

BIOL190: First Year Launch: Scientific thinking in Biology

Course Information

Course Number: BIOL190
Time: Tues/Thurs 12:30 – 1:45 pm
Location: 1374 Genome Science Building
Pre-requisites: None – *Must be a first-year or transfer student in your first year at UNC!*
Instructor: Dr. Elizabeth Shank
4157 Genome Sciences Building
919-962-4459
eshank@unc.edu
Office hours: Regular office hours Monday 12 – 1 pm; *Email me if this time doesn't work for you*

Course description: This course provides an introduction to the dynamic, creative, and open-ended process that is the scientific method. It is not a standard lecture-style class. Instead, we will be using an approach termed CREATE (Consider, Read, Elucidate the hypotheses, Analyze the data, Think of the next Experiment). Through the analysis of news reports and scientific articles, this teaching method encourages students to discuss and debate data and their interpretation, generate and evaluate hypotheses, and design experiments to test their hypotheses. This approach directly emphasizes the creativity and open-ended nature of scientific research and exposes students to the diversity of people who undertake research careers. We will discuss current biological topics relevant to society, such as human behavior, antibiotic resistance and discovery, and the human microbiome.

Target audience: First-year students. No previous experience reading scientific literature is required, but a curiosity about biology, the scientific process, research and discovery, or communication of technical ideas is recommended. This course is focused on understanding and implementing scientific thinking and strengthening skills applicable to different kinds of biological data; it should thus be relevant to many students, regardless of their future career path.

Course Organization: Early in the semester, we will spend class periods not only learning essential scientific concepts necessary to understand a few general topics and also talking about and modeling concrete skills needed to read and understand scientific literature. These skills include creating concept maps, annotating figures, re-phrasing jargon, cartooning experimental designs, and analyzing data. As we move further into the semester, more in-class time will be dedicated to interpreting data and generating and evaluating scientific hypotheses and experiments via peer 'grant panels'. In addition, over the course of the class, students will participate in writing and peer evaluating scientific abstracts, generating and presenting a poster, and contacting the authors of scientific papers.

Course Goals

1. To teach you how to apply high-level critical thinking skills to the analysis and interpretation of data. This course will ask you to consistently *apply* and *analyze* information and *draw conclusions from it* rather than to memorize facts. We will do this by sequentially studying individual parts of research studies to build a successive understanding of them as a complete scientific story. As a class, in small groups, and individually, we will discuss and consider how to dissect data and figures by: identifying the scientific question being addressed, ensuring we have the background knowledge necessary for the question, exploring the experimental design, interpreting and drawing conclusions from the data, and proposing and evaluating potential follow-up experiments.

2. To empower you to think of yourself as scientist. You will practice skills in this class that parallel the way of thinking and approaches taken by real scientists. You will be coached at how to construct an understanding of a series of experiments rather than accepting the presented description of the results. You will build hypotheses to answer specific scientific questions, design experiments using the appropriate technique/assay to answer the question, and predict the results of your experiment. You will learn to identify and explain the purpose of positive and negative controls in well-designed experiments and interpret experimental data and infer conclusions from the results. We will engage with the scientists who did the research to demystify and humanize science and those who perform it.

3. To teach collaboration and communication skills. This class requires and encourages an engaged community of learners in the classroom. We will use a variety of collaborative group structures to facilitate interactions and encourage constructive and collaborative learning. Assignments focused on communication skills will include writing abstracts (summaries of studies and their results) and generating and critiquing visual representations of experimental designs.

Tentative Overview of Class Schedule and Topics:

