Prerequisites: A score of 4 or 5 on the AP Biology test, an A or B in Biology 1510/1511, or permission of the instructors.

Description: A focused introduction to organismal biology, with emphasis on physiological processes and integration of growth and development. This course will foster the development of critical scientific skills including hypothesis testing, experimental design, data analysis and interpretation, and scientific communication. Biology 1521 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 1520.

Textbook: Freeman et. al. (2010), Biological Science, 4th edition. Benjamin Cummings, San Francisco. For the students who already purchased the previous book you may also use: 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 access to the publisher’s web content (MasteringBiology.com).

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 at GT—these can be resold to the bookstore for $5. This course is not set up to use the TurningPoint laptop or mobile device instead of a clicker.

Honor Code: All students are expected to abide by the Academic Honor Code, which can be viewed online at http://www.honor.gatech.edu. We take the Honor Code very seriously and are required to report any potential violations. Some specific examples of Honor Code violations that we’ve encountered include: copying during exams, use of another student's PRS in class, and plagiarism.

Lectures: Lectures are held in Clough Commons 102. Attendance in lecture correlates strongly with performance in Biology 1521. 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.

Please turn off phones and computers while in lecture, unless otherwise prompted.
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 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.

Recitation: We will have an optional T-square chat room a couple of days before an exam. Additionally, we will hold optional recitation sessions on Thursday evenings as needed and/or available. This is an opportunity for you to discuss lecture material and text readings.

Quizzes: Short quizzes may be administered in lecture, lab and via the web (T-Square and/or MasteringBiology.com).

Group Activities: Groups of 4 students will work together to prepare class presentations on two topics related to the lecture syllabus. Each group member is expected to contribute to both presentations, but will deliver only one of the two. You may use various learning aids and we will guide you in the process of assembling an effective presentation. 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: Labs are held in Clough 473. Note that labs do not start during the first week of classes. Laboratory attendance is mandatory and each unexcused absence will lower your final grade by 5%.

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. You can earn up to two points, which 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 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 & quizzes: 40%
Final exam: 20%
Group project: 10%
Participation: 10%
Laboratory: 25%

