ARIZONA STATE UNIVERSITY

GENERAL STUDIES COURSE PROPOSAL COVER FORM

Course information:

*Copy and paste **current** course information from Class Search/Course Catalog.*

Academic Unit: **College of Liberl Arts and Sciences** Department: **School of Life Sciences**

Subject: **BIO** Number: **151** Title: Biological Thinking Units: 4

Is this a cross-listed course? No
If yes, please identify course(s)

Is this a shared course? No If so, list all academic units offering this course

Course description:

Requested designation: Natural Sciences-SQ

*Note- a **separate** proposal is required for each designation requested*

Eligibility:

Permanent numbered courses must have completed the university's review and approval process.
For the rules governing approval of omnibus courses, contact Phyllis.Lucie@asu.edu or Lauren.Leo@asu.edu.

Submission deadlines dates are as follow:

For Fall 2015 Effective Date: October 9, 2014

For Spring 2016 Effective Date: March 19, 2015

Area(s) proposed course will serve:

A single course may be proposed for more than one core or awareness area. A course may satisfy a core area requirement and more than one awareness area requirements concurrently, but may not satisfy requirements in two core areas simultaneously, even if approved for those areas. With departmental consent, an approved General Studies course may be counted toward both the General Studies requirement and the major program of study.

Checklists for general studies designations:

Complete and attach the appropriate checklist

- Literacy and Critical Inquiry core courses (L)
- Mathematics core courses (MA)
- Computer/statistics/quantitