BIOL 1220: The Biology of Sex and Death

T R 12:05-1:25 pm lecture

M W 12:05-2:55 or 3:05-5:55 pm lab

**Course Purpose and Objectives:** This course is designed to teach biology through the lens of the formation and collapse of biological systems, organized around questions pertaining to life, sex, and death. Sex and death are two constants of living organisms and are a consequence of how organisms interact with each other and the environment. We’ll explore questions such as why sex exists, how sexual reproduction differs between organisms, and what are the costs and benefits of sex. We will also consider modes of cancer and infectious disease, how forensic DNA fingerprinting can solve crimes, and how climate change and land use decisions by humans cause extinction, the death of entire species.

Students will be able to demonstrate the ability to obtain, analyze, interpret, and criticize qualitative observations and quantitative measurements to explain natural phenomena and to test hypotheses. Lecture time will be spent on of a variety of team-based activities designed to allow students to discuss, clarify, and apply new ideas by answering questions, drawing diagrams, analyzing science news articles and figures from the primary literature, and explaining phenomena in the context of biological principles. Specifically, by the end of this course, students will be able to:

1. Obtain and interpret information from the course readings, case studies, online sources, or lab resources to determine how the biology of sex and death impacts how organisms, particularly humans, interact with each other and with the dynamics of natural biological systems.
2. Demonstrate critical scientific skills that include hypothesis testing, experimental design, quantitative data analysis and interpretation, and scientific communication. In lab, students collaborate to design and conduct experiments and interpret the collected data, applying statistical tests to gain insight into how interpretations of data generated by scientists include scientific uncertainty.
3. Explain and critique their analysis and interpretation of information by writing lab reports in the format of articles for Charged Magazine, answering questions in class, and discussing their ideas with peers and instructors in class.
4. Reflect upon how scientific thinking about biological topics can inform ethical decisions about human health, social interactions, and how humans interact with the environment.

**Pre-requisites and the General Education Core:** This course is a 4-credit hour lecture and lab course. It has no pre-requisites and fulfills a lab science elective for non-Biology majors. Students who decide to change majors into Biology after taking this course may consult with the course instructor and their academic advisor to take an advanced standing exam to substitute this course for BIOL 1510. This course is not a recommended substitute for BIOL 1510 or BIOL 1511 for Pre-Health students seeking to prepare for medical training and the MCAT. This course is not intended for declared Biology majors.

**Faculty Instructors: TBA**

**Course Materials:**

* Readings and Videos on the course website bio1220.biology.gatech.edu
* Learning Catalytics subscription (purchase at www.learningcatalytics.com)
* Dr. Tatiana’s Sex Advice to All Creation by Olivia Judson. Holt Paperbacks, 2003.
* Laboratory manual (Course reader available only at Georgia Tech Bookstore)
* Lab Coat (long sleeve, 100% cotton, available at Georgia Tech Bookstore or from the CULC 5th floor Chemistry Stockroom)

**Course Mechanics & Expectations:** Lecture time will be spent on of a variety of team-based activities designed to let you discuss, clarify, and apply new ideas by answering questions, drawing diagrams, analyzing primary literature, and explaining phenomena in the context of biological principles. We will spend class time on building your comprehension of the material you find the most difficult, based on pre-class assessments. You will play a prominent role in determining the focus of each day’s effort.

What is our role as instructors? Our goal is to increase your engagement and comprehension of course material during the class period. We will encourage you to be fearless in attempting class activities, and we will help you optimize your in class time as an opportunity for you to reveal your misconceptions and be corrected in real-time. Mini-lecture tutorials will be offered when needed. We will strive to balance your desire to hear from us as “experts” with our goal for you to become an expert yourself.

