**Final Exam** *(cumulative with A&P. No Nervous System)*		**Final Exam**		**[Final Exam]**	
*aspects of the schedule can be subject to change based on unforeseen circumstances						

The Ethos of Foundations in Biology: Basics + **I**nquiry + **O**wnership = **BIO**

"**Basics**" – Biology courses tend to be about what we already know – and at their best, how we came to know it. This is what I call the "basics" – and it is an important part of the whole. But it is only one part, yet Biology courses and textbooks tend to make it the "end all and be all". So, let's say that a mastery of the "Basics" is (only) one goal of this course.

But biology itself is largely about what we don't yet know! Biology courses should therefore embrace this and teach to this as a goal as well. But how? We'll foreground two additional elements in this course. Two points that can in part be summarized by the phrase "The Value of Not Knowing":

"**Inquiry**" – meaning asking questions and searching for answers, investigating, and working at the edge. Authentic inquiry is really quite fraught and of necessity means a high failure rate. The NY Times, writing about Dr. Eric Wieschaus, 1995 Nobel prize winner in developmental biology, said "Dr. Wieschaus said he was amazed at having conducted experiments that actually worked. 'Ninety percent of the time they didn't work,' Dr. Wieschaus said, a situation that he said was much the same in his current work."

"**Ownership**" – engagement and self-awareness, making it yours and being responsible for making it yours, knowing what you know and what you don't know. To truly learn something, you must have the ability to know what you know – and to know what you don't know. (Re-read that a few times until it makes sense!) Indeed, it is the latter ability that makes you an expert learner because only by defining the gaps and misconceptions in your knowledge can you work effectively to repair them.

Unfortunately, students expend a lot of energy trying desperately to hide what they don't know: in class, on tests, and even in conversations with peers. How often have you refrained from asking or answering a question in class because you thought you would look dumb? How often have you simply written aimlessly on an exam, hoping that somewhere in the torrent of words, there might be a word or two that would gain you some partial credit? Sigh… These actions are of course just the opposite of what would really help you learn, but they are very ingrained into our nature, and they are often rewarded by teachers who look happy that the class has no questions – or by the stray point or two you pick up on short answer questions when you really didn't know the answer.

We want to change that in this class. We want this class to be a place where you feel supported – and rewarded (note this emphasis) – for exploring the realm of what you don't know and for having the courage to make mistakes. We will truthfully acknowledge that this is probably an easier sentiment to express than it is for me to enable and you to perform. It is easy to support students in learning information, relatively easy for students to learn information, and easy to check to see if students know it. It is harder to support students in learning habits of the mind, equally hard for students to learn how to learn and how to become scientific thinkers, and very hard to assess this process… and in particular to reward failure.

But if we want to have this course mirror authentic scientific practice than we must do that very thing. How can we together transcend the usual practice of staying only in charted waters? We'll need to change a few significant aspects of the course that will likely make it quite different from previous science courses you have taken. Be forewarned… and read on!

Changing Class Habits: The classes will be interactive. It will be a time of active learning, so come prepared to work together in groups to discuss ideas, problem solve, brainstorm, etc. This will be true in lecture and especially in the smaller recitations.

Changing Lab Habits: The labs are very open-ended and inquiry-driven. There will be lots of cutting edge science, lots of opportunity to talk about the science that you are doing, lots of opportunities to design your ownexperiments, and lots of opportunities to have experiments fail! This will be cool – we promise – but likely very different and a bit unnerving if you have never had this level of freedom and responsibility in a lab before.

Changing Reading Habits: We will work to make the readings an interactive experience by providing Blackboard Discussion Boards as a means to allow you to talk with your colleagues about the information andideas as you are reading about it. Recitations will also be a good time for talking about your own ideas and questions.

Changing Writing Habits: Writings this semester – for lab and for the research paper – will focus on developing the skills of thoughtful scientific analytical thinking. Get used to thinking hard before you put fingers to keyboard. You will be judged on the strength of your arguments rather than on the conclusions youdraw.

Changing Exam Habits: The exams will provide an opportunity – and reward points accordingly – for insightful answers that cogently address both what you are certain about and what you are uncertain about.

