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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 hardcover, looseleaf-bound and ebook versions of the textbook bundled with access to the Mastering Biology website.
- Clicker:** A TurningPoint "clicker" is required 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:** MWF 9:05 - 9:50 in CULC 102. Attendance in lecture correlates strongly with performance in Biology 1511. We will make our lectures available via T-Square and urge you to download and print them for use in taking notes during lecture. **Computers may be used in class only for group work; please plan on taking notes by hand.** 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 in CULC 102, are closed-book and will be made up of multiple-choice and short-essay questions based on topics, materials, and discussions presented in class, in the assigned readings, and on MasteringBiology.com. Exams and quizzes may also be given in the laboratory and on-line via 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 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 online.
- Group Projects:** Groups of 4 students will work together as **Discussion Leaders** to put together clear concise presentations related to two topics in the lecture syllabus. All four group members are expected to work together in putting together each presentation, but each member is expected take part in just one of the in-class presentations. You should be creative in your use of learning aids and we will guide you in the process of assembling an effective presentation. Your score will be based on evaluations by your fellow students as well as input on your contribution from other group members.
- 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 Science.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 Garden, the Fernbank Museum, 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. 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 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. Because not everyone will be able to take advantage of this opportunity, you will have two points *deducted* from your final grade if you are unprepared for your chosen time.

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

In-class exams:	40%
Final exam:	20%
Group activities:	10%
Participation:	10%
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	<ul style="list-style-type: none">• Course intro	<ul style="list-style-type: none">• Scientific method
1	<ul style="list-style-type: none">• Evolution and Genetics	<ul style="list-style-type: none">• Mechanism of evolution• Mendelian genetics• DNA and genomics• Gene regulation in prokaryotes and eukaryotes
2	<ul style="list-style-type: none">• 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
3	<ul style="list-style-type: none">• Ecology	<ul style="list-style-type: none">• Behavior and evolution• Simple population models• Community structure• Mass and energy flow through ecosystems
4	<ul style="list-style-type: none">• Life on Earth	<ul style="list-style-type: none">• Origin of Life• Earth history• History of life on Earth• Planetary modification
5	<ul style="list-style-type: none">• Current Issues in Biology	<ul style="list-style-type: none">• Stem cells and cloning• Immunology and evolution• Bioethics• Human health and evolution• Climate change• Course synthesis

Date	Lec #	Lecture Topics	Readings ¹	Lecturer
22 Aug	01	Course overview and introductions What is science? What is the scientific method?	Platt (1964) 1.3: 18-24	Both
=> M1		Start Module 1: Evolution & Genetics		
24 Aug	02	What is life? What is evolution? An evolutionary framework for biology	22: 452-466	JPM
26 Aug	03	Mechanisms of evolution Genetic variation Mutation, drift, selection	23: 468-484	JPM
29 Aug	04	History of life on Earth Patterns of biological diversity over time Biological classification	25.3-25.6: 514-531 24.1: 487-492	JPM
31 Aug	05	Mendelian genetics Mendel's model genetic system	14: 262-277	JKL
2 Sep	06	Monohybrid and dihybrid crosses		JKL
7 Sep	07	Sex-linkage and pedigree analysis Probabilities of genetic outcomes Genetics of human disease	15.1-15.3: 286-296	JKL
9 Sep	08	DNA as the basis of inheritance Experimental evidence for role of DNA DNA structure Semi-conservative replication of DNA	16: 305-317	JKL
12 Sep	09	Gene expression: DNA to protein Basics of transcription and translation	17: 325-348	JKL
14 Sep	10	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	JKL
16 Sep	11	Group Presentation 1		JKL
=> M2		Start Module 2: Molecules, Membranes, Metabolism		
19 Sep	12	Biomolecules Small molecules Major classes of macromolecule	5: 68-89	JKL
21 Sep	13	Cellular Structure Lipid bilayer membranes Archaeal membranes Serial endosymbiosis and eukaryote evolution	6.2-6.5: 94, 98-122	JKL
22 Sep		Exam 1 (evening, CULC 102)	Module 1	JKL
23 Sep	14	Membrane function and transport systems Membrane composition and adaptation Membrane proteins Transport: passive diffusion, osmosis, facilitated diffusion, active transport	7: 125-139	JKL
26 Sep	15	Energetics and enzymes Thermodynamics and free energy Catalysis and kinetics, and enzymes Redox reactions Membrane potential	8: 142-159	JKL

