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Lectures: MWF 9:05 – 9:55 am, 102 Clough Commons

Recitations: Thursday 6:05 – 6:55 pm, 102 Clough Commons (except on exam days)

Exams: Selected Thursdays, 6:05 – 6:55 pm, 102 Clough Commons

Prerequisites: A good background in high school biology and chemistry.

Description: This is an **active-learning** class that introduces students to basic principles of modern biology, including biomacromolecules, bioenergetics, cell structure, genetics, homeostasis, evolution, and ecological relationships. This course will foster the development of critical scientific skills including hypothesis testing, experimental design, data analysis and interpretation, and scientific communication.

Textbook: Freeman et al. (2014). *Biological Science*, 5th Edition. Benjamin Cummings, San Francisco. We have arranged special pricing through the bookstore for hardcover, looseleaf-bound and e-book versions of the textbook bundled with access to the Mastering Biology (MB) website (required as part of course homework assignments).

MB Course ID: GTBIOL1511F14

Lectures: Attendance in lecture correlates strongly with performance in Biology 1511. We will make our lecture slides available via T-Square and urge you to download and print them for use in taking notes during lecture. The lectures and readings are complementary and some materials will be presented only in lecture. Please complete each reading assignment before class.

LC: We will use Learning Catalytics (<http://lcatalytics.com>) for interactive lecture sessions, which will contribute to the "participation" portion of your course grade. You can use any internet-enabled mobile device (laptop, tablet, cell phone) to access LC and respond to questions.

Exams: Four midterm exams and the final exam. The midterm exams will be held in the evening, are closed-book and will be made up of multiple-choice questions based on topics, materials, and discussions presented in class, in the assigned readings, and in the Mastering Biology assignments. Exams and quizzes may also be given in the laboratory and on-line on Mastering Biology and/or T-square.

- Missed Exams: If you miss an exam for any reason, you will receive a grade of 0 (zero) on that exam unless you **petition us to have the exam grade excused within 24 h of the start of the missed exam**, and we approve your petition. Your petition must be submitted in writing (by e-mail) and must include documentation of a legitimate reason for missing the exam. You can, of course, submit your petition before the exam if you know of your scheduling conflict in advance. We will consider each petition individually. Examples of legitimate reasons to miss an exam include illness, illness or death in your immediate family, and participation in official university activities. If we approve your petition, we will remove the missed exam from your grade calculation by using the weighted mean of your other exam scores as your grade for the missed exam.
- Quizzes: Short quizzes may be administered in lecture, lab, and online.
- Homework: Mastering Biology offers animations, videos, interactive tutorials and simulations, as well as practice quizzes and an on-line version of the textbook (see Mastering's "Study Area" for access to these resources). Individual access codes for Mastering Biology are included with each new textbook, or may be purchased separately from the publisher at masteringbio.com. Throughout the semester you will have assignments in Mastering Biology. The Mastering Biology assignment scores are recorded and will comprise 5% of the overall course grade. We encourage you to complete your assignments on time; however, if you miss a due date you should still complete the assignment and accept a late penalty. Late assignments will be accepted until 5 pm on the last day of classes. Hints are available with no point penalty in MB. Homework assignment deadlines are listed on the syllabus and on Mastering Biology's website. Please note that an assignment may be due during the last week of classes and plan accordingly.
- Group Projects: For each module, 3–4 groups of 4 students will each research an issue of current interest related to the topic of the module. Each student will be assigned to a group and a topic, and each group will complete two group projects: one in-class presentation and one video presentation. **Group assignments, details and deadlines will be provided once the drop/add period ends.** Grades will be based on instructors' grades and peer evaluations. The same group project grade will be assigned to all members of a group; each group member is fully responsible for all submitted project work.
- Recitations: Lecture recitations occur weekly and are led by the recitation Teaching Assistant. Attendance is optional but strongly encouraged, as it is designed to improve your understanding of the lecture material. Bring your mobile devices to recitation to receive participation credit for your recitation attendance.
- Labs: **Labs will begin the week of August 18.** Laboratory attendance is mandatory and each unexcused absence will lower your final grade by 5%. We cannot accommodate makeup labs and will consider requests for excused absences from lab on a case-by-case basis. Legitimate reasons to miss a lab include illness, illness or death in the immediate family, and participation in official university activities. All such requests must be submitted in writing with appropriate documentation (e.g., a letter from a physician or the athletic department) no later than the day after the missed lab. See the lab syllabus for additional details.
- Biology Minute: This is an opportunity to earn extra credit. Once during the semester, you may present an oral "minute paper," with one PowerPoint slide, to the class. Exceptional presentations will earn two points, average presentations will receive 1 point, and inadequate presentations will receive no credit. Any Biology Minute points earned will be added to your FINAL grade. Your one-minute presentation should summarize any biologically-relevant current issue or topic from *reputable* news sources (newspapers such as the AJC and the New York Times, journals such as Science and Nature, or popular magazines such as Scientific American). We will post a signup calendar on T-