"*In the real science you aren't too worried about the right answer… Real science recognizes that you have an advantage over practically any other human enterprise because what you are after – call it truth or understanding – waits patiently for you while you screw up. … Nature speaks in many tongues and we are all alien. What a scientist is trying to do is decipher one of those dialects. [If a scientist makes progress, we do so] because nature doesn't change and we just keep trying.It's not because we are particularly smart but because we are stubborn."* ~ Dudley Herschbach, Harvard chemist

How to Succeed in Foundations of Biology

Based on previous experience, we know that this course will be different than many of your previous biology classes. Hence, you may need to take a different approach to your studying. Here is a good list of successful strategies for approaching this course. Not all of them will be right for you – but some of these will help!

Time

How much time should this course take each week? We get asked this a lot, and while it is hard to give a goodanswer, here are some general guidelines: 2 hours in class + 2.75 hours in lab + 2 hours reading/discussion board + 2.25 hour other work (lab report/research paper/studying) = 4.75 hours in class and 4 hours outside of class = 10 hours total per day. This short intensive class is a full-time job and you should treat it as such. Plan to spend an additional 10 hours on the three days you are not in the class to revise, review and prepare for exams. Sit down with your planner now and set aside blocks of time. Remember that this is a 5-credit course.

Individual v. Group Effort

You'll need to find a balance that works for you between working solo and working with a partner or two. It can often be helpful to have someone with whom you can sort through difficult concepts; this is why you work in pairs in the lab, and converse on our discussion board. But you also want to make sure that you take ample time to think through topics on your own so that you are clear about what you can understand and solve and create with just your own mind at your disposal. Most students find that it is best to think on their own first, figure out what they do and do not know; then use the group to fill in missing knowledge, and finally go back toworking on their own to embed the new knowledge deeply.

Course Readings

There is a significant amount of reading in this course. You will be reading ~1-2 chapters a day, or ~40-80 pages. We remember being students in introductory biology course (many) years ago and being frustrated by our textbooks. We found them *fascinating*, but we also know that we often found it *impenetrable and time-consuming*. We compensated by either highlighting all of the information that was new to me (with the result ofmany soggy yellow pages!) or simply ignoring the book and hoping we wouldn't really need it. Neither was an effective strategy.
Let's try to avoid that scenario for you by the following tips:

1. Be clear about why you are reading the textbook. You're likely thinking this is a trick point: that the purpose is obviously to read the material in order to compress it into a set of more compact notes – i.e. thatthe purpose is to extract the facts. Nope! As lovely as it would be for you to be able to do this, it is pretty much an impossible task. Why? Have you *seen* the size of our textbook?? Do you have any idea how much information is *in* that book? If you read it for the purpose of finding facts, get a shovel… there are thousands of them.

   So, then… why read the textbook? Glad you asked! The primary purpose of reading the book is to give you a first round of exposure to the topics before class – and a place to serve as a reference after class. Wehave a lot of ground to talk about in class and move quickly. We also use class as to problem-solve – tryingout how well you understand the ideas. If you are encountering ideas for the first time in class, you simply won't be able to keep up.

   So how do you know which ideas are the right ones to read and think about before class? Look at the powerpoint slides and see what parts of the chapter will be emphasized in lecture.

2. Skim the chapter before class. You can make more effective use of our time together if you come a bit prepared. This first reading should take you ~30 minutes per chapter. Aim for three goals when you read:
   - Familiarize yourself with the big concepts (what are the main 3 or 4 ideas?)
     - Each chapter starts with a set of Core Concepts. Read them first (or at least the ones that apply to the sections of the chapter you are assigned to read) and think about them until they make at least abit of sense – i.e. slow down here and take time to think about what those brief sentences really mean.
     - Each chapter ends with a Core Concepts Summary. Read the relevant parts. These first two tasks are your key to identifying the big ideas in the chapter. They provide your roadmap to help you readwith a purpose.
     - Make connections to your prior knowledge. Where do these new ideas fit what you already know?How do they surprise you because they don't seem to fit?
   - Take *very* sparse notes. Just enough to put the roadmap down on paper (~1 side of a page). You'll mostly use your class notes for studying, so the primary purpose of the book notes is really just to helpyou in your reading: many of us have brains that are wired to better understand something if we both read it and write it. Jot down a few big ideas, but mostly write out your questions: what don't you understand?
   - Join the discussion board if you want to do so. Talking about an idea you are working to understand,asking a question about it, attempting to answer someone else's question (even imperfectly or incompletely) is a great way to make your understanding stronger.

3. Come to class. Take great notes! We strongly advise that you print out the powerpoint slides and annotate these for your class notes. This way you won't need to write down what we've already put on the slides foryou.

