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Lectures: MWF 10:05 – 10:55 am, Weber SST III 1

Recitations: Thursday 6:05 – 6:55 pm, Weber SST III 1

Exams: Selected Thursdays, 6:05 – 6:55 pm, Weber SST III 1

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: We require at least one and recommend that you use/acquire two of the following:
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 Mastering Biology (MB; required as part of course homework assignments) and Learning Catalytics (LC, required for in-class exercises).
OpenStax Biology (open source e-book): <https://openstaxcollege.org/textbooks/biology>
Biology 1511 website: <http://bio1511.biology.gatech.edu>

Online tools: You must have access to Mastering Biology (<http://www.masteringbiology.com>) and Learning Catalytics (<http://learningcatalytics.com>) for homework and in-class assignments. MB and LC can be purchased individually online or as a bundle with the Freeman text. Our course MB ID is **GTBIOL1511F15**.

Attendance: 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 and Class Participation	We use LC for various in-class exercises, and LC points count toward the participation portion of your grade. Taking part in a classroom LC session remotely is effectively an attempt to gain participation credit without participating in class. We will periodically monitor attendance, and anyone who is taking part in an LC session remotely will receive a 15% penalty on their semester participation score. This penalty will be applied multiple times as needed.
In Class use of Electronics:	You can use any web-enabled device (laptop, tablet, or phone) to access Learning Catalytics in class, but you may not use these devices during lecture for any non-class related task. Texting, posting to Facebook, shopping, and watching videos are examples of distracting activities that are prohibited in class.
Missed classes:	If you are unable to attend lecture
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 17. Be sure to wear long pants and closed toe shoes that cover your entire foot, and bring a 100% cotton lab coat to every lab session. 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.
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 and short-answer 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, Learning Catalytics, 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 (MB) offers animations, videos, interactive tutorials and simulations, as well as practice quizzes and an on-line version of the textbook (see MB'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 MB; these scores are recorded and will comprise 5% of the overall course grade. We encourage you to complete your assignments on time, but 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 class MB site. Please note that an assignment may be due during the last week of classes and plan accordingly.

Group Projects: Groups of 4 students will research an issue of current interest related to the topic of the current module. Each student will be assigned to a group and a topic, and each group will create a video presentation and upload it to the course website for review by faculty and fellow students. In addition, each group should prepare a 10 minute class presentation of their project. Selected groups will be invited to present their work in class for extra credit. **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.

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). You should provide general context and present at least one figure or table containing data from the original research paper or article.

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 and may have points deducted from your final score at the discretion of the instructors.

Honor Code and Student Conduct: All students are expected to abide by the Academic Honor Code, which can be viewed online at www.honor.gatech.edu. Plagiarism and cheating are serious academic offenses and we are required to report any suspected occurrence. Please see the Student Code of Conduct for more info: <http://www.catalog.gatech.edu/rules/19b.php>.

Accommodations: If you have learning needs that require some accommodations for you to succeed in this course, please contact The Office of Disability Services as soon as possible (<http://disabilityservices.gatech.edu>). We will arrange to accommodate your learning needs based on their recommendations.

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

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 $< 70.0\%$

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	• Integrative Biology	<ul style="list-style-type: none"> • Recombinant DNA technology & bioethics • Genetic diseases as model biological systems • Immunology • Course synthesis

Fall 2015	Class	Class Topics	Who	Reading Assignments*	OpenStax Biology	1511 Website	Mastering Biology†
17 Aug	1	Course overview Introduction to instructors	Both				0.01 Intro to MB (ungraded)
19 Aug		Start Module 1: Evolution					
19 Aug	2	What is science? What is the scientific method? What are data?	SK	Platt (1964) 1.5: 9-14	1-1-2 Science of Biology	Strong Inference	
21 Aug	3	What is life? What is evolution? An evolutionary framework for biology	SK	1: 1-9	1-1-3 Themes and Concepts of Biology	What is life? What is evolution?	1.01 Scientific method
24 Aug	4	Evolution of evolutionary thought Evidence for evolution Evolution by natural selection Common misconceptions	SK	25: 444-464	4-1-2 Understanding Evolution	Evolution by Natural Selection	1.02 Evolution
26 Aug	5	Mechanisms of evolution	SK	26: 465-488	4-2-2 Population Evolution	Mechanisms of evolution	1.03 Mechanisms of evolution
28 Aug	6	Genetic variation Hardy-Weinberg equilibrium Mutation, drift, selection Biological classification	SK		4-2-3 Population Genetics	Mechanisms of evolution	
31 Aug	7	Species and speciation What is a species? Mechanisms of speciation Reinforcement & hybridization Allopatry & sympatry	SK	27: 489-504	4-1-3 Formation of New Species	Speciation	1.04 Speciation
2 Sep	8	Phylogenetic trees	SK	28.1: 506-511	4-3-2 Organizing Life on Earth 4-3-3 Determining Evolutionary Relationships	Phylogenetic trees	1.05 Phylogenies

* Chapter:page numbers refer to Freeman, 5th edition. Other readings available on TSquare or at <http://bio1511.biology.gatech.edu>

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

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4 Sept		Earth History Fossil record & dating Key events in the history of life	JM	28.1-2: 506-516 Radiometric Dating.pdf	Radioactive Decay Radiometric dating (Tsquare)	Earth History Radiometric dating (Tsquare)	1.06 Earth history
7 Sep	~	Holiday					
9 Sep	10	Origin of life RNA world Miller-Urey experiment	JM	2.4: 32-36 4.3-4: 65-69 6.3: 91-94 30.3: 559-563	N/A	Origin of Life	1.08 Origin of life
11 Sep	11	History of life on Earth Life in the remote past Patterns of diversity through time Life and the physical environment	JM	28.3-4: 516-523			1.07 History of life
14 Sep		Start Module 2: Ecology					
14 Sep	12	Intro to Ecology Physical environment	JM	52: 1059-1080	8-1-2 Scope of Ecology 8-1-3 Biogeography	Intro to Ecology	2.01 Ecology intro
16 Sep	13	Behavioral ecology Foraging and predation Mate choice and sexual selection Kin selection and altruism	JM	53: 1082-1098	8-2-8 Behavioral Biology	Behavioral Ecology	2.02 Behavior
17 Sep	Exam	Module 1 exam (6pm)					
18 Sep	14	Population ecology 1 Life history and population structure	JM	54: 1101-1120	8-2-3 Life Histories 8-2-4 Environmental Limits to Population Growth 8-2-5 Population Dynamics and Regulation 8-2-6 Human Population Growth	Population ecology	2.03 Population ecology
21 Sep	15	Population ecology 2 Population dynamics and regulation	JM				
23 Sep	16	Community ecology 1 Resources, niches, competition	JM	55: 1123-114	8-2-7 Community Ecology	Community ecology	2.04 Community ecology

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25 Sep	17	Community ecology 2 Predation and keystone species	JM				
28 Sep	18	Ecosystems 1 Flows of energy and materials	JM	56: 1149-1169	8-3 Ecosystems	Ecosystems	2.05 Ecosystems
30 Sep	19	Ecosystems 2 Human impacts	JM	56: 1149-1169			
2 Oct		Start Module 3: Molecules, Membranes, and Metabolism			1-2 The Chemical Foundation of Life (entire chapter)	Chemistry Review	
2 Oct	20	Biomolecules Small molecules Major classes of macromolecule	SK	Ch. 3 Ch. 5	1-3 Biological Macromolecules (entire chapter)	Biomolecules & Protein structure and function	3.01 Biomolecules
5 Oct	21	Cellular structure Lipid bilayer membranes Archaeal membranes Serial endosymbiosis and eukaryote evolution	JM	6.1-6.2: 85-91	2-1 Cell Structure (entire chapter)	Membranes & Membrane transport	3.02 Cell biology
6 Oct	**	Module 1-2 videos due					
7 Oct	22	Membrane function and transport systems Membrane composition and adaptation Membrane proteins Transport: passive diffusion, osmosis, facilitated diffusion, active transport	JM	6.3-6.4: 91-101	2-2 Structure and Function of Plasma Membranes (entire chapter)	Membranes & Membrane transport	
8 Oct	Exam	Module 2 exam (6pm)					
9 Oct	23	In-class presentations					
12 Oct	-	Holiday					
14 Oct	24	Energetics and enzymes Thermodynamics & free energy Catalysis, kinetics, & enzymes Redox reactions Membrane potential	JM	Ch. 8	2-3 Metabolism (entire chapter)	Energy and Enzymes	3.03 Energetics
16 Oct	25	Cellular respiration Oxidation of food and reduction	JM	9.5: 166-172	2-4-2 Energy in Living Systems	Respiration	3.04 Respiration and oxidative

Fall 2015	Class	Class Topics	Who	Reading Assignments*	OpenStax Biology	1511 Website	Mastering Biology†
		of an e-acceptor Chemiosmosis Oxidative phosphorylation			2-4-5 Oxidative Phosphorylation		phosphoryl.
19 Oct	26	Oxidative pathways Glycolysis, substrate-level phosphorylation Pyruvate oxidation Citric acid cycle Regeneration of NADH, fermentation	JM	9.1-9.4: 155-166	2-4-3 Glycolysis 2-4-4 Oxidation of Pyruvate and the Citric Acid Cycle 2-4-6 Metabolism without Oxygen	Oxidative pathways	
21 Oct	27	Evolution of mitochondria and eukaryotes Amino acid and lipid catabolism Defects in metabolism	JM	9.6: 172 Smith & Bacco 2003	Smith and Baco 2003 (Tsquare) 2-4-7 Connections of Carbohydrate, Protein and Lipid Metabolic Pathways	Fermentation Smith and Baco 2003 (Tsquare)	3.05 Fermentation
23 Oct	28	Photosynthesis Pigments and light absorption Origin of photosynthesis Cyclic photophosphorylation	JM	10.1-10.3: 176-189	2-5-2 Overview of Photosynthesis 2-5-3 Light-Dependent Reactions	Photosynthesis	
26 Oct	29	Carbon fixation	JM	10.4: 190-193	2-4-4 Using Light Energy to Make Organic Molecules	Carbon fixation	3.06 Photosynthesis
28 Oct	30	Photosynthetic strategies C3 vs C4 photosynthesis Recap: compare and contrast respiration and photosynthesis, mitochondria and chloroplasts	JM	10.4: 193-196	Photosynthetic Pathways	C4 plants	
28 Oct	**	Module 3 videos due					
30 Oct		Start Module 4: Genetics					
30 Oct	31	Chromosomes and cell division Mitosis & meiosis	SK	12.1-12.2: 220-228 13.1-13.2: 238-248	2-7-2 Cell Division 2-7-3 The Cell Cycle 3-1-2 The Process of Meiosis	Mitosis and Meiosis	4.01 Mitosis and Meiosis
2 Nov	32	Mendelian genetics	SK	14.1-14.3: 256-280	3-2 Mendel's Experiments and Heredity (entire)	Mendelian genetics	4.02 Mendelian Genetics

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4 Nov	33	Mendel's model genetic system Monohybrid and dihybrid crosses	SK	14.4-4.5: 266-271 14.6: 277-279	chapter) 3-2 Mendel's Experiments and Heredity (entire chapter)	Chromosome theory of inheritance	4.03 Chromosome Theory of Inheritance
5 Nov	Exam	Module 3 exam (6pm)					
6 Nov	34	Sex linkage & pedigree analysis Probabilities of genetic outcomes Genetics of human disease	SK	14.5: 271-277	3-3 Modern Understanding of Inheritance (entire chapter)	Patterns of Inheritance	4.04 Patterns of inheritance
9 Nov	35	DNA as the basis of inheritance Experimental evidence for the role of DNA DNA structure Semi-conservative replication	SK	15.1-15.3: 285-294 4.1-4.2: 58-65	3-4 DNA Structure and Function (entire chapter)	DNA	4.05 DNA
11 Nov	36	Gene expression: DNA to protein Basis of transcription and translation	SK	Ch. 16 Ch. 17	3-5 Genes and Proteins (entire chapter)	Gene expression	4.06 Gene Expression
13 Nov	37	Gene regulation	SK		3-6 Gene Expression (entire chapter)	Gene Regulation	
16 Nov	38	Prokaryotic and eukaryotic gene regulation Genome size and organization Mammalian genomes Genome evolution	SK	21: 390-400	3-7-3 Mapping Genomes 3-7-4 Whole- Genome Sequencing 3-7-5 Applying Genomics	Genomes	4.07 Genomes and Gene Regulation
16 Nov	**	Module 3-4 videos due					
18 Nov		Module 5: Integrative Biology					
18 Nov	39	Recombinant DNA	SK	20.1-20.2: 368-376	3-7-2 Biotechnology (entire chapter)	Recombinant DNA	5.01 Recombinant DNA
19 Nov	Exam	Module 4 exam (6pm)					
20 Nov	40	Stem cells, cloning and bioethics	SK	20.5: 383-385 22.2: 408-410	N/A	Cloning and Stem Cells	

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23 Nov	41	In-class presentations	SK				
25 Nov	–	Holiday					
27 Nov	–	Holiday					
30 Nov	42	Immunology and infections diseases	SK	51.1-51.4: 1037-1055	7-10 The Immune System (entire chapter) N/A	Adaptive Immunity	5.02 Immunology
2 Dec	43	Human health and evolution Balancing selection Sickle cell, Thalassemia, CF	SK			Human health and evolution	
4 Dec	44	Course wrap-up and review	Both				
7 Dec	Exam	Final Exam (11:30 – 2:20) Comprehensive exam, with an emphasis on Module 5 materials					