Class 1:	Jan 10:	Icebreaker; Concept Mapping; Organization and Overview
Class 2:	Jan 15:	Creativity of Science; Participation Ground Rules; Cartooning; Exptal Design
Class 3:	Jan 17:	More Experimental Design; Grant Panel Criteria; Grant Panel 1
Class 4:	Jan 22:	Established knowledge can be wrong: <i>Ulcers</i> and Developing Alternative Interpretations: <i>Writing about Test Worries</i>
Class 5:	Jan 24:	Discussion of microbes and multicellularity (prep for seminar attendance)
Class 6:	Jan 29:	Dr. Rosie Alegado Biology Seminar: Evolution of multicellularity
Class 7:	Jan 31:	Reflective writing assignment and in-class Quiz
Class 8:	Feb 5:	Developing Alternative Interpretations: <i>Empathy in Rat Social behavior</i>
Class 9:	Feb 7:	<i>Rat Empathy</i> continued; Parts of a Scientific Paper
Class 10:	Feb 12:	Secondary source analysis
Class 11:	Feb 14:	Primary literature analysis
Class 12:	Feb 19:	Primary literature analysis
Class 13:	Feb 21:	Grant Panel 2; review
Class 14:	Feb 26:	Midterm 1
Class 15:	Feb 28:	Poster Planning
Class 16:	Mar 5:	Review of microbes, antibiotics, resistance mechanisms
Class 17:	Mar 7:	Secondary source analysis
<i>Spring Break</i>		
Class 18:	Mar 19:	Secondary source and primary literature analysis
Class 19:	Mar 21:	Primary literature analysis
Class 20:	Mar 26:	Primary literature analysis; Grant Panel 3
Class 21:	Mar 28:	Midterm 2
Class 22:	Apr 2:	Background/review
Class 23:	Apr 4:	Secondary source analysis
Class 24:	Apr 9:	Primary literature analysis
Class 25:	Apr 11:	Primary literature analysis; Grant Panel 4
Class 26:	Apr 16:	Poster presentations
Class 27:	Apr 18:	Poster presentations
Class 28:	Apr 23:	Review scientist's answers and perspectives, class synthesis/overview
Class 29:	Apr 25:	Class wrap up/review

Course Materials

Reading: There is no textbook for this course. We will be using 'secondary source' literature (articles intended for a broad public audience, such as those from *Scientific American*, *National Geographic*, *Science News*, etc.) as well as 'primary' scientific literature (original research articles) for our classroom discussions and homework assignments. These papers will not be provided in their entirety at the start of the course, but instead on an as-needed basis by the instructor in advance of the class for which they are needed.

Reference Materials: Over the course of the class, you will compile your own "reference textbook" for the course in the form of a personal notebook. As we analyze and discuss each reading (annotate figures, cartoon of experiments, draw concept maps, do homework), you will assemble this material into a three-ring binder. This binder is expected to be brought to every class. You are encouraged to include in your notebook any supplementary notes that you independently collect as you identify your knowledge gaps (personal notes from your reading; information from references, textbooks or on-line sources). This will be the "book" that you can reference during the open-book exams.

Course Website: Sakai site, BIOL190

This site will be where the reading materials will be provided (although typically I will email them out with your assignment as well). I will also have postings from my lectures such as outlines, power point slides, and supplemental reading material. I will also post class announcements through this site. *It is your responsibility to check it regularly and elect to receive email announcements.*

Course Policies

If you participate in class and do your reading, homework, and assignments, there should be no need to cram for an exam. *This is not a class based on memorization of facts but on depth of thinking:* you must think critically and solve logic-based problems – and there is no cramming for that! Instead, by consistently participating in the expected class activities both inside and outside of the classroom, you will be given many opportunities to practice problem-solving, as well as be provided with guidance and feedback on your progress towards this way of thinking. All assessment in the class is entirely 'open book' where you can reference your personal notebooks; this encourages you to process, think, and apply knowledge rather than attempt to memorize facts.

1. Exams: Two mid-semester exams and one final exam will be given. The final examination is cumulative. *All students are expected to take all exams when they are scheduled unless they have a Dean's Office excuse.* Unexcused absences for an exam will be given a grade of zero. If you feel an error has been made in determining an exam score, you may submit the exam for a re-grade within 3 school days after the exam has been returned to the class. You must submit in writing your reasons for requesting a re-grade. Legitimate reasons for a re-grade request include, for example, incorrect summation of scores, but do not include student judgments about the amount of partial credit deserved for incorrect answers. Written responses to student requests will be returned in class, in office hours, or by secure electronic distribution.

2. Attendance: With the exception of illness, all registered students are expected to: a) Be on time to class periods, b) Attend classes (more than two unexcused classes will accrue grade penalties), c) Meet deadlines for homework and other assignments. Of course if you are too sick to attend class, please

focus on getting healthy, but contact me as soon as possible (ideally before class, or after if necessary). It will be your responsibility to make up missed material. To account for life and its unexpectedness, the average of one-to-two days worth of homework and attendance points will be excused for all students during the calculation of final grades.

