BIOLOGY 1511 HONORS BIOLOGICAL PRINCIPLES FALL 2008

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Prerequisites: A score of 4 or 5 on the AP Biology test or permission of the instructors.

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. This course is intended for students with a strong background and interest in biology and includes a greater emphasis on current research and recent advances in biology than Biology 1510.

Textbook: Campbell, N.A. et al. (2008). *Biology*, 8th Edition. Benjamin Cummings, San Francisco. We have arranged special pricing through the bookstore for both hardcover and ebook versions of the textbook bundled with a PRS coupon and access to the publisher's web content.

PRS: A PRS is required and will be used for quizzes and interactive lecture sessions, which will contribute to the "participation" 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. Please complete each reading assignment before class. We will make our lectures 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. Lecture exams will be based on topics, materials, and discussions presented in class and in the assigned readings.

Lecture Exams: Two 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-essay questions. Exams and quizzes will be given in the laboratory as well.

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 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, making it completely neutral in your final point total. You may also petition for a makeup exam. If we accept your petition, we will administer a makeup exam before the end of the term.

Quizzes: Short quizzes may be administered in lecture, lab and on our T-Square site.

Group Activities: Groups of 4 students will work together as **Discussion Leaders** to put together clear concise lectures on any two available topics in the lecture syllabus. All four are expected to work on putting together both lectures, however, two out of the four will take lead on presenting one lecture as discussion leaders and the other two will present the second lecture. You may use various learning aids and we will guide you in the process of assembling an effective lecture session. You will also be evaluated by members of your group as to participation and ability to contribute to the teams' success. More details will be posted 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.

Bonus Points: We will provide two opportunities to earn bonus points which (if earned) will be added to your lowest exam grade. You may attempt either or both opportunities once during the semester for up to four points added to your lowest exam score. We will consider both the content and writing (spelling, grammar, punctuation, and style) in assigning 0, 1, or 2 bonus points to your effort.

1. We will post podcasts from Nature.com, NakedScientists.com, and ScientificAmerican.com on T-Square. Choose one, listen to it, and write a one-page paper following any one of the following formats:
   a. Critical review: critique the podcast at a level appropriate for an audience of scientists.
   b. Opinion piece: write a paper either supporting or criticizing the podcast at a level appropriate for an educated reader who is not a scientist.
   c. Popular summary: summarize the podcast for a lay audience unfamiliar with biology.
2. Visit the Georgia Aquarium, the Atlanta Zoo, the Atlanta Botanical Garder, or the Fernbank Science Center. Write a one-page summary of your visit to describe your observations to someone who has not visited, and attach your admission receipt

Biology Minute: This is another opportunity to earn extra credit. Once during the semester, you may present an oral "minute paper," with one PowerPoint slide, to the class. Well-prepared students will earn two points, which will be added to their FINAL grade. Your one-minute presentation should summarize any biologically-relevant current issue or topic from *reputable* news sources (newspapers such as

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 for you to choose a time slot. Because not everyone will be able to take advantage of this opportunity, in the event that you are unprepared for your chosen time, you will have two points *deducted* from your final grade.

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

In-class exams:	40%
Final exam:	25%
Group activities:	10%
Participation:	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 is effectively yet another 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 group activity 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	• 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	• Bioenergetics	• 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 • CF as a model biological system • Cell signaling and immunology • Course synthesis

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Date	Lecture Topics	Readings[1]	Lecturer
18 Aug	Course overview Introduction to instructors		All
=> M1	**Start Module 1: Evolution**		
20 Aug	What is science? What is the scientific method?	Platt (1964) 1.3: 18-24	JPM
22 Aug	What is life? What is evolution? An evolutionary framework for biology	1: 1-24	JPM
25 Aug	Earth history	25.2-25.3: 510-519	JPM
27 Aug	Origin of life RNA world, Miller & Urey experiment	25.1: 507-510	MMB
29 Aug	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	JPM
1 Sep	Holiday: Labor Day		
3 Sep	Evolution and life on Earth Gradualism Descent with modification Historical biogeography	22: 452-466	JPM
5 Sep 8 Sep	Mechanisms of evolution Genetic variation Hardy-Weinberg equilibrium Mutation, drift, selection Case study: HIV drug resistance, human resistance to HIV	23: 468-484	MMB
10 Sep	Species and speciation What is a species Mechanisms of speciation Adaptive radiation	24: 487-504	MMB
=> M2	**Start Module 2: Ecology**		
12 Sep	Intro to Ecology Physical Environment	52: 1148-1171	JPM
15 Sep	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	JPM
17 Sep	Group activity 1		JPM
19 Sep 22 Sep	Population ecology Structure, dynamics, & regulation of populations Life histories Human populations through history Population management	53: 1174-1195	NS