4. That same evening (!) go back to re-read the textbook. Focus in on the parts that we talked about in class.Spend another hour with your textbook now.

- Flesh out your class notes if you were incomplete in class.
- Be sure that you are gaining a true understanding of the ideas (not just acquiring factoids) by trying toanswer the orange questions and the end of the chapter questions.
- Make sure you understand the hierarchy of ideas! Use trees to shape your notes.

5. What about LaunchPad? The online support that comes with the text has pros and cons. It's a decent source of fact-based questions to test your knowledge. *But* it doesn't really test your understanding, andthat's what is ultimately important in this course. *And* it tests all of the facts from the chapters, whereaswe'll be more selective. So, use it carefully.

Conversations

As you read, you'll find that you have lots of questions and some new ideas. Talking about these is the best way to help you reinforce your understanding and clear up points of confusion. We'll provide ample time in lecture, lab and recitation for questions and conversation, but we also want to provide a forum where you canhave real-time conversations as you are reading the material.

Lectures

It is all too easy in a large lecture to sit there passively and let the ideas wash over you. But then lecture is largely wasted time from a learning perspective when it should really be among the most valuable time becausewe have so many minds in one room thinking about the ideas.

- Look over powerpoints, and have them available as you listen to lectures. They are always up on Canvas before class.
- We strongly recommend that you write – not type – your notes; studies have shown the former to be much more effective as a tool for learning the material! Take quality notes on the Powerpoints and/or in a notebook – annotate the figures, use multiple colors, jot down questions/confusions, etc.
- Work hard to solve the problems that are sprinkled throughout the class. These problems will be a good way to test your understanding (and they often appear on exams!). If you don't get a problem – or understand the answer – ask a question during recitation!

The volume of information in this course can be daunting. And importantly you will be expected tonot only know the material but also be able to use the knowledge. This will require that you spend time reading, thinking, and doing with the ideas of the course on a continual basis and not just in a mad studying frenzy before each exam. More importantly, this will require you to practice using that knowledge. So, each lecture, we will have time set aside to work together, first by answering any questions you might have on the worksheets, then to give you time to work in small groups and practice answering the same types of questions you might expect in an exam for this course. It is of course therefore crucial that you come to class, and that you come to class prepared.

Quizzes

As an entry ticket to class, and to give you incentive and to reward your efforts of keeping up, you'll have quizzes on which you can practice developing your scientific skills. (Hopefully you are by now getting the message that biology is NOT about memorizing facts – it is about thoughtfully tackling new ideas!)

These quizzes should be taken after lecture, but before coming to the next day's class (for dates on when we will discuss a topic/chapter please see schedule above) Take the time to do these thoughtfully! Be sure that you can write a solid explanation for each of your answers; this is great practice for the exam. Seek help if you are truly stuck.

The last question of each quiz is an open-ended ungraded communication tool, where you can tell me ifthere is any aspect of the class that still confuses you. Note that this section should not be in lieu of youspeaking

with me or the TAs to get help.

Research Paper
You will be expected to write a research paper in this class. We will discuss the assignment in class to get you started. This paper will be based on scientific research and news articles. We will spend time in class and in lab showing you how to search for articles in the primary literature and how to read them. This assignment will be worked on throughout the semester.

Lab
There is a daily required lab. It follows the subject matter of the classes and will allow you to encounter science much more vividly than you can do via a textbook, to do and think about the process of science rigorously and creatively, to work collaboratively with your peers, and to write effectively about your research. Lab here is not about getting the right answer or 'finishing'. A well-done experiment may provide insight (never answers) but usually just raises more questions. The entire concept of completion is really anathema to research.

Our goal is for you to slow down/observe, be rigorous/creative, think/do, write/reflect. Don't stress about how far or fast you are going. But be sure to think carefully about everything you are doing as you move along. Your lab papers need to demonstrate the quality of your thinking and how well you understand what you did,why you did it, and what you learned from it (about the science and your scientific process). Write your lab papers to be understood by a peer.

One important trick is to think of the lab as a review session. We have designed the labs to illuminate many, many of the big ideas in lecture. So, as you work in lab, slow down and keep trying to relate what is happening in the test tube (or under the microscope or on the gel) to the underlying concepts.

You will be ably assisted by our trained cohort of TAs. Your TA will have primary responsibility for mentoring you and evaluating your work, but I provide strong oversight. Any questions/concerns about the lab should be brought to their attention.