Note that these components total 105%. The maximum overall score we will allow in this course is 100%, so this scheme includes 5% of extra credit. We will assign final letter grades based on your scores using the following scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>≥ 90%</td>
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<tr>
<td>B</td>
<td>≥ 80% and &lt; 90%</td>
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<tr>
<td>C</td>
<td>≥ 70% and &lt; 80%</td>
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<tr>
<td>D</td>
<td>≥ 60% and &lt; 70%</td>
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<tr>
<td>F</td>
<td>&lt; 60%</td>
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<tr>
<td>Module</td>
<td>Major theme</td>
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<td>1</td>
<td>Biodiversity</td>
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<td>2</td>
<td>Growth and Reproduction</td>
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<td>3</td>
<td>Chemical and Electrical Signals</td>
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<td>4</td>
<td>Nutrition and Transport</td>
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<td>5</td>
<td>Materials Balance</td>
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<tr>
<td>Date</td>
<td>Lecture Topics</td>
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<tr>
<td>9 Jan</td>
<td>Course overview&lt;br&gt;Introduction to instructors</td>
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<tr>
<td>=&gt; M1</td>
<td><strong>Start Module 1: Biodiversity</strong></td>
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<tr>
<td>13 Jan</td>
<td><strong>&lt;CAMBRIAN → SILURIAN&gt;</strong> Cambrian&lt;br&gt;Cambrian explosion&lt;br&gt;Body plans and diversity of marine life&lt;br&gt;(Ordovician &amp; Silurian)&lt;br&gt;Gondwana.&lt;br&gt;Jawless and jawed fishes.&lt;br&gt;Plants, arthropods, and apsids colonize land.</td>
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<td>16 Jan</td>
<td>Holiday: MLK Day</td>
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<td>18 Jan</td>
<td><strong>&lt;DEVONIAN → PERMIAN&gt;</strong> Devonian&lt;br&gt;Age of fishes, first tetrapods&lt;br&gt;Vascular plants, glomeromycetes&lt;br&gt;Plants, arthropods, and vertebrates colonize land.&lt;br&gt;Carboniferous&lt;br&gt;Amniote egg and Gymnosperms appear.&lt;br&gt;Pangaea, Panthalassa Ocean and Tethys Sea&lt;br&gt;Conifers and insects diversify&lt;br&gt;End-Permian mass extinction</td>
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<tr>
<td>20 Jan</td>
<td><strong>&lt;MESOZOIC&gt;</strong> Mesozoic&lt;br&gt;Dinosaurs dominate on land&lt;br&gt;Mammals and angiosperms diversify&lt;br&gt;Extinctions at end of Triassic and Cretaceous.</td>
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<tr>
<td>23 Jan</td>
<td><strong>&lt;CENOZOIC&gt;</strong> Diversification of mammals, angiosperms, grasses.&lt;br&gt;Climate variability.</td>
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<tr>
<td>25 Jan</td>
<td><strong>&lt;MODERN PROKARYOTES&gt;</strong></td>
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<tr>
<td>27 Jan</td>
<td><strong>&lt;MODERN EUKARYOTIC DIVERSIFICATION&gt;</strong></td>
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<tr>
<td>30 Jan</td>
<td><strong>&lt;MULTICELLULARITY&gt;</strong></td>
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<tr>
<td>1 Feb</td>
<td>Group Presentations</td>
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<tr>
<td>Date</td>
<td>Lecture Topics</td>
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<tr>
<td>2 Feb</td>
<td>Exam #1 (evening)</td>
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<tr>
<td>=&gt; M2</td>
<td><strong>Start Module 2: Growth and Reproduction</strong></td>
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</tbody>
</table>
| 3 Feb  | Intro to reproduction and development  
Differentiation and colony formation  
Ontogeny ≠ phylogeny, but they're linked. | 40: 852-860         | Chapter 21        | SP       |
| 6 Feb  | Plant Development  
Tissue development, differentiation and function  
Role of meristems, secondary growth | 35: 738-761         | Chapter 23        | SP       |
| 8 Feb  | Animal development  
Cleavage patterns, polarity, differentiation  
Coelom formation and body plans | 32: 655             | Chapter 22        | SP       |
| 10 Feb | Reproduction  
Mitosis, meiosis, and ploidy  
Alternation of generations | 28: 587-589         |                   | SP       |
|        |                                                                                 | 29: 602-603         |                   |          |
|        |                                                                                 | 33: 671-673         |                   |          |
| 13 Feb | Reproduction in vascular plants  
Double fertilization, seeds, fruits  
Vegetative growth | 30: 618-632         | 557-558           | SP       |
|        |                                                                                 | 38: 801-811         | 30: 560-565       |          |
|        |                                                                                 |                     | 40: 783-801       |          |
| 15 Feb | Animal reproduction  
Asexual reproduction (budding and parthenogenesis)  
Gametogenesis, hermaphroditism | 46: 997-1003        | 48: 950-956       | SP       |
|        |                                                                                 | 32: 615-617         | 32: 615-617       |          |
| 17 Feb | Human reproduction  
Spermatogenesis, oogenesis  
Ovarian and uterine cycles  
Hormonal control | 46: 1003-1016       | 48: 957-971       | SP       |
| 20 Feb | Group Presentations                                                             |                     |                   | SP       |
| => M3  | **Start Module 3: Chemical and Electrical Signals**                             |                     |                   |          |
| 22 Feb | Intro to chemical signaling and signal transduction  
Hormones and pheromones  
Quorum sensing, biofilm formation in microbes | 11: 206-207         | 8: 139-145        | SP       |
|        |                                                                                 | 39: 821-824         | 47: 929-935       |          |
|        |                                                                                 | 51: 1125            | 8: 145-146        |          |