square where you can reserve a time slot. Your slide must be submitted by email by 9pm the evening before your presentation (email your presentation to the faculty member lecturing that day). If you are late, fail to submit your slide on time, or are otherwise unprepared for your chosen time slot, you will forfeit this opportunity for extra credit.

Honor Code: All students are expected to abide by the Academic Honor Code, which can be viewed online at www.honor.gatech.edu.

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

- In-class exams: 40%
- Final exam: 20%
- Group activities: 10%
- Mastering Biology: 5%
- Participation: 5%
- Laboratory: 25%

Note that these components total 105%, though the maximum score possible is 100%.

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

1. We will combine your exam, lab, and group activity and other scores into a raw composite score (0 – 100%) using the weights shown above.
2. We will use the mean score earned by the top 5% of the class as a gauge of real student performance in the class.
3. We will normalize your score to actual student performance by dividing your raw composite score by the mean score earned by the top 5% of the class. If you're in the top 2.5% of the class, your score will be 100%.
4. We will assign final letter grades using the following scale:

- A: $\geq 90.0\%$
- B: $\geq 80.0\%$ and $< 90.0\%$
- C: $\geq 70.0\%$ and $< 80.0\%$
- D: $\geq 60.0\%$ and $< 70.0\%$
- F: $< 60.0\%$

Organization: The course is organized into five modules, each of which deals with a major area of modern biology.

| Module | Major theme | Teaching Goals |
|--------|--|---|
| Intro | • Course intro | • Scientific method |
| 1 | • Evolution | • Earth history • History of life on Earth • Mechanism of evolution |
| 2 | • Ecology | • Behavior and evolution • Simple population models • Community structure • Mass and energy flow through ecosystems |
| 3 | • Molecules, Membranes, and Metabolism | • Overview of biomolecules • Introduction to bioenergetics: respiration and photosynthesis. • Chemiosmosis in respiration and photosynthesis • Diversity of metabolic pathways |
| 4 | • Genetics | • Mendelian genetics • DNA and genomics • Gene regulation in prokaryotes and eukaryotes |
| 5 | • Biomedicine | • Recombinant DNA technology & bioethics • Genetic diseases as model biological systems • Immunology • Course synthesis |

