Advanced Biology - SCI 04301 and 04302, Dual Credit for BSU BIO-111 and BIO-112

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Office Hours: M, W, F: 10am-12pm; 1-2pm
Tues: 1-2pm
*I am also available by appointment

Lecture: BU209 M,W,F: Section 1 = 8-8:50 am; Section 2 = 9:00-9:50 am
Laboratory: BU211 Tuesday: Section 1 = 8-9:50 am; Section 2 = 10-11:50 am

Instructional Resources:
3. AP Biology Investigative Labs: an Inquiry Based Approach – this is the lab manual for Biology.
   *Many of our labs will be taken or modified from this source. All lab materials will be posted through Canvas so a hard copy of the lab manual is NOT required.

Course Overview
This Biology course is designed to offer students a solid foundation in introductory college-level biology. By structuring the course around the four Big Ideas and Science Practices, the students will be assisted in developing an appreciation for the study of life and helped to identify and understand unifying principles within a diversified biological world.

Science is a way of knowing. Therefore, knowing about Biology requires that students learn the process of science and develop critical thinking skills. The course will focus not only on knowing science content, but also learning skills to analyze and interpret data, and to communicate information in a meaningful way to others.

At the end of the course, students will have an awareness of the integration of other sciences into the study of Biology, understand scientific processes, know how to apply science methodology, recognize how our own species is similar, yet different from other species, and become knowledgeable and responsible citizens in understanding biological issues that could potentially impact their lives.

Instructional Context
This course in Biology will be taught to juniors and seniors at a school that follows a college style schedule. Students will meet for three 50-minute lecture periods each week and one 2-hour laboratory period. Computer and internet access is required for the course as the materials will be posted to Canvas or require the use of other internet sites.

Students should have completed one year of biology and one of chemistry, if possible, prior to enrolling in Biology. However, students without the suggested pre-requisites may be admitted by instructor permission. The most important co-requisite for this course is the student taking enough TIME to keep up with the work. The usual ratio is about 2 hours of outside work for each hour spent in class.
Advanced Biology Content
This course in Biology is structured around the four Big Ideas, while learning and using Science Practices reinforced throughout the course.

The Big Ideas:

**Big Idea 1**: The process of evolution drives the diversity and unity of life.

**Big Idea 2**: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.

**Big Idea 3**: Living systems store, retrieve, transmit and respond to information essential to life processes.

**Big Idea 4**: Biological systems interact, and these systems’ interactions possess complex properties.

The Investigative Laboratory Component
The course is structured around inquiry in the lab and the use of science practices throughout the course. Students will be given the opportunity to engage in student-directed laboratory investigations throughout the course of a minimum of 25% of instructional time. Students will conduct a minimum of eight inquiry-based investigations (two per big idea) throughout the course as described in *AP Biology Investigative Labs: an Inquiry Based Approach*. The science practices covered by each lab are listed in this document. These practices are correlated with aspects of the Scientific Method:

The Science Practices
1. **Concept Explanation**: The student can use representations and models to communicate scientific phenomena and processes to explain and solve scientific problems.
2. **Visual Representation**: The student can describe, explain, and represent biological concepts, processes, and/or theories through visual models.
3. **Questions and Methods**: The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the biology field using the scientific method. The student can plan and implement data collection strategies appropriate to a particular scientific question.
4. **Representing and Describing Data**: The student can differentiate between quantitative and qualitative data, create proper scientific graphs/tables, and describe relationships between variables use mathematics appropriately to elucidate trends.
5. **Statistical Tests and Data Analysis**: The student can perform data analysis using mathematics appropriately to elucidate trends and evaluate evidence using statistics to determine hypothesis support.
6. **Argumentation**: The student can draw conclusions based on the data while being able to relate knowledge across various concepts as well as connecting it back to scientific explanations and theories.

Units of Instruction
The course content has been divided into eight instructional units over the two semesters. An attempt has been made to “chunk” chapters into related units. Four units will be presented each semester. The Four Big Ideas will be interwoven within the units and science practices spiraled throughout.

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<thead>
<tr>
<th>Unit 1 – Introduction and Biochemistry</th>
<th>Suggested Labs</th>
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<tbody>
<tr>
<td>Introduction to Biology</td>
<td>Introduction to Science Practices</td>
</tr>
<tr>
<td>Chemistry of Life</td>
<td>Artificial Selection – predator/prey selection</td>
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<tr>
<td>Water</td>
<td>Simulation; Formal Lab Report</td>
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<tr>
<td>Carbon and Molecular Diversity</td>
<td>Mathematics in Biology – graphs, calculations etc.</td>
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<tr>
<td>Macromolecules</td>
<td>Essay Writing, Rubric Setting and Practice</td>
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<td>Grading</td>
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<table>
<thead>
<tr>
<th>Unit 2 – Cells and Cell Cycle</th>
<th>Suggested Labs</th>
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<tbody>
<tr>
<td>Membrane Structure and Function</td>
<td>Osmosis – dialysis tubing, potatoes</td>
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<tr>
<td>Tour of a Cell</td>
<td>Cell observations – Cell structures lab</td>
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<tr>
<td>Cell Cycle</td>
<td>Mitosis</td>
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<tr>
<td>Osmoregulation and Excretion</td>
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</tbody>
</table>
### Unit 3 – Cellular Energy
- Introduction to Metabolism
- Cellular Respiration
- Photosynthesis

### Suggested Labs
- Enzymes – computer probe lab
- Respiration – seed respiration
- Photosynthesis

### Unit 4 – Organism Form and Function
- Cell Communication
- Hormones and the Endocrine System
- Neurons, Synapses and Signaling
- Immune System
- Basic Principles of Animal Form and Function

### Suggested Labs
- Cell Communication – termites
- Hormones – investigation (Endocrine diseases)
- Nerve signaling – simulation or website
- Case studies may be used in all three human system areas

### Unit 5 – Genetic Basis of Life (Spring)
- Meiosis and Sexual Life Cycles
- Mendel and the Gene Idea
- Chromosome Basis of Inheritance
- Genomes and their Evolution

### Suggested Labs
- Meiosis simulation
- Fast Plant – who’s the daddy?
- Fruit Fly Genetics simulation, Chi Square test on Genetic Corn

### Unit 6 – Gene Activity and Biotechnology
- Molecular Basis of Heredity
- From Gene to Protein
- Regulation of Gene Expression
- Biotechnology
- Viruses

### Suggested Labs
- DNA Puzzle kit
- Transformation using pGLO
- Restriction Enzymes and Gel Electrophoresis

### Unit 7 – Evolution and Phylogeny
- Descent with Modification: Darwin
- Evolution of Populations
- Origin of Species
- History of Life on Earth
- Phylogeny and the Tree of Life

### Suggested Labs
- Population Genetics
- Evo-Devo – videos from HHMI
- Hemoglobin investigation and Blast Lab

### Unit 8 – Ecology
- Introduction to Ecology
- Population Ecology
- Community Ecology
- Ecosystems
- Conservation Biology
- Animal Behavior

### Suggested Labs
- Animal Behavior – red worms or pillbugs
- Transpiration – whole plant method
- Aquatic Production – DO bottles, ecosystem simulation with probes

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Additional labs will be conducted to deepen students’ conceptual understanding and to reinforce the application of science practices within a hands-on, discoverer-based environment. Directed Inquiry will be the most common method of lab instruction used. The course will provide opportunities for students to develop, record, and communicate the results of their laboratory investigations.