| 23 Feb | Exam #2 (evening)                                                               | Module 2            |                   | SP       |
| 24 Feb | Plant Hormones and Defenses  
Hormones controlling growth, dormancy, germination  
Responses to injury, chemical defenses. | 39: 821-835         | 39: 755-781       | MB       |
| 27 Feb |                                                                                 | 39: 845-847         | MB               |          |
| 29 Feb | Animal hormones  
Hormone effects, production, distribution  
Insect development  
Vertebrate endocrine system | 45: 975-994         | 47: 929-947       | SP       |
| 2 Mar  |                                                                                 |                     | SP               |          |
| 5 Mar  | Neurons and Nervous System  
Anatomy and function  
Ion channels, synapses, neurotransmitters, integration | 48: 1047-1061       | 45: 885-889       | MB       |
| 7 Mar  |                                                                                 | 49: 1064-1069       | MB               |          |
|        |                                                                                 | 1078-1080           | MB               |          |
| 9 Mar  | Sensory Systems  
Sensory cells & organs, specificity  
Mechano- and photoreception  
Information processing | 50: 1087-1105       | 46: 907-920       | MB       |
<p>| 12 Mar |                                                                                 |                     | MB               |          |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Topics</th>
<th>Campbell 8 reading</th>
<th>Freeman 4 reading</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 Mar</td>
<td><strong>Effectors</strong>&lt;br&gt;Movement: role of cilia, flagella, muscles, skeletons</td>
<td>6: 114-116</td>
<td>7: 123-128</td>
<td>MB</td>
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<td>50: 1105-1117</td>
<td>46: 920-926</td>
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<tr>
<td>15 Mar</td>
<td>Exam #3 (evening)</td>
<td>Module 3</td>
<td>Module 3</td>
<td>MB/SP</td>
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<tr>
<td>16 Mar</td>
<td>Group Presentations</td>
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<td>MB</td>
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<tr>
<td>19 Mar</td>
<td>Spring Break (no classes)</td>
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<td>23 Mar</td>
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<td>=&gt; M4</td>
<td><strong>Start Module 4: Nutrition and Transport</strong></td>
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<td>26 Mar</td>
<td><strong>Microbial nutrition</strong>&lt;br&gt;Autotrophy, heterotrophy, mixotrophy</td>
<td>27: 564-565</td>
<td>28: 564-565</td>
<td>MB</td>
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<tr>
<td>28 Mar</td>
<td><strong>Plant nutrition</strong>&lt;br&gt;Nutrients and soil processes, N₂-fixation</td>
<td>37: 785-798</td>
<td>38: 737-752</td>
<td>MB</td>
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<tr>
<td>30 Mar</td>
<td><strong>Plant transport processes</strong>&lt;br&gt;Uptake of water and minerals</td>
<td>36: 764-782</td>
<td>37: 717-735</td>
<td>MB</td>
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<tr>
<td>2 Apr</td>
<td><strong>Xylem and evapotranspiration</strong>&lt;br&gt;Phloem, sieve tubes, and translocation</td>
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<td>MB</td>
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<tr>
<td>4 Apr</td>
<td><strong>Animal nutrition</strong>&lt;br&gt;Nutrient requirements and energy acquisition</td>
<td>41: 875-896</td>
<td>43: 841-858</td>
<td>MB</td>
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<tr>
<td>6 Apr</td>
<td><strong>Digestive organs: structure and function</strong></td>
<td>45: 885-906</td>
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<tr>
<td>9 Apr</td>
<td><strong>Animal circulation</strong>&lt;br&gt;Evolution of circulatory systems</td>
<td>42: 898-915</td>
<td>44: 874-883</td>
<td>MB</td>
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<tr>
<td>11 Apr</td>
<td><strong>Human vascular system, hormonal regulation</strong></td>
<td>43: 898-915</td>
<td>44: 874-883</td>
<td>MB</td>
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<tr>
<td>13 Apr</td>
<td>Group Presentations</td>
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<tr>
<td>=&gt; M5</td>
<td><strong>Start Module 5: Materials Balance</strong></td>
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<tr>
<td>16 Apr</td>
<td><strong>Gas Exchange and Transport</strong>&lt;br&gt;Principles of diffusion</td>
<td>42: 915-927</td>
<td>44: 861-883</td>
<td>MB</td>
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<tr>
<td>18 Apr</td>
<td><strong>Lungs and gills</strong>&lt;br&gt;Mechanisms for transporting O₂ and CO₂</td>
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<td>MB</td>
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<tr>
<td>19 Apr</td>
<td>Exam 4 (evening)</td>
<td>Module 4</td>
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<td>MB</td>
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<tr>
<td>20 Apr</td>
<td><strong>Ion and water balance in animals</strong>&lt;br&gt;Excretory mechanisms and systems</td>
<td>44: 954-972</td>
<td>42: 822-838</td>
<td>MB</td>
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<tr>
<td>23 Apr</td>
<td><strong>Adaptations to different environments</strong></td>
<td>44: 954-972</td>
<td>42: 822-838</td>
<td>MB</td>
</tr>
<tr>
<td>25 Apr</td>
<td><strong>Plant homeostasis and responses to the environment</strong>&lt;br&gt;Photosynthetic strategies and water conservation</td>
<td>10: 198-203</td>
<td>10: 187-190</td>
<td>MB</td>
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<td></td>
<td><strong>Water, temperature, wounds, pathogens</strong></td>
<td>36: 776-778</td>
<td>37: 720-721</td>
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<td>39: 835-847</td>
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<tr>
<td>27 Apr</td>
<td><strong>Physiological Ecology and course wrap-up</strong></td>
<td>41: 815-819</td>
<td></td>
<td>All</td>
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<tr>
<td>30 Apr</td>
<td>Final Exams (see exam schedule for date and time)</td>
<td>Comprehensive</td>
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<td>2 May</td>
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