Writing
Both your Lab Papers and your Research Paper are opportunities for you to work on your (scientific) writing skills. Your grade will be largely dependent on how well you communicate your ideas – and that is in turn largely dependent on the quality of your writing. Quality of writing refers to the mechanics, the rhetoric, and the process. Details about writing goals are in the "Writing Goals" pages at the back of this document. If youstruggle writing, we recommend you visit the *Writing Center.* (http://writingcenter.georgetown.edu/).

General points to keep in mind when writing:

- Have something to say. Be selective in what you choose to say. Put your main message(s) up front in your writing – in the form of thesis statements and topic sentences.
- Remember your audience. Your writings should be aimed at a peer who is unfamiliar with the specifics of your topic. Write to teach them.
- Organize your arguments. The goal of your writing is to support your message. You can discern your organization best post-writing by creating a quick and dirty outline from your writing: does that outline seem logical?
- Revise your writing. None of us has ever written something well the first pass through. Proofread with the goal of eliminating 20% of what you wrote the first time and restructuring the rest! Tighter writing is always better writing. And please double-check grammar, punctuation and spelling. If you are sloppywith

these, you are likely sloppy with your science, too.

All work done in connection with this class must adhere to the rules of the Georgetown honor system. As *responsible scholars*, you are expected to properly reference at all times. Proper citations include a notationwithin the text and a reference list at the end of the text.
Your job as a *responsible scholar* is to critically evaluate your sources to be sure you are using only the highestquality information in your writing. This is particularly challenging with the vast proliferation of on-line material (see below for specific help with this topic) but is true of all sources. Just because it is published, doesn't make it true.

Some tips:

- Read with a critical eye – Can you find the same information elsewhere by a different author? Do you see gaps in the logic? Is the information fully cited or are the data presented in the source? Does the author have a bias?
- Read with a creative eye – What can you do with the new ideas that you have just read? Does it lead you to new research? Does it lead you to re-evaluate your research question?
- Be certain that you have dug down to the origin of the information and are citing it properly – You should not be citing from a source if it is in turn only citing that information from another source. Be sure to find the original source for the information, read that and then cite it. Information can get blurred when it is handed down too often (like playing telephone as a kid). This is especially true with information on the web.
- Be cautious with on-line sources – It is a remarkable how much information is now readily available at a click of the computer button. It is also dangerous how much false information is readily available at a click of the computer button. Check out this link for a really good resource on evaluating on-line sources: http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html
- A note on Wikipedia. Everyone loves Wikipedia. I love Wikipedia. I use Wikipedia. BUT Wikipedia is not a peer-reviewed or professionally or impartially edited source. It has errors (like everything) but it also has bias from its authors. Use it with care and only as a starting point for further research! It cannot be your final citation for information!

Within the text citations:
Scientists do not typically use quotations within papers. They rethink and rewrite the information *in their ownwords*. You should do the same. Regardless of whether you use another person's words or just their thoughts,you need to cite them. Please do not use footnotes!

Within-text citations should be as follows:

Journal article:

Single author (author last name, year)
2 authors (author last name and author last name, year)
3 or more authors (author last name, et al., year)

Book: As above, but include page numbers.

For example: *Others have recently shown that numerous enzymes are active at low temperatures; importantly, this is particularly true of enzymes found in psycrophiles (Smith, et al., 2010).*

\End of text references:
These should be listed by author, in alphabetical order, exactly as shown below. If you cite from our textbookyou must reference, too. Examples of proper references are given below. Follow the capitalization and punctuation precisely! Italicize all Latin names!

- Article in a journal: Sondheimer, N., and Lindquist, S. (2000). Rnq1: an epigenetic modifier of protein function in yeast. Mol. Cell 5, 163–172.
- Article in a book: King, S.M. (2003). Dynein motors: Structure, mechanochemistry and regulation. In Molecular Motors, M. Schliwa, ed. (Weinheim, Germany: Wiley-VCH Verlag GmbH), pp. 45–78.
- An entire book: Cowan, W.M., Jessell, T.M., and Zipursky, S.L. (1997). Molecular and Cellular Approaches to Neural Development (New York: Oxford University Press).
- For on-line sources, give the title of web site, author or editor, organization responsible for the site, date of site's publication or date of last update, date of access, and the url. A regular scientific journal article accessed on-line is an article, not an on-line source!