**Students are strongly encouraged to maintain a portfolio of their lab activities and class materials electronically or in a binder to take with them to college.**

**Instructor’s Conceptual Framework for Biology**

The instructor’s conceptual framework for understanding Biology is well illustrated by a quote from Theodosius Dobzhansky (1973): “**Nothing in Biology makes sense except in the light of Evolution**”

This conceptual framework will manifest in questions such as:
- What is the adaptive value of ________?
- Why has __________ persisted over time?
- What is the role of the environment in _________? If the environment changes, what might happen over time?
- Does _________ improve the ability of the organism to survive and reproduce? How?
The instructor will try to illuminate you with the “in light of evolution” each and every class period. This may sound strange now, but it will make all kinds of sense very quickly.

### Suggested Note-taking Methods

The instructor will provide a handout for each chapter covered in class, which will give the objectives for the chapter and an outline on how it will be presented. The information on the PowerPoint slides are in a bulleted format and do not represent the entire coverage of the topic. The PowerPoint slides should be viewed as a “framework” for the content. Additional information will be given orally by the instructor to “flesh out” the framework, or will be developed through classroom discussions. Students will be asked to take notes from class discussions and put them into an outline. Each unit, outlines will be periodically checked for homework points.

### Students should focus on:

1. Knowing the items provided in the outline for each chapter or unit.
2. Add notes to the PowerPoint slides and/or the notes outlines posted on Canvas based on the instructor’s oral presentation to gain a better understanding of a topic.
3. Students will construct their own study guides by converting the PowerPoint slides to an outline text format and adding in the relevant orally presented information.

### Homework

Due dates for all homework assignments will be provided throughout each unit. All work will be submitted on Canvas. If any assignment is handwritten, photos of the work can be taken and submitted on Canvas. Please make sure the submitted photos are easy to read.

*As a suggestion for taking scans of handwritten work, AdobeScan is a free app (there are others out there) that can be downloaded on a smart phone or device. A PDF of scanned work is created and can be uploaded to Canvas.*

### Chapter Assignments:

- A selection of short answer questions and multiple choice questions will be assigned for each chapter to help master some of the most important concepts.
- For the short answer, students should focus on the task words (shown in bold font text) in the questions such as discuss, justify and explain, identify, compare and contrast etc. when answering these questions. These same bold font task words will be used in essay questions on exams.
- Due dates for assignments will be provided throughout each unit.
- Assignment grading: For most assignments, only a portion of the assignment will be graded for correctness. The remaining portion will be graded for completeness.

### Video Assignments:

- Throughout each unit, concept videos will be assigned (most of the videos were created by College Board).
- Students will be responsible for watching the video, taking notes, and completing a short assignment regarding the content.

### Chapter Outlines:

- For each chapter covered, learning objectives will be posted.
- Each student will be responsible for using their notes/textbook/assigned videos to complete an outline using the learning objectives as a guide.
- Outlines will be periodically checked for completion points.

### Student Expectations

- Please know that I like hearing from you. I am here to support you. Please do not hesitate to contact me when you need help. **Communication is key.**
- You are expected to take an active role in class discussions/activities during lecture and lab. Please come to our class meetings distraction free from other electronic devices or applications (yep, those cell phones).
- You are expected to periodically check your email accounts and Canvas. I will make class announcements through email.
• Class materials and grades will be posted to Canvas and PowerSchool. As grades are posted, it is your
  responsibility to make sure grades are posted correctly. Please contact me immediately if any grades are posted
  incorrectly.
• You are expected to turn in assignments on time. Please see the late policy provided above for submitted
  assignments for more details.
• You are expected to attend class regularly and be there on-time. If you are late to class, you will receive a
  warning for the first time, but subsequent tardiness will be recorded as such. If you are more than 15 minutes
  late for lecture or lab, then these may be recorded as absences. Exceptions might be made for students with
  extenuating circumstances.
• If you are absent from lecture or lab, it is your responsibility to contact me. Work can be made up for excused
  absences.
• If you are absent on the day of the exam, it is your responsibility to contact me as soon as you can to set up a
  time for you to make it up.
• All work you submit for individually submitted assignments/exams must be original. Copying from another
  student or plagiarism of others’ work (including websites, textbooks, etc.) will result in at least a “0” for that
  assignment (see the Academic Integrity Policy below).