[1] Textbook readings given as Chapter #: page range in Campbell & Reese, 7th ed.

Date	Lecture Topics	Readings[1]	Lecturer
24 Sep 26 Sep	Community ecology Competition, Predation, parasitism, mutualism Keystone species Island Biogeography	54: 1198-1219	NS
29 Sep 1 Oct	Ecosystems Energy and material flow through ecosystems Biogeochemical cycles Human impact on ecosystems	55: 1222-1242	NS JPM
2 Oct	Exam #1 (evening)	Modules 1 & 2	
3 Oct	Group activity 2		RT
=> M3	**Start Module3: Bioenergetics**		
6 Oct 8 Oct	Diversity of metabolic pathways Evolution of energy metabolism Thermodynamic principles Chemoautotrophy ATP, enzymes, catalysis	8: 142-159 27.3: 564-565 55.4: 1232-1233 5: 77-80	JPM
10 Oct	Cellular organization Cell structure Organelles Cytoskeleton	5: 68-77 (reference) 6: 94, 98-122	RT
13 Oct	Holiday: Fall break		
15 Oct	Cellular transport systems Membrane systems Transport	7: 125-139	RT
17 Oct 20 Oct	Cellular respiration Glycolysis and pyruvate oxidation Citric acid cycle Respiration Chemiosmotic generation of ATP Fatty acid and amino acid metabolism	5: 68-77 9: 162-182	RT
22 Oct 24 Oct	Photosynthesis Pigments and the photosynthetic spectrum Photosystems I and II C3 and C4 photosynthesis	10: 185-203	RT
27 Oct	Group activity 3		RT
=> M4	**Start Module 4: Genetics**		
29 Oct	Chromosomes Cell division	12: 228-238 13: 248-258	MMB
31 Oct 3 Nov 5 Nov	Mendelian genetics Mendel's model genetic system Monohybrid and dihybrid crosses Sex-linkage and pedigree analysis Probabilities of genetic outcomes Genetics of human disease	14: 262-277 15: 286-300	MMB
7 Nov	DNA as the basis of inheritance Experimental evidence for role of DNA DNA structure Semi-conservative replication of DNA	16: 305-315 320-321	RT

Date	Lecture Topics	Readings[1]	Lecturer
10 Nov	Gene expression: DNA to protein Basics of transcription and translation	17: 325-331 337-348	RT
12 Nov	Prokaryotic and eukaryotic genomics Genome size and organization Mammalian genomes Genome evolution	18: 351-356 21: 426-427 432-435	RT
14 Nov	Group activity 4		MMB
=> M5	**Start Module 5: Biomedicine**		
17 Nov	Cystic fibrosis as a model disease Membrane biogenesis Membrane transport processes Testing for genetic diseases	Fig. 17.21: 343-344 Fig. 7.10: 130 7.3-7.4: 132-138 CF article	MMB
19 Nov	Recombinant DNA	20.1-20.2: 396-411	MMB
20 Nov	Exam 2	Modules 3 & 4	
21 Nov	Genetic diagnosis and gene therapy	20.4: 417-422	MMB
24 Nov	Stem cells, cloning and bioethics	20.3: 412-416	MMB
26 Nov	Cell signaling and cancer	11: 206-214 12.3: 238-243	RT
28 Nov	Thanksgiving Holiday		
1 Dec	Immunology and infectious diseases	43: 930- 946	RT
3 Dec	Group activity 5		RT
5 Dec	Course wrap-up and review		All
8 Dec 12 Dec	Final Exams (see exam schedule for dates and times)	Comprehensive	