BIOLOGY 1510 BIOLOGICAL PRINCIPLES SPRING 2010

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Recitation TA	Matthew Johnson, matt.johnson@gatech.edu
Pre-requisites:	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. We have arranged special pricing through the bookstore for hardcover, looseleaf-bound and ebook versions of the textbook bundled with a PRS coupon and access to the Mastering Biology website.
PRS:	An Interwrite PRS-RF unit ("clicker") is required and will be used for quizzes and interactive lecture sessions, this is the PRS portion of your course grade.
Organization:	The course is organized into five modules, each of which deals with a major area of modern biology.
Honor Code:	All students are expected to abide by the Academic Honor Code, which can be viewed online at http://www.honor.gatech.edu.
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.
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 petition us 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 (email is sufficient) and you must provide 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 substitute the missed exam in your grade calculation with the weighted mean of your other exam scores (class mean of the

missed midterm multiplied by sum of your other midterm scores/sum of the class means of the other midterms).

Quizzes: Short quizzes may be administered in lecture and online.

Labs: 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.

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

In-class exams:	40%
Final exam:	20%
Mastering Biology:	10%
PRS+quizzes:	10%
Laboratory:	25%

Note that these components total 105%, though the maximum overall score we will allow in this course is 100%. The extra 5% is effectively a source of extra credit toward the final grade.

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

1. We will combine your exam, lab, 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:	$\geq 90\%$
B:	$\geq 80\%$ and $< 90\%$
C:	$\geq 70\%$ and $< 80\%$
D:	$\geq 60\%$ and $< 70\%$
F:	$< 60\%$

Biology 1510 Module Themes and Teaching Goals

Module	Major theme	Teaching Goals
Intro	• Course intro	• Scientific method
1	• Ecology	• Behavior and evolution • Simple population models • Community structure • Mass and energy flow through ecosystems
2	• Evolution	• Earth history • History of life on Earth • Mechanism of evolution
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

Date	Lecture Topics	Readings[1]	Lecturer
11 Jan	Course overview Introduction to instructors		All
=> M1	**Start Module 1: Ecology**		
13 Jan	Science as a WAY of knowing? What is science and the scientific method?	Chamberlin (1964) 1.3: 18-24	MH
14 Jan	No recitation		
15 Jan	This is the Century of Biology – Like it or not, this is THE challenge of your generation.	53.6: 1190-1195	MH
18 Jan	Holiday - MLK Jr. Day		
20 Jan	Intro to Ecology Physical Environment	52: 1148-1171	MH
21 Jan	Recitation 6-7 pm		

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

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Date	Lecture Topics	Readings	Lecturer
22 Jan	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	MH
25 Jan	Population ecology I Structure, dynamics, & regulation of populations	53: 1174-1195	MH
27 Jan	Population ecology II Life histories Human populations through history Population management	53: 1174-1195	MH
28 Jan	Recitation 6-7 pm		
29 Jan 1 Feb	Community ecology Competition, Predation, parasitism, mutualism Keystone species Island Biogeography	54: 1198-1219	MH
3 Feb	Ecosystems Energy and material flow through ecosystems Biogeochemical cycles Human impact on ecosystems	55: 1222-1242	MH
4 Feb	**Exam #1 (6-7 pm)**	Module 1	
=> M2	**Start Module 2: Evolution**		
5 Feb	What is evolution? An evolutionary framework for biology	1: 1-24	JC
8 Feb	Earth history	25.2-25.3: 510-519	JC
10 Feb	Origin of life RNA world, Miller & Urey experiment	25.1: 507-510	JC
11 Feb	Recitation (6-7 pm)	**Module 1**	
12 Feb	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 24.1: 487-492	JC
15 Feb	Evolution and life on Earth Gradualism Descent with modification Historical biogeography	22: 452-466	JC
17 Feb	Mechanisms of evolution Genetic variation Hardy-Weinberg equilibrium	23: 468-484	JC
18 Feb	Recitation		
19 Feb	Mutation, drift, selection Case study: HIV drug resistance, human resistance to HIV		JC
22 Feb	Species and speciation What is a species Mechanisms of speciation Adaptive radiation	24: 487-504	JC

Date	Lecture Topics	Readings	Lecturer
=> M3	**Start Module3: Molecules, Membranes, Metabolism**		
24 Feb	Biomolecules Basic building blocks Major classes of macromolecules	5: 68-89	JC
25 Feb	**Exam #2 (6-7 pm)**	**Module 2**	
26 Feb	Cellular Structure Lipid bilayer membranes Archaeal membranes Serial endosymbiosis and eukaryote evolution	6.2-6.5; pp. 94, 98-122	JC
1 Mar	Membrane function and transport systems Membrane composition and adaptation Membrane proteins Transport: passive diffusion, osmosis, facilitated diffusion, active transport	7: 125-139	JC
3 Mar	Energetics and enzymes Thermodynamics and free energy Catalysis and kinetics, and enzymes Redox reactions Membrane potential	8: 142-159	JC
4 Mar	Recitation 6-7 pm		
5 Mar	Glycolysis and fermentation Oxidation of food and reduction of an e- acceptor Metabolic diversity LUCA and prokaryotes glycolysis, substrate-level phosphorylation regeneration of NADH, fermentation	27.3: 564-565 9: 9.1-9.2, 9.5 162-169;177-179	JC
8 Mar	Cellular respiration Pyruvate oxidation Citric acid cycle Electron transport chain Chemiosmotic generation of ATP	9: 9.3-9.4 170-177	JC
10 Mar	Eukaryote respiration Mitochondrial origins Amino acid and lipid breakdown Feedback regulation	9: 9.6 180-182	JC
11 Mar	Recitation 6-7 pm		
12 Mar	Photosynthesis Overview: reduce CO_2 to organic C Pigments and light absorption Evolution of photosystems I and II	10: 10.1-10.2 185-198	JC
15 Mar	Carbon fixation Calvin-Benson cycle Energetics and stoichiometry of C fixation	10: 10.3 185-189; 198-199	JC
17 Mar	Photosynthetic strategies C3, C4, and CAM photosynthesis Recap: compare and contrast respiration & photosynthesis, mitochondria & chloroplasts.	10: 10.4 200-203	JC
18 Mar	**Exam #3 (6-7 pm)**	**Module 3**	
19 Mar	Integration & synthesis topic TBA		JC
22-26 March	SPRING BREAK		
=> M4	**Start Module 4: Genetics**		

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Date	Lecture Topics	Readings	Lecturer
29 Mar	Chromosomes & Cell division Mitosis Meiosis	12: 12.1-12.2 13: 248-258 16: 16.3 320-323	JC
31 Mar	Mendelian genetics Mendel's model genetic system Monohybrid and dihybrid crosses	14: 262-279	JC
1 Apr	Recitation 6-7 pm	Module 3	
2 Apr	Sex-linkage and pedigree analysis Probabilities of genetic outcomes	15: 15.1-15.3 286-296	JC
5 Apr	Genetics of human disease		JC
7 Apr	DNA as the basis of inheritance Experimental evidence for role of DNA DNA structure Semi-conservative replication of DNA	16: 305-317	BH
8 Apr	Recitation 6-7 pm		
9 Apr	Gene expression: DNA to protein Basics of transcription and translation	17: 325-348	BH
12 Apr	Prokaryotic genomes and gene regulation Lac operon	18: 351-356	BH
14 Apr	Mammalian genomes & genome evolution	21.1, 21.3-21.4 426-247, 432-438	BH
15 Apr	**Exam #4 (6-7 pm)**	**Module 4**	
=> M5	**Start Module 5: Biomedicine**		
16 Apr	Recombinant DNA	20.1: 396-405	BH
19 Apr	Genetic modification Gene therapy	20.3-20.4: 412-423	BH
21 Apr	Stem cells, cloning and bioethics		BH
22 Apr	Recitation 6-7 pm		
23 Apr	Immunology and infectious diseases	43: 930- 946	BH
26 Apr	Human health and evolution Balancing selection Sickle cell, Thalassemia, Cystic Fibrosis		BH
28 Apr	Forensic DNA analysis		JC
29 Apr	Recitation 6-7 pm		
30 Apr	Course wrap-up and review		All
3-7 May	**Final Exams** (see exam schedule for dates and times)	Comprehensive	