Late Work
All assignments are expected on the date announced in class. Those due dates may also be posted with the
assignment on Canvas. However, assignments will be permitted a 24-hour extension without penalty or explanation. For
example, work due on Friday must be turned in before 11:59 p.m. (midnight) on Saturday, not Monday. Work received
after the 24-hour extension will receive a 20% penalty deducted for each day late unless permission is granted by the
instructor in advance. No credit will be given to assignments turned in after graded assignments have been returned to
the class, and those assignments will receive a grade of “0”. The only exception will be for those individuals with
extenuating circumstances and/or an Academy approved documented excuse. If you are absent for an exam, the exam
MUST be made up within the week of your return.

Academic Integrity Policy
Academic dishonesty in any form will not be tolerated. The student is responsible for knowing the policies and
consequences as stated in the Academy handbook. Specifically for this course, cooperative group work on homework
assignments is appropriate and is encouraged, but simple copying of an assignment from another or allowing another to
copy your homework without collaboration is not acceptable. Additionally, exchanging ANY information about the
content of quizzes or tests with students yet to take the exam or solicitation of such information is a severe violation
of academic honesty standards. Plagiarized work will receive a minimum penalty of “0” for that assignment and/or
reduction of the overall course grade as deemed appropriate to the severity of the infraction. If an ethics violation
occurs, instructors are required to report them regardless of the severity → this includes talking to your
parents/guardians. If you have any questions regarding what constitutes cheating, please speak to me. In order to
preserve the credibility of all students’ grades, I encourage you to tell me if you observe violations of the integrity policy.

Exams
The exams used in the course will attempt to reflect the style and difficulty level of a college level Biology course. Four
unit exams will be given each semester. Each exam will consist of 30 multiple-choice questions. The essay exam will
consist of two long essays and a few short essays. Each exam will be allowed 55 minutes for each part and will be
administered in the two-hour lab block. Keys and grading standards will be made available after each exam.
Grading

Course grades will be based on the following items and approximate points and percentages:

- **MC Exam**: ~30% = ~240 points (60 points/unit)
- **Essay Exam**: ~30% = ~240 points (60 points/unit)
- **Homework**: ~20% = ~160 points (40 points/unit)
  - Chapter assignments: ~5-10 points/chapter
  - Video assignments: ~3-5 points/video
  - Outline checks: ~2 points/check
- **Labs**: ~20% = ~160 points (40 points/unit)
  = ~800 points

**Dual Credit Scale:**

- A > 89.5%
- B = 80 – 89.5%
- C = 70 – 79.5%
- D = 60 – 69.5%
- F < 60%

Indiana Academy Mask Policy

The Indiana Academy will follow Ball State University’s mask policy (see Section IV). Based on current CDC guidance recommending the wearing of face masks for all people—regardless of vaccination status—in public indoor settings in communities where the rate of coronavirus transmission is high or substantial, all employees, students, and campus visitors are required to wear a mask while inside any University building. This requirement is effective on August 9, 2021. Fully vaccinated people are not required to wear masks outdoors.

Individuals who are not fully vaccinated for COVID-19 are required to wear face masks while inside campus buildings and outside when physical distancing cannot be maintained.

If a student declines to wear a face mask as required, the student will be referred to the Director of Academic Affairs or the Director of Residential Affairs. If the situation occurs in a classroom or other academic setting, it is considered a classroom management issue, and the teacher will remind the student of the requirement and give the student a chance to comply with it prior to referring the matter to the Director of Academic Affairs or the Director of Residential Affairs. Wearing masks is crucial to preventing the spread of COVID-19 to others.

Special Circumstances

If you need course adaptations or accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building needs to be evacuated, please make an appointment with me as soon as possible.