What is your role? Before class, read/watch/listen to the assigned preparatory material, attempt each pre-class assessment, create a notes template for class, and formulate any questions you want to ask. During class, you can expect to build your understanding through team activities and contribute to class discussions. Following class, there will be short homework assignments to give you an additional opportunity to ensure you’ve mastered the material. This course format will ask you to develop skills in identifying what information you need, and learning how to break down a complex problem into discreet and solvable parts. We expect you to demonstrate persistent learning by attending every class period, reading ahead, bringing appropriate notes that support quality participation during class, and taking personal responsibility for the success of both yourself and your team.

**Academic Honor Code and Plagiarism:** All students are expected to abide by the Academic Honor Code, which can be viewed online at [www.honor.gatech.edu](http://www.honor.gatech.edu). We take the Honor Code very seriously and are required to report any potential violations. Some specific examples of Honor Code violations include copying during exams, falsifying attendance in class, and plagiarism. Everything that you write or create in this course, including lab reports, test answers, homework, and in-class work, must be generated by you, not copied from another source. Copying the words or even the ideas of someone else is plagiarism. Any suspected plagiarism will be submitted to the Office of Student Integrity for evaluation.

**Learning Accommodations:** We will make classroom and laboratory accommodations for students with disabilities. These accommodations must be arranged in advance and in accordance with the [Office of Disability Services](http://disabilityservices.gatech.edu).

**Evaluation:** Your final grade will depend on the following combination of grades:

Exams (approx 10% each, see below): 50%

Pre-class Assignments: 5%

In-class Activity Assignments: 10%

Homework Assignments: 10%

Laboratory: 25%

We will use the following procedure in calculating your final grade:

1. We will weigh your 5 exams 6%, 10%, 10%, 10%, and 14%, where your lowest exam score will count 6% and your highest exam score will count 14% of your final grade.

2. We will combine your exam, lab, and group activity and other scores into a raw composite score (0 – 100%) using the weightings shown above.

3. We will assign final letter grades using the following scale:

A: ≥ 90.0% B: ≥ 80.0% and < 90.0% C: ≥ 70.0% and < 80.0% D: ≥ 60.0% and < 70.0% F: < 60.0%

**Exams**: Periodic exams will be a mix of multiple choice and short answer questions. Four exams will be held during the regular semester and the fifth exam will be held during finals week, although this last exam will not be a cumulative exam. Exam questions will be focused on recent material but as content knowledge deepens, some degree of cumulative recall is expected. If you miss an exam for any reason, you will receive a grade of 0 (zero) on that exam unless you petition the instructors for a makeup exam within 24 h of the start of the missed exam, and we approve your petition. Your petition must be submitted in writing and must include documentation of a legitimate reason for missing the exam. You may submit your petition before the exam if you know of your scheduling conflict in advance. Examples of legitimate reasons to miss an exam include your illness, an illness or death in your immediate family, and participation in official university activities. If we approve a makeup exam, we will administer the makeup exam before the end of the term, and typically within one week of the scheduled exam. If we approve your petition but circumstances prevent a makeup exam, we will remove the missed exam from your grade calculation by using the mean of your other exam scores as your grade for the missed exam, weighted by the class average on the missed exam.

**Assignments:** To complete your pre-class and in-class activities and your weekly homework assignments, students are required to have a [Learning Catalytics](https://learningcatalytics.com/users/sign_up) account. Learning Catalytics can be purchased directly at <https://learningcatalytics.com/users/sign_up> or from the Georgia Tech Bookstore. To participate in class, you will need to bring an internet-ready laptop, tablet, or smartphone to class to earn participation points. Phone and computer use is restricted to class-related material, and off-task use may result in loss of participation points for that day.

**Pre-class assignments:** Before each class, we’ll expect you to complete the pre-class readings on the website. Once you’ve reviewed the material, log in to learning catalytics to complete a short Incoming Knowledge Evaluation (IKE). IKE sessions close at the start of class and will not be reopened for credit, but you can review closed sessions for study purposes. IKE questions are not often at the same level as you can expect to see on an exam; instead, they ensure that you come to class with effective baseline knowledge to work up to exam level questions in class.

**In-class Activity assignments:** Attendance in lecture correlates with performance and course grades. We will make our lecture materials available and urge you to download and print them for use in active note-taking during class. Questions presented in class are usually at the same level of difficulty as exam questions, so attending class gives you practice for taking the exams. In-Class Activity sessions in Learning Catalytics close at the end of class, with a few exceptions, and will not be reopened for credit, but you can review closed sessions for study purposes.

**Homework:** Homework assignments will be made available each week in Learning Catalytics and are always due on Sundays at midnight. Homeworks close on Sunday at midnight, with few exceptions, and will not be reopened for credit, but you can review closed sessions for study purposes.

**Bloopers and Gaffes:** This course explores many aspects of sex and death, and we will try to present and discuss the material in a fair and balanced way, but everyone makes mistakes – especially when we are talking about a loaded subject such as sex for an entire semester. Faculty, peer-leaders, and students will each need to do their best to choose words carefully and avoid offending others, and we apologize in advance for anything we say that you might find offensive or uncomfortable. We ask that everyone treat these subjects with respect but also with an open mind. Please let a faculty member know if you are upset by any of the content in the course and help us to refine the material with each passing year to make the course better than the year before.

**Intellectual Property:** With the exception of third-party material, course materials provided in BIOL 1220 are licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. They are not to be re-distributed or re-purposed without express permission of the instructor.

**Lecture Topics & Schedule**

|  |  |
| --- | --- |
| **Date** | **Topic** |
|  | **Module 1: LIFE** |
| 23-Aug | What is life? |
| 25-Aug | What are life cycles versus life histories, and why do they matter? |
| 30-Aug | How are living organisms related to each other? |
| 1-Sep | Where does the energy for living organisms come from? |
| 6-Sep | Project Intro and **Exam 1** |
|  | **Module 2: SEX** |
| 8-Sep | What is sex? |
| 13-Sep | How is gender determined? |
| 15-Sep | Why have sex(ual reproduction)? |
| 20-Sep | How do non-animals have sex? |
| 22-Sep | How do animals have sex? |
| 27-Sep | **Exam 2** |
| 29-Sep | Why do males and females look different? |
| 4-Oct | How do sexually reproducing organisms persist and evolve? |
| 6-Oct | Why does homosexuality persist if it doesn’t produce offspring? |
| 11-Oct | How can biotechnology help create offspring? |
| 13-Oct | What are the consequences of sex? |
| 18-Oct | How does sex lead to disease? |
| 20-Oct | **Exam 3** |
|  | **Module 3: DEATH** |
| 25-Oct | Do all living things die? |
| 27-Oct | How do infectious diseases spread? |
| 1-Nov | How do we protect ourselves from disease? |
| 3-Nov | Why and how does our immune system try to kill us? |
| 8-Nov | How and why do our own genes increase our chance of disease or death? |
| 10-Nov | **Exam 4** |
| 15-Nov | Why and how does cancer affect humans and other animals? |
| 17-Nov | Why does aging exist? |
| 22-Nov | What are the causes of death before old age? |
| 24-Nov | **Thanksgiving Holiday** |
| 29-Nov | Student's choice question |
| 1-Dec | Student's choice question |
| 6-Dec | Synthesis |
| 8-Dec | Exam 5 (during final exam time): DAY TIME |

BIOL 1220: The Biology of Sex and Death – Laboratory Syllabus

Tu Th 12:05-1:25 pm lecture

M W 12:05-2:55 or 3:05-5:55 pm lab in CULC 4XX

**TA Instructors:** *Your TAs’ names, office hours, and contact information are posted on the lab T-square site*

**Faculty Instructor: TBA**

**Lab format:** The laboratory provides an opportunity for you to practice biology like a scientist to complement lecture content and activities. In lab, students collaborate to design and conduct experiments and interpret the collected data. Students also practice communicating their science in a written format.

**Online lab notebook:** For lab, you’ll keep an online lab notebook that should be updated within 24 hours after your lab ends each week. In lab, please keep careful notes in a notebook of your choice for accurate transfer of information to the online notebook. Details on how to set up your notebook, elements that should be included, and grading will be discussed in lab.