3. Participation: Both individual and small-group participation will be an integral part of this class. Scientific communication is a specific skill set, one that we are developing in this class – therefore your active participation is essential for you to learn (practice) this skill! I expect that every student should participate verbally in every class. This could include either asking a question, commenting on other student’s comments, responding when asked questions directly, and participating in small group work. Students are expected to: be courteous and respectful to the other participants and their ideas; contribute in a substantial way to class discussions and small group work; be actively involved in grant panel evaluations; and honor the Honor Code. In addition, you will be periodically asked to complete self- and peer-reflections of the class, which also contribute to your participation grade.

4. Homework and Quizzes: Homework will be assigned in advance as much as possible; however, the flexible and dynamic nature of this class may make it impossible to do so too far in advance. At the end of every class day, however, a clear and defined set of expectations for what you need to do or complete before the next class will be made, and posted onto Sakai by 5 pm that evening. Some of this homework will be graded, other parts will be spot-checked, and some will simply be included in your notebook for your future reference. (All homework is expected to be included in your notebook, and will be evaluated as part of your notebook grade.) Quizzes may or may not be announced. *No make-up credit will be given for in-class assignments or quizzes that are missed due to unexcused absences.*

5. Poster Generations and Presentation: With guidance by me you will each identify an article discussing a scientific paper about a topic of your choice. You will then and prepare a poster to present to the class as part of a multi-day, class-wide 'poster session.' This may sound overwhelming, but you will be using skills we will be consistently learning and practicing through the course – only now you can apply them to a topic of your choice!

9. Grading: **45% Exams (15% each midterm, 15% final)**
 20% Participation and attendance
 15% Notebooks, homework, quizzes
 10% Sakai responses
 10% Poster and writing assignment

The two midterms and cumulative final will all be equally weighted (15 % each). All exams will be open notebook. The questions will mirror the activities and analyses we will be actively learning in class, and will emphasize critical analysis of data and interpretation. Participation will be evaluated as defined above and discussed together in class. The notebook, homework, and quizzes grade will include: completeness of your self-assembled notebook after each midterm; scores from pre-scheduled and unannounced quizzes; completion of pre-assigned homework; spot-check evaluations of material expected to be prepared in advance of class. Sakai responses include minute assessments and other electronic assignments. Final grades will be assigned based on the total number of points for the entire semester based on a standard 10-point-per-letter-grade scale.

A = 93 – 100%; **A-** = 90 – 92.99%; **B+** = 87 – 89.99%; **B** = 83 – 86.99%; **B-** = 80 – 82.99%;
C+ = 77 – 79.99%; **C** = 73 – 76.99%; **C-** = 70 – 72.99%; **D+** = 65 – 69.99%; **D** = 60 – 64.99%; **F** = < 60

10. Special Circumstances: Please talk with me directly if you are a student-athlete who will need to travel frequently and miss class.

11. Accessibility Resources and Services: If you have a disability and need accommodations, please let me know, and ensure you register early with Accessibility Resources and Service (ARS) to be eligible for appropriate accommodations (<http://accessibility.unc.edu/students>). UNC-Chapel Hill facilitates the implementation of reasonable accommodations for students with learning disabilities, physical disabilities, mental health struggles, chronic medical conditions, temporary disability, or pregnancy complications, all of which can impair student success.

12. Counseling and Psychological Services: CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to: <https://caps.unc.edu> or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.

***Please Note:** The professor reserves the right to make changes to the syllabus, including project due dates and test dates (excluding the officially scheduled final examination), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules*

***Departmental Diversity Statement:** The Department of Biology values the perspectives of individuals from all backgrounds reflecting the diversity of our students. We broadly define diversity to include race, gender identity, national origin, ethnicity, religion, social class, age, sexual orientation, political background, and physical and learning ability. We strive to make this classroom and this department an inclusive space for all students.*

***HONOR CODE:** All work done in this class must be carried out within the letter and spirit of the UNC Honor Code. You must sign a pledge on all graded work certifying that no unauthorized assistance has been given or received. You are expected to maintain the confidentiality of examinations by divulging no information about any examination to a student who has not yet taken that exam. You are also responsible for consulting with your professors if you are unclear about the meaning of plagiarism or about whether any particular act on your part constitutes plagiarism. Please talk with the professor if you have any questions about how the Honor Code pertains to this course.*