| Fall 2014 | Class | Class Topics | Who | Reading Assignments ¹ | Mastering Biology ² |
|-----------|-------|---|-------|--|--------------------------------|
| 18 Aug | 1 | Course overview Introduction to instructors | All | Bio 1510 website | 0.01 Intro to MB (ungraded) |
| 20 Aug | | Start Module 1: Evolution | | | |
| 20 Aug | 2 | What is science? What is the scientific method? What are data? | JC | Platt (1964) 1.5: 9-14 Strong Inference | 1.01 Scientific method |
| 22 Aug | 3 | What is life? What is evolution? An evolutionary framework for biology | JC | 1: 1-9 What is evolution? | |
| 25 Aug | 4 | Earth history, fossil record & radiometric dating. Key events in the history of life | JC | 28.1-28.2: 505-516 Earth history Radioisotope dating | 1.02 Earth history & Phylogeny |
| 27 Aug | 5 | Origin of life RNA world | JM | 2.4: 32-36 4.3-4.4: 65-69 6.0: 84-85 6.3: 91-94 | 1.03 Origin of life |
| 29 Aug | 6 | History of life on Earth Life and changes in the physical environment. Patterns of biological diversity through time Biological classification | JM | 28.3-28.4: 516-523 29: 541-542 "The O ₂ Revolution" 30: 560-562 "Endosymbiosis ..." "Nuclear Envelope" | 1.04 History of life |
| 1 Sep | – | Holiday | | | 1.05 Evolution |
| 3 Sep | 7 | Evolution Evidence for evolution Natural selection | JM | 25: 444-464 | |
| 5 Sep | 8 | Mechanisms of evolution | JM | 26: 465-488 | 10.6 Mechanisms of evolution |
| 8 Sep | 9 | Genetic variation Hardy-Weinberg equilibrium Mutation, drift, selection | JM | | |
| 10 Sep | 10 | Speciation What is a species? Mechanisms of speciation | JM | 27: 489-504 | 1.07 Speciation |
| 11 Sep | ** | Group project 1 videos due | | | |
| 12 Sep | 11 | Module 1 presentations | JC/JM | | |
| 15 Sep | | Start Module 2: Ecology | | | |
| 15 Sep | 12 | Intro to Ecology Physical environment | JM | 52: 1059-1079 | 2.01 Ecology intro |
| 17 Sep | 13 | Behavioral ecology Foraging and predation | JM | 53: 1082-1098 | 2.02 Behavior |

1 Chapter: page numbers refer to Freeman, 5th edition. Other readings available on TSquare or at <http://bio1510.biology.gatech.edu>

2 Mastering Biology assignments are due at 1159pm the evening before lecture

| Fall 2014 | Class | Class Topics | Who | Reading Assignments ¹ | Mastering Biology ² |
|-----------|-------------|---|-------|---|--|
| | | Mate choice and sexual selection Kin selection and altruism | | | |
| 18 Sep | Exam | Module 1 exam (6pm) | | | |
| 19 Sep | 14 | Population ecology 1 Life history and population structure | JM | 54: 1110-1120 | |
| 22 Sep | 15 | Population ecology 2 Population dynamics and regulation | JM | 54: 1110-1120 | 2.03 Population ecology |
| 25 Sep | 16 | Community ecology 1 Resources, niches, and competition | JM | 55: 1123-1145 | |
| 27 Sep | 17 | Community ecology 2 Predation and keystone species | JM | 55: 1123-1145 | 2.04 Community ecology |
| 29 Sep | 18 | Ecosystems 1 Flows of energy and materials | JM | 56: 1149-1169 | |
| 1 Oct | 19 | Ecosystems 2 Human impacts | JM | 56: 1149-1169 | 2.05 Ecosystems |
| 2 Oct | ** | Group project 2 videos due | | | |
| 3 Oct | 20 | Module 2 presentations | JM/JC | | |
| 6 Oct | | Start Module 3: Molecules, Membranes, and Metabolism | | Bio 1511 website | |
| 6 Oct | 21 | Biomolecules Small molecules Major classes of macromolecule | JC | 3-1a: molecules 3-1b: proteins | 3.01 Biomolecules |
| 8 Oct | 22 | Membranes and transport Membrane proteins Membrane function and transport systems | JC | 6: 84-102 3-2a: membranes 3-2b: transport | 3.02 Cell biology |
| 9 Oct | Exam | Module 2 exam (6pm) | | | |
| 10 Oct | 23 | Cell structure Serial endosymbiosis and eukaryote evolution Endomembrane system Organelles | JC | 7.1-3: 106-119 3-3: cells | |
| 13 Oct | – | Holiday | | | |
| 15 Oct | 24 | Energetics and enzymes Thermodynamics & free energy Catalysis, kinetics, & enzymes Redox reactions Membrane potential | JC | 2.3: 30-32 8: 136-152 3-4: energy & enzymes | 3.03 Energetics |
| 17 Oct | 25 | Cellular respiration Oxidation of food and reduction of an e-acceptor Chemiosmosis Oxidative phosphorylation | JC | 9.5: 166-172 3-5: respiration and oxidative phosphoryl. | 3.04 Respiration and oxidative phosphorylation |
| 20 Oct | 26 | Metabolic pathways Glycolysis | JC | 9.1-9.4: 154-166 3-6: oxidative pathways | |

| Fall 2014 | Class | Class Topics | Who | Reading Assignments ¹ | Mastering Biology ² |
|-----------|-------------|--|-------|--|--|
| | | Pyruvate oxidation Citric acid cycle | | | |
| 22 Oct | 27 | Fermentation Protein and lipid metabolism | JC | 9.6: 166-169 3-7: fermentation | 3.05 Fermentation |
| 25 Oct | 28 | Photosynthesis Pigments and light absorption Origin of photosynthesis Cyclic photophosphorylation | JC | 10.1-10.3: 176-189 3-8: light energy | |
| 27 Oct | 29 | Carbon fixation | JC | 10.4: 190-193 3-9: carbon fixation | 3.06 Photosynthesis |
| 29 Oct | 30 | Photosynthetic strategies C3 vs C4 photosynthesis Recap: compare and contrast respiration and photosynthesis, mitochondria and chloroplasts | JC | 10.4: 193-196 3-10: C4_review | |
| 30 Oct | * | Group project 3 videos due | | | |
| 31 Oct | 31 | Module 3 presentations | JC/SK | | |
| 3 Nov | | Start Module 4: Genetics | | Bio1511 Website | |
| 3 Nov | 32 | Chromosomes and cell division | SK | 12.1-12.2: 220-228 13.1-13.2: 238-248 4.1 Mitosis and Meiosis | 4.01 Mitosis and Meiosis |
| 5 Nov | 33 | Mendelian genetics | SK | 14.1-14.3: 256-266 4.2 Mendelian Genetics | 4.02 Mendelian Genetics |
| 6 Nov | Exam | Module 3 exam (6pm) | | | |
| 7 Nov | 34 | Chromosome theory of inheritance | SK | 14.4-4.5: 266-271 14.6: 277-279 4.3: Chromosome theory of inheritance | 4.03: Chromosome theory of inheritance |
| 10 Nov | 35 | Non-Mendelian patterns of inheritance | SK | 14.5: 271-277 4.4 Non-Mendelian patterns of inheritance | 4.04 Non-Mendelian Inheritance |
| 12 Nov | 36 | DNA as the basis of inheritance | SK | 15.1-15.3: 285-294 13.1-13.2: 238-248 4.5 DNA | 4.05 DNA |
| 14 Nov | 37 | Gene expression: DNA to protein | SK | 16: 304-315 17: 317-332 4.6 Gene expression | 4.06 Gene Expression |
| 17 Nov | 38 | Prokaryotic and eukaryotic gene regulation | SK | 18.1: 337-338 18.3-18.5: 341-345 19.1-19.5: 349-361 4.7 Gene regulation | 4.07 Gene Regulation |
| 18 Nov | * | Group project 4 videos due | | | |

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|-----------|-------------|---|-----|--|--------------------------------|
| 19 Nov | 39 | Module 4 presentations | SK | | |
| 20 Nov | Exam | Module 4 exam (6pm) | | | |
| 21 Nov | | Start Module 5: Biomedicine | | Bio1511 Website | |
| 21 Nov | 40 | Genome organization | SK | 21: 390-400 4.8 Genomes | 4.08 Genomics |
| 24 Nov | 41 | Recombinant DNA | SK | 20.1-20.2: 368-376 5.1 Recombinant DNA | 5.01 Recombinant DNA |
| 26 Nov | 42 | Stem cells, cloning, and bioethics | SK | 20.5: 383-385 22.2: 408-410 5.2 Cloning and stem cells | 5.02 Stem Cells and Cloning |
| 28 Nov | – | Holiday | | | |
| 1 Dec | 43 | Immunology and infectious diseases | SK | 51.1-51.4: 1037-1055 5.3 Adaptive Immunity | 5.03 Immunology |
| 3 Dec | 44 | Human health and evolution | SK | 5.4 Human health and evolution | |
| 5 Dec | 45 | Course wrap-up and review | All | | |
| 10 Dec | Exam | Final Exam (0800 – 1050) Comprehensive exam | | | |