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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	<ul style="list-style-type: none"> • Earth history • History of life on Earth • Mechanism of evolution
2	• Ecology	<ul style="list-style-type: none"> • Behavior and evolution • Simple population models • Community structure • Mass and energy flow through ecosystems
3	• Molecules, Membranes, and Metabolism	<ul style="list-style-type: none"> • Overview of biomolecules • Introduction to bioenergetics: respiration and photosynthesis. • Chemiosmosis in respiration and photosynthesis • Diversity of metabolic pathways
4	• Genetics	<ul style="list-style-type: none"> • Mendelian genetics • DNA and genomics • Gene regulation in prokaryotes and eukaryotes
5	• Biomedicine	<ul style="list-style-type: none"> • 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			

Fall 2014	Class	Class Topics	Who	Reading Assignments ¹	Mastering Biology ²
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			