If you are struggling with study habits, stress and/or personal issues, I encourage you to discuss this with your SLC and/or contact the Guidance Office for help in dealing with these issues so that you can thrive at the academy. Many resources are available to students and important contact information is listed below:

**For Academic assistance:** Ms. Rebecca Hammons (rebecca.hammons@bsu.edu)
phone: 765-285-8108
office: WA 160-B

**For Tutoring:**
Contact: iaguidance@bsu.edu

**Mental Health Therapist:** Dr. Mindy Wallpe (mcwallpe@bsu.edu)
phone: 765-285-8130
office: WA 160-C
BSU and IA commitment to Diversity
Ball State University aspires to be a university that attracts and retains a diverse faculty, staff, and student body. We are committed to ensuring that all members of the community are welcome, through valuing the various experiences and worldviews represented at Ball State and among those we serve. We promote a culture of respect and civil discourse as expressed in our Beneficence Pledge and through university resources found at http://cms.bsu.edu/campuslife/multiculturalcenter.

The most important thing for students in AP Biology is to advocate your needs!!! Please know I am here to help you!
<table>
<thead>
<tr>
<th>Unit</th>
<th>Week</th>
<th>Lab Topic</th>
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<tbody>
<tr>
<td><strong>Unit 1 - Introduction and Biochemistry</strong></td>
<td></td>
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<tr>
<td>Introduction to the study of biology</td>
<td>Week 1- Aug 16th</td>
<td>What is Life/Big Ideas Activity</td>
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<tr>
<td>Chemistry of life</td>
<td>Week 2- Aug 23rd</td>
<td>Pill Bug Behavior</td>
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<tr>
<td>Water</td>
<td>Week 3- Aug 30th</td>
<td>Water Pennies</td>
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<tr>
<td>Carbon and Molecular Diversity</td>
<td>Week 4- Sept 6th- Extended weekend (No class Mon or Tues)</td>
<td>No Lab</td>
</tr>
<tr>
<td>Macromolecules</td>
<td>Week 5- Sept 13th</td>
<td><strong>Unit 1 Exam</strong></td>
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<td><strong>Unit 2 - Cells and Cell Function</strong></td>
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<tr>
<td>Cell structure and function</td>
<td>Week 6- Sept 20th</td>
<td>Osmosis</td>
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<td>Osmoregulation</td>
<td>Week 7- Sept 27th</td>
<td>Cell Structure</td>
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<td>Cell cycle</td>
<td>Week 8- Oct 8th</td>
<td>Mitosis</td>
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<td></td>
<td>Week 9- Oct 13th- Extended weekend (No class Mon or Tues)</td>
<td>No Lab</td>
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<td>Week 10- Oct 18th</td>
<td><strong>Unit 2 Exam</strong></td>
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<td><strong>Unit 3 - Cellular Energy</strong></td>
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<tr>
<td>Introduction to bioenergetics</td>
<td>Week 11- Oct 25th</td>
<td>Enzymes</td>
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<td>Cellular respiration</td>
<td>Week 12- Nov 1st</td>
<td>Respiration</td>
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<tr>
<td>Photosynthesis</td>
<td>Week 13- Nov 8th</td>
<td>Photosynthesis</td>
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<td>Week 14- Nov 15th</td>
<td><strong>Unit 3 Exam</strong></td>
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<td><strong>Unit 4 - Cells and Cell Function</strong></td>
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<tr>
<td>Cell communication</td>
<td>Week 15- Nov 22nd Thanksgiving No school all week</td>
<td>No Lab</td>
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<tr>
<td>Hormones</td>
<td>Week 16- Nov 29th</td>
<td>Cell communication</td>
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<td>Nervous system signaling</td>
<td>Week 17- Dec 5th</td>
<td>Nervous System</td>
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<tr>
<td>Immune system</td>
<td>Week 18- Dec 13th</td>
<td><strong>Unit 4 Exam</strong></td>
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*The instructor reserves the right to change the syllabus on an “as needed” basis. Students will be notified of any changes, as they might occur. Please be sure to check Canvas and your e-mail regularly for announcements.*