¹ Textbook readings given as Chapter #: page range in Campbell & Reese, 8th ed.
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Date	Lec #	Lecture Topics	Readings ¹	Lecturer
28 Sep	16	Glycolysis and fermentation Oxidation of food and reduction of an e- acceptor LUCA and prokaryotes glycolysis, substrate-level phosphorylation regeneration of NADH, fermentation	27.3: 564-565 9.1-9.2 162-169 9.5: 177-179	JKL
30 Sep	17	Cellular respiration Pyruvate oxidation Citric acid cycle Electron transport chain Chemiosmotic generation of ATP	9.3-9.4: 170-177	JKL
3 Oct	18	Eukaryote respiration Mitochondrial origins Fermentation (anaerobiosis) Amino acid and lipid breakdown Feedback regulation	9.6: 180-182	JKL
5 Oct	19	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	JKL
7 Oct	20	Carbon fixation Evolution of PSII & noncyclic photophosphorylation Calvin-Benson cycle Energetics and stoichiometry of C fixation	10.3: 185-189 198-199	JKL
10 Oct	21	Photosynthetic strategies C3, C4, and CAM photosynthesis Recap: compare and contrast respiration & photosynthesis, mitochondria & chloroplasts.	10.4: 200-203	JKL
12 Oct	22	Group Presentation 2		JKL
13 Oct		Exam 2 (evening, CULC 102)	Module 2	JPM
=> M3		Start Module 3: Ecology		
14 Oct	23	Intro to Ecology Physical Environment	52: 1148-1171	JPM
17 Oct		Holiday: Fall break		
19 Oct	24	Behavioral ecology Foraging and defense against predation	51.1-3: 1120-1132	JPM
21 Oct	25	Mate choice and sexual selection Kin selection and altruism	51.4-5: 1133-1142	JPM
24 Oct	26	Population ecology Structure, dynamics, & regulation of populations	53: 1174-1195	JPM
26 Oct	27	Life histories Human populations through history Population management		JPM
28 Oct	28	Community ecology Competition, Predation, parasitism, mutualism	54: 1198-1219	JPM
31 Oct	29	Keystone species Island Biogeography		JPM
2 Nov	30	Ecosystems Energy and material flow through ecosystems	55: 1222-1242	JPM
4 Nov	31	Biogeochemical cycles		JPM
7 Nov	32	Group Presentation 3		JKL

Date	Lec #	Lecture Topics	Readings ¹	Lecturer
=> M4		Start Module 4: Life on Earth		
9 Nov	33	Origin of life RNA world, Miller & Urey experiment	25.1: 507-510	TBD
11 Nov	34	Exam 3 (in class, Friday 11 Nov)	Module 3	JPM
14 Nov	35	Earth History Stratigraphy, time scale, dating	25.2-25.3: 510-519	JPM
16 Nov	36	History of life on Earth Life in the remote past, Life and changes in the physical environment	25.3-25.6: 514-531 24.1: 487-492	JPM
17 Nov	37	Macroevolutionary patterns (Note: evening meeting) Radiation and extinction events Historical biogeography	22: 452-466	JPM
18 Nov	38	Human impacts on the Earth	53.6: 1190-1195	JPM
21 Nov	39	Population growth and carrying capacity Nutrients, gases, and ecosystems	55.5: 1236-1242 56.1-56.3: 1245-1260	JPM
23 Nov	40	Group Presentation 4		JPM
25 Nov		Thanksgiving Holiday		
=> M5		Start Module 5: Current Issues in Biology		
28 Nov	41	Stem cells, cloning and bioethics	20.3-20.4: 412-423	JKL
30 Nov	42	Immunology and evolution	TBD	JKL
1 Dec		Exam 4 (evening, CULC 102)	Module 4	JPM
2 Dec	43	Human health and evolution Balancing selection Sickle cell, Thalassemia, Cystic Fibrosis	TBD	JPM
5 Dec	44	Infectious diseases, evolution, and society	TBD	JPM
7 Dec	45	Climate change	TBD	JPM
9 Dec	46	Course wrap-up and review		Both
14 Dec		Final Exam (8:00 – 10:50) (verify exam dates and times here: http://www.registrar.gatech.edu/home/calendar.php)	Comprehensive	