Exams

Exams will be conducted on the dates listed above. Exams will be closed book.

We will be relying on your honor. I have compelling evidence that a student did not keep to the honor code, I will have nochoice but to bring a case against that student to the honor council.

All exams will be cumulative. This means that while the questions on each exam will focus on the most recent material, you will be expected to be able to integrate ideas throughout the semester. Each exam question will bewritten so that you can describe what you know and what you don't know about the answer. You will gain credit for accurate accounts of both, though you can only achieve full credit by actually knowing the answer.

The exams are designed to take 60 minutes I will give you 2 hours. If you require extra time on exams or special testing conditions, please be sure to see the *Academic Resource Center* (3rd floor Leavey Center) to complete the required paperwork.

If you cannot take an exam on the designated day, you must get permission in advance from the professor to take a make-up exam.

Exams will be returned soon after you have taken it. If you disagree with the grading of a question, you mustsubmit a written request for a re-grade.

- Your request must clearly explain why your answer merits more credit than it received.
- Re-grade requests must be submitted in lecture by the day after your exam was returned.
- You should know that a re-grade request opens the question to a fresh assessment. The result may be an increase or a decrease in the grade.

The FINAL EXAM is scheduled for Fr Aug 12th. You must be in attendance to take the exam.

Studying for Exams

1. *Look ahead.* Exams from previous years are available on Canvas. At the very beginning of a new unit, lookat these exams. This will help make the finish line clear.
2. *Repeated exposure* to the material – even if brief – is better than trying to study all at once before the exam.This is especially important on exams that ask you to apply your knowledge. So, try this as a weekly pattern:
    a. *Briefly read the text* the night before class and jump into the conversation.
    b. *Attend class* and be an active participant.
    c. *Look over the notes/slides/textbook* that evening. Fill in gaps in your notes. Be sure you are clear on the BIG ideas. Write down questions you need to get answered.
    d. *Complete the problem set* that week. This will give you an opportunity to really try to

use the ideaswhen solving new problems.

e. *Review the day's material the previous night.* One very useful technique is to organize the informationfrom the week into a tree or flowchart of ideas; this will help you organize the information and to be clear on what are big, medium, and small ideas in each topic.

f. *Apply your knowledge in lab*. We've worked hard to align class and lab. Use this to your advantage andthink in lab! Try to apply new ideas, vocabulary, etc.

3. *Practice problem solving*. The exams are all about applying your knowledge. So… when you study, be sure to continually test the depth of your understanding. How? Rework the questions in the text, the questions at the end of the chapter, the questions we did in class, the questions from the quizzes and recitation. And you can make up new questions by just extrapolating a bit beyond the questions you alreadyhave in hand; tweak the scenario and see if you can figure out the consequence: what would happen to a cellwithout telomerase? without a peroxisome? Why would a cell need twice as many mitochondria? What if DNA polymerase was less accurate? What if…?
4. *Practice writing out your explanations*. Thinking about ideas to yourself and expressing them concisely in written form are different skills, and you need to practice the latter to do well. Note that we do NOT use theterm "answer" here. Ironically, one of the worst things you can do when you see a new question is to immediately say "Aha! I've got *an* answer!" This is because a good "answer" is really all about the explanation. We often don't give much or any credit for just the answer alone! What earns you credit is theexplanation.
5. *Use bullet points to build these explanations*. Use bullet points as a quick way to organize your explanationinto a set of coherent and connected ideas. Think of each bullet point as one part of the full explanation. If you add the bullet points up, they should equal the answer!
6. *Emphasize class notes when studying*. It is simply impossible for you to learn all of the information in the textbook. Reading through it is important to give you a brief exposure to the full breadth of information, and reviewing it can help clarify concepts form class. But what you will be held responsible for on exams iswhat we talk about in class. So when you study, don't go back to re-read the chapters. Focus on understanding the material we talked about in class (the book can help you do this) and applying that material.
7. *Make sure you know the theory behind your lab work*. Lab exists in part to reinforce the theory behind thescientific principles we discuss in class. Do include it in your studying.
8. *Study in small groups* but be sure to let everyone in the group try to answer a problem independently beforeyou share ideas. This is the way to gauge your own understanding.
9. *Get extra help.* I am available! Ask for extra help, please!

