BIOLOGY 1510 BIOLOGICAL PRINCIPLES FALL 2011

Faculty:

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Section	**A**	**B**
Time	MWF 11 am	MWF 3pm
Location	Clough Commons 152	Clough Commons 144
Mastering Biology Code	BIOL1510AF2011	BIOL1510BF2011
Recitation TA	Shandra Justicia shandra.justicia@gatech.edu	Natasha De Leon natasha.deleon@gatech.edu
TA office hours	M 12–1 pm & W 10–11 am	M 2–3 pm & W 4–5 pm
TA OH location	Clough Tutoring desk, 2nd floor	Clough Tutoring desk, 2nd floor

Prerequisites: 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: Campbell, N.A. et al. (2008). *Biology*, 8th Edition. Benjamin Cummings, San Francisco. The bookstore sells hardcover and looseleaf-bound texts, each bundled with a Mastering Biology access code. If you plan to work solely with the on-line e-book versions (not downloadable), then you can simply purchase access to the Mastering Biology website, which has e-book access. Mastering Biology is required as part of course homework assignments. If you choose to use a different edition of Campbell, you are responsible for readings on the equivalent material from that edition. Please compare editions before deciding not to use the 8th edition.

Clickers: A TurningPoint ResponseCard NXT unit ("clicker") is required and will be used for quizzes and interactive lecture sessions, which will contribute to the "participation" portion of your course grade. The old PRS clickers are no longer in use for this course—these can be resold to the bookstore. Details on TurningPoint clickers can be found here: www.cetl.gatech.edu/it/clicker.htm. This course is *not* set up to use a laptop or mobile device instead of a clicker.

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

Lectures: Attendance in lecture correlates strongly with performance in Biology 1510. 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.

Recitations: Lecture recitations occur weekly and are led by the recitation Teaching Assistant. Attendance is optional but strongly encouraged, as recitation is designed to improve your understanding of the lecture material. Lecture faculty may appear unannounced at recitation as well.

Lecture 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 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 **notify the exam instructor with a valid excuse within 24 h of the start of the missed exam**. You must submit your clearly labeled documentation for missing the exam to the instructor. You may, of course, inform us in advance of the exam if you know of your scheduling conflict beforehand. We will consider each case 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: Throughout the semester you will have **assignments** in Mastering Biology, which in addition offers animations, videos, interactive tutorials and simulations, as well as practice quizzes and an on-line version of the textbook. Individual access codes for Mastering Biology are included with each new textbook, or may be purchased separately from the publisher at www.masteringbiology.com. The Mastering Biology assignment scores are recorded and will comprise 5% of the overall course grade. The assignments are individual and to be completed non-collaboratively; they are open-book and open-notes.

Group Projects: For each module, assigned groups of ~4 students each will each research an issue of current interest related to the topic of the module. Each student will be assigned to one group and participate in one activity during the semester. **Group assignments, details, a rubric, and deadlines will be provided after drop/add ends.** Grades will be based on instructor and peer evaluations. Keys to successful group work are to work well ahead of the deadlines and to seek in-person guidance for your project from the instructor during office hours or by appointment.

Labs: Labs will begin in the **second week of classes**. 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) to your TA no later than the day after the missed lab. All communications regarding lab should be directed to your lab TA.

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

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

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

Note that these components total 105%, though the maximum overall score we will allow in this course is 100%. This means that class participation or Mastering Biology is effectively a source of extra credit toward the raw score of your final grade.

We will use the following procedure to calculate 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 based on normalized scores 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%

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 2011	Lecture	Lecture Topics	1510 Readings [1]	Lecturer
22-Aug	01	Course overview Introduction to instructors		JC
=> M1		**Start Module 1: Evolution**		
24-Aug	02	What is science? What is the scientific method?	Platt (1964) 1.3: 18-24	CS
26-Aug	03	What is life? What is evolution? An evolutionary framework for biology	1: 1-17	CS
29-Aug	04	Earth history	25.2-25.3: 510-519	CS
31-Aug	05	Origin of life RNA world Miller & Urey experiment	25.1: 507-510	CS
2-Sep	06	History of life on Earth Life in the remote past, Patterns of biological diversity over time Life and changes in the physical environment Biological classification	25.3-25.6: 514-531 26.1: 536–540	CS
5-Sep		*Holiday*		
7-Sep	07	Evolution and life on Earth Gradualism Descent with modification Historical biogeography	22: 452-466	CS
9-Sep	08	Mechanisms of evolution	23: 468-484	CS
12-Sep	09	Genetic variation Hardy-Weinberg equilibrium Mutation, drift, selection Case study: HIV drug resistance, human resistance to HIV		CS
14-Sep	10	Species and speciation What is a species Mechanisms of speciation Adaptive radiation	24: 487-504	CS
15-Sep		**Midterm 1**	**Module 1**	
=> M2		**Start Module 2: Ecology**		
16-Sep	11	Intro to Ecology Physical Environment	52: 1148-1171	CS
19-Sep	12	Behavioral ecology Foraging and defense against predation Mate choice and sexual selection Kin selection and altruism	51.1-2: 1120-1128 51:4-5: 1133-1142	CS
21-Sep	13	Population ecology	53: 1174-1195	CS
23-Sep	14	Structure, dynamics, & regulation of populations Life histories Human populations through history Population management		CS
26-Sep	15	Community ecology **Group project 1: Website due by 11:59 pm (CS)**	54: 1198-1219	CS
28-Sep	16	Competition, Predation, parasitism, mutualism Keystone species Island Biogeography		CS

Fall 2011	Lecture	Lecture Topics	1510 Readings [1]	Lecturer
30-Sep	**17**	**Group project presentations 1**		**CS**
3-Oct	18	Ecosystems	55: 1222-1242	CS
5-Oct	19	Energy and material flow through ecosystems Biogeochemical cycles Human impact on ecosystems		CS
6-Oct		**Midterm 2**	**Module 2**	
=> M3		**Start Module 3:** **Molecules, Membranes, Metabolism**		
7-Oct	20	Biomolecules Small molecules Major classes of macromolecule	5: 68-89	JC
10-Oct	21	Cellular Structure Lipid bilayer membranes Archaeal membranes Serial endosymbiosis and eukaryote evolution	6.2-6.5: 94, 98-122	JC
12-Oct	22	Membrane function and transport systems Membrane composition and adaptation Membrane proteins Transport: passive diffusion, osmosis, facilitated diffusion, active transport	7: 125-139	JC
14-Oct	24	Energetics and enzymes Thermodynamics and free energy Catalysis and kinetics, and enzymes Redox reactions Membrane potential	8: 142-159	JC
17-Oct		*Fall Break*		
19-Oct	25	Cellular respiration Oxidation of food and reduction of an electron acceptor Electron transport chain Chemiosmosis and oxidative phosphorylation of ATP	27.3: 564-565 9.1: 162-167 9.4: 172-177	JC
21-Oct	26	Glycolysis Pyruvate oxidation Citric acid cycle Fermentation, regeneration of NAD+ **Group project 2: Website due by 11:59 pm (JC)**	9.2-9.3: 167-172 9.5: 177-179	JC
24-Oct	27	Mitochondrial origins Eukaryotic respiration Amino acid and lipid breakdown Feedback regulation	25: 516-517 9: Figs. 9.6, 9.17 9.6: 180-182	JC
26-Oct	28	Photosynthesis Overview: reduce CO_2 to organic C Pigments and light absorption Origin of photosynthesis: single PS, cyclic photophosphorylation	10.1-10.2: 185-198	JC
28-Oct	**23**	**Group project presentations 2**		**JC**
31-Oct	29	Carbon fixation Evolution of PSII & noncyclic photophosphorylation Calvin-Benson cycle Energetics and stoichiometry of C fixation	10.3: 185-189 198-199	JC

Fall 2011	Lecture	Lecture Topics	1510 Readings [1]	Lecturer
2-Nov	30	Photosynthetic strategies C3, C4, and CAM photosynthesis Recap: compare and contrast respiration & photosynthesis,	10.4: 200-203	JC
3-Nov		**Midterm 3**	**Module 3**	
=> M4		**Start Module 4: Genetics**		
4-Nov	31	Chromosomes and Cell Division Mitosis Meiosis	12.1-12.2: 228-238 13: 248-258 16.3: 320-323	JC
7-Nov	32	Mendelian genetics Mendel's model genetic system	14: 262-279 (stop at Genetic testing) 15.1-15.3: 286-296	CS
9-Nov	33	Monohybrid and dihybrid crosses	(same as previous)	CS
11-Nov	34	Sex-linkage and pedigree analysis Genetics of human disease		CS
14-Nov	35	DNA as the basis of inheritance Experimental evidence for role of DNA DNA structure Semi-conservative replication of DNA **Group project 3: Website due by 11:59 pm (CS)**	16: 305-317	JC
16-Nov	36	Gene expression: DNA to protein Basics of transcription and translation	17: 325-348	JC
18-Nov	37	Prokaryotic and eukaryotic genomics Genome size and organization Mammalian genomes Genome evolution	18: 351-356 21.1: 426-427 21.3-21.4: 432-438	JC
21-Nov	**38**	**Group project presentations 3**		**CS**
23-Nov	39	Gene regulation **Group project 4: Website due by 11:59 pm (JC)**		JC
25-Nov		*Thanksgiving Holiday*		
=> M5		**Start Module 5: Biomedicine**		
28-Nov	40	Recombinant DNA	20.1: 396-405	JC
30-Nov	41	Stem cells, cloning and bioethics	20.3-20.4: 412-423	JC
1-Dec		**Midterm 4**	**Module 4**	
2-Dec	42	Immunology and infectious diseases	43: 930- 946	JC
5-Dec	43	Human health and evolution Balancing selection Sickle cell, Thalassemia, Cystic Fibrosis	TBD	JC
7-Dec	**44**	**Group project presentations 4**		**JC**
9-Dec	45	Course wrap-up and review		Both

	Section A (11am) Final Exam 12/12 8:00-10:50 am	**Comprehensive**
	Section B (3pm) Final Exam 12/14 2:50–5:40 pm	**Comprehensive**

[1] Textbook readings given as Chapter #: page range in Campbell & Reese, 8th ed.