**Safety:** For every wet lab, you must wear your lab coat, long pants, close-toed shoes, and tie back long hair. Safety policies are mandated by Georgia Tech institutional rules to keep everyone safe. At the beginning of each lab, your TA will alert you to all of the potential hazards. You will lose all of your participation points for that lab if you violate safety policies. The following safety policies are non-negotiable:

* You must wear shoes that cover your feet entirely (i.e., no flip flops, ballet slippers, or sandals). You will not be allowed to enter the lab without appropriate footwear.
* No food or drinks, including water bottles.
* No cell phone use, including texting (phones must be silenced and off the lab bench).
* Clean up your lab station at the end of lab and report any mess left behind from previous lab sections to your TA.
* Properly dispose of trash, glassware, and biohazard waste. Other people’s safety may be compromised by your negligence.
* During “wet labs” you must wear long pants to the ankle, your lab coat and safety glasses, and long hair should be tied back. Your TAs will indicate when gloves are necessary. Safety glasses and disposable nitrile gloves are provided in lab.
* Follow additional safety procedures for specific lab activities as indicated by your TA.
* **Report** **all injuries or accidents to your TA** **immediately**.

**Absences:** You must attend your assigned lab section unless you have been given permission to attend another lab section to make up an excused absence. Contact your TAs as soon as you know that you will miss lab, preferably beforehand. We advise contacting your group members as well, to get data they may collect.

* *Excused absences:* Documented excused absences may include your illness, an illness or death in your immediate family, and participation in official university activities. Any missed lab assignments will be due within one week of the original due date. There is no penalty for an excused absence. **It is your responsibility to contact your group members to obtain necessary data from the missed lab exercise.**
* *Unexcused absences:* There are no make-up labs for unexcused absences. An unexcused lab results in a 5% reduction of your overall course grade and participation points for that lab.

**Plagiarism will not be tolerated**: In the context of lab, most of the work you do will be with your group. Although your experiments are designed as a group, we expect you to articulate your experimental design and findings in your own words in your lab notebook, not copy from a group member’s notes. You are not permitted to work together to complete pre-lab assignments, nor to write your lab reports. *Note that your group may carry out data analysis in lab together but your figures and figure legends must be completed individually.* Anything written in your lab report that is not an original idea of yours must be referenced. Direct copying from other students’ work or from the lab manual or other sources will result in a grade of "0" for that assignment, and possibility other penalties and sanctions. Your conduct is expected to conform to the Georgia Tech Honor Code (<http://www.honor.gatech.edu>). Please familiarize yourself with its expectations and responsibilities.

**Additional resources to help you be successful in Biology 1220 Lab:** If you have no experience with statistics and/or creating graphs, we encourage you to use Appendices A and B in the lab manual as a resource. You may find the following statistics tutorial on t-tests and chi-square tests at MathBench to be helpful: <http://www.mathbench.umd.edu/>If you’re interested in additional resources on writing, check out the following web resources:<http://owl.english.purdue.edu/> and <http://labwrite.ncsu.edu/>

**Grades:** Your lab grade is comprised of the components described below:

Lab Reports **40%**

Pre-lab assignments **20%**

Lab Participation **20%**

Lab Notebook (online) **20%**

Please note that the grades on the T-square Lab site are for your record-keeping only; T-square does not calculate your lab course grade accurately.

**Lab reports:**

Lab reports are written in the style of article submissions on Charged Magazine, <http://chargedmagazine.org/>, Georgia Tech’s on-line science magazine. For each lab activity, students will write part of the article while outlining the remainder. An effective outline helps envision the full article, a key step to create original writing. The schedule below indicates which part should be fully written out for each lab report. The final assignment is to select one article draft and write the full article. We will discuss the specific guidelines for Charged articles in lab (and see Charged Magazine Article Rubric).