<u>Test-Taking</u>

1. *Get sleep the night before and eat something for breakfast*. Your brain works better when it is well-rested and well-fed. Really.
2. *Pace yourself*! Stick to the time recommendations so that you don't overwrite for the first problems and runout of time at the end! Don't get too hung up on problems that confuse you and don't focus too much on theproblems with which you are comfortable.
3. Students struggle to provide the right level of detail in their answers. So pretend that your audience on theexam is an imaginary peer who missed that day of class. They know a bunch of biology, but they need thesteps of the answers spelled out for them, and don't clutter their thinking with extraneous ideas!
4. Use the same bullet point idea as you did when studying. Try this idea:
    a. *Read the question* carefully (including the title) and <u>underline</u> important terms.
    b. *Stop and brainstorm* for 30 seconds. What ideas come to mind that you think you want to include inyour answer?
    c. *Write these down as bullet points* with some space in between. Then write a sentence or two

next to each bullet point. You don't even need complete sentences – just complete thoughts! Quick pictures aregood, too.

d. *THEN – and only then – think of your answer by connecting the dots.*
e. *Move on* to the next question and the next and the next…
f. *Go back* with the extra time to reread your answers and flesh them out as needed.

5. If you don't know an answer – or can only get partway to an answer – don't panic. Put down the bullet points of what you do know, and then with your last bullet point try to be as specific as possible about whatyou don't know that is preventing you from answering fully.

Policies

Honor Code

Georgetown's honor code prohibits academic dishonesty – including cheating, plagiarism and false citations –and I must report any suspicion of plagiarism to the Honor Council. To quote the Honor Guide:

(1) "Cheating is the use or attempted use of unauthorized materials, information, study aids, or unauthorized collaboration on in-class examinations, take-home examinations, or other academic exercises." Cheating is an honor code violation for both the giver and receiver of information. I will be quite specific when collaboration is encouraged/required; if it is ever unclear – ask! Do not make assumptions. On all assignments, provide the name of all students who have contributed intellectually to the assignment.

(2) "Plagiarism is the act of passing off as one's own the ideas or writings of another." and "False citation is the attribution of intellectual property to an incorrect or fabricated source with the intention to deceive." Follow the rules described in the citations section.

To be clear about how we are vigilant about academic dishonesty:

(3) All written work may be submitted to Turnitin.com.

We have come across several instances of plagiarism in my time at Georgetown, and several points worth noting have emerged: (1) Plagiarism typically results from last minute pressures to complete an assignment. Work ahead of schedule! (2) Boundaries between collaborative and individual work can seem blurry. We willtry to be clear, and you should be sure to ask when you are uncertain. (3) Plagiarism is remarkably easy to detect. Really. (4) All experiences with the Honor Council have been thoughtful and respectful – yet uncomfortable for all involved.

As Rick Pitino once said "When you have a problem, if you tell the truth, the problem becomes part of your past. If you lie, it becomes part of your future."

IF you find yourself "stuck" (e.g. desperate about a deadline and seeing no option but to take a "short-cut"), just relax. Keep working. Write to the professor and your TA to alert us that you will be turning inthe assignment late. Then, we can work together to help you finish your assignment promptly and thoroughly. No grade is worth sacrificing your integrity.

To learn more about the Honor System: http://gervaseprograms.georgetown.edu/hc/honor_system.html
If you are unclear what constitutes plagiarism, please read:
http://gervaseprograms.georgetown.edu/hc/plagiarism.html

On all lab papers, research papers, and exams, you must sign the University Honor Pledge:
In the pursuit of the high ideals and rigorous standards of academic life,
I commit myself to respect and uphold the Georgetown University Honor System:
To be honest in any academic endeavor, and to conduct myself honorably, as a responsible member of theGeorgetown community, as we live and work together.

Turnitin Statement: Students agree that by taking this course all required papers may be subject to submission for a Textual Similarity Review to Turnitin.com for the detection of plagiarism. All submitted papers will be added as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers in thefuture. Use of the Turnitin.com service is subject to the terms of use agreement posted on the Turnitin.com site.

Sexual Misconduct

Please know that I am committed to supporting survivors of sexual misconduct, including relationship violence, sexual harassment and sexual assault. However, university policy also requires us to report any disclosures about sexual misconduct to the Title IX Coordinator, whose role is to coordinate the University's response to sexual misconduct. Georgetown has a number of fully confidential professional resources who can provide support and assistance to survivors of sexual assault and other forms of sexual misconduct. More information about campus resources and reporting sexual misconduct can be found at http://sexualassault.georgetown.edu