**Pre-lab assignments:**

Pre-labs are designed to help you to prepare for lab. Pre-lab assignments will be posted on T-square by the Friday before your next lab, and can be found under Pre-labs or Resources (as noted in Schedule below). Pre-labs will be completed online as well as in your lab notebook, as indicated. Pre-labs must be completed before lab. It’s your responsibility to read the lab in advance (as indicated on the Schedule). There is no credit for late pre-lab work, except in the case of an excused absence.

**Lab participation:**

You will be assessed by your TA for each laboratory exercise (3 points per lab) and by your group members at the midpoint and end of the semester (20 points each; 40 points total). Group work is an essential part of lab. If you are >10 minutes late to lab, you will lose 1 participation point for that lab. A safety violation will result in the loss of all participation points for that lab.

**Lab notebook:**

For lab, you will keep an on-line lab notebook. Your notebook will be extremely helpful when writing lab reports. Your lab notebook should be updated within 24 hours of the end of your lab session. Notebooks will be commented on several times during the semester and checked at random twice during the semester (20 points each, 5% each). Late notebooks are not accepted. At the end of the semester, the final lab notebook check is worth 10%. We will discuss the specific guidelines for notebooks in lab (and see Lab Notebook Rubric).

**Concerns about grades:**

There is no extra credit that is offered for Biology 1220 lab. We think the distribution of points possible to earn is fair, and in particular, we feel strongly about giving you credit for your weekly participation in lab, since doing lab can be a lot of work. Your lab grade is 25% of the Biology 1220 final course grade. It is your responsibility to keep up to date with grades posted on T-square to confirm that your work is correctly reflected in the assigned grade. If a grade on T-square appears to be inaccurate, e.g., a zero entered for an assignment you turned in, etc., contact your TAs within 3 weeks of the assignment due date, to request a grade re-evaluation.

### Tentative Lab Schedule

|  |  |  |
| --- | --- | --- |
| **Week** | **Lab** | **Lab Assignment due** |
| 1-Aug-22 | *No labs – First Week of Classes* | Pre-lab on t2: Lab Intro part1 |
| 2-Aug-29 | Design an Experiment | Assignment on t2: Lab Intro part2 |
| 3-Sep-05 | *No labs – Labor Day Week* | *Nothing due* |
| 4-Sep-12 | Bean beetle biomonitoring Part1 | Pre-lab on t2 |
| 5-Sep-19 | Bean beetle biomonitoring Part2 | Assignment on t2: Draft of Methods |
| 6-Sep-26 | Human pheromones lab part1 | Pre-lab on t2 |
| 7-Oct-03 | Human pheromones lab part2 | Assignment on t2: Peer-evaluation 1 |
| 8-Oct-10 | Paternity case part1 | Pre-lab on t2 |
| 9-Oct-17 | Paternity case part2 | Assignment on t2: Draft of Results |
| 10-Oct-24 | How antibiotics kill microbes part1 | Pre-lab on t2 |
| 11-Oct-31 | How antibiotics kill microbes part2 | Assignment on t2: Draft of Figures with captions |
| 12-Nov-07 | Debate Lab | Assignment on t2: Peer-evaluation 2 |
| 13-Nov-14 | Forensics case part1 | Assignment on t2: Draft of Charged Magazine article on lab of your choice |
| 14-Nov-21 | *No labs – Thanksgiving Week* | *Nothing due* |
| 15-Nov-28 | Forensics case part2 | Article for Charged Magazine due |
| 16-Dec-05 | *No labs – Dead Week* | *Nothing due* |

**Lab Notebook Rubric**

|  |  |  |  |
| --- | --- | --- | --- |
| **Criteria** | **Specific objectives** | **Level of achievement** | |
| ***Scientific approach*** | Acceptable (1) | Needs work (0) |
| (1) *Purpose & Hypotheses:* What question is your experiment designed to address? What do you expect to find and what evidence is needed to support this claim? How is your alternative hypothesis(es) grounded in scientific concepts? | 1. The question or objective is stated. 2. Null and alternate hypotheses are stated. 3. Reasoning for hypothesis(es), based on scientific concepts and logic, is explained. 4. Evidence needed to support/reject hypothesis(es) is described. |  |  |
| (2) *Methods:* How will you address your question? What data will you collect and how? How will you analyze and interpret this data? | 1. Pertinent details are described (e.g., controls). 2. Specific data collection is described in enough detail so the experiment could be replicated. 3. Analysis (including appropriate statistical test, if applicable) and interpretation procedures are described in enough detail so the experiment could be replicated. |  |  |
| (3) *Findings:* What did you find? | 1. Table of data collected is included. 2. Table is labeled with units and a descriptive title. 3. Results are described. Notes and observations are recorded as appropriate, e.g., problems that occurred; sources of uncertainty in the lab procedure or findings; comparison to others’ findings and explanation for differences. |  |  |

(Scientific approach points *x* 2) = 20 points possible to earn

If your notebook is illegible and/or unorganized, you will lose 1 point.

**Grade**= (Scientific approach points *x* 2) + organized notebook updated to address TA feedback = 20 points possible

**Charged Magazine Article Rubric (note: continues on 2nd page)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Specific objectives** | **Level of achievement** | | |
| ***Scientific approach*** | Excellent (2) | Needs work (1) | Absent (0) |
| *(1) Title of lab article* | 1. Title clearly conveys a summary of findings with a clever twist. |  |  |  |
| (2) *Introduction:* The introduction provides the reader with a reason to keep reading, contains a hook or a surprise that captures their attention. | 1. Gives the background information that a reader needs to understand your work. 2. Has a hook or storyline to capture the reader’s interest. 3. States a clear hypothesis and describes evidence needed to support/reject hypothesis. |  |  |  |
| (3) *Methods:* What did you do and how does it address your question? How did you analyze and interpret this data? | 1. States the experimental design and the purpose of the experiment. 2. Describes specific data collected, with the appropriate amount of detail so the experiment is readily understandable to a lay reader, without including too much detail. 3. Describes analysis and interpretation procedures, e.g., statistical test, that are appropriate for the data & question. |  |  |  |
| (4) *Results and Discussion:* What did you find? What do your findings mean? Interpret your results with regard to your hypothesis. | 1. Describes overall findings. 2. Uses specific data as evidence to support or refute the hypothesis. 3. Uses scientific concepts accurately and convincingly to explain whether the data support the hypothesis. |  |  |  |
| (5) *Conclusion and the bigger picture:* | 1. Other issues are addressed as appropriate, e.g., problems that occurred; sources of uncertainty in the lab procedure or findings; comparison of findings to others’ findings and explanation for differences; improvements or extensions of the experiment. 2. Why this matters & significant implications of this experiment are described. 3. Ties back in to opening hook or attention grabber |  |  |  |
| (6) *Figures & tables:* Images, Graphs, drawings, diagrams, tables. | 1. Presents data or evidence in an appropriate visual. 2. Provides visual interest to link to the hook or story that you are telling to your reader. |  |  |  |
| ***Presentation*** |  |  |  |  |
| (7) *Writing:* Grammar; spelling; clarity and conciseness of sentences; flow of ideas; minimal use of technical terminology. | 1. There are no grammatical or spelling errors. 2. Sentences are clear and to the point, in the style of Charged Magazine. 3. Flow of ideas is cohesive and logical. |  |  |  |
| *(8) Format of report*: Organization; page formatting; font style; Honor Agreement | 1. Report is one long article without sections headers. 2. Page format: Times New Roman 12 pt font (even for headings); 1 inch margins; double-spaced; pages are numbered and stapled as needed. 3. Report submitted electronically on t2 and as hard copy in lab. 4. Georgia Tech Honor Agreement is included at end of report with signature. | 0 or 1 point for present or absent | |

**Grade**= (Scientific approach points *x* 5) + (Presentation points *x* 2.5) = 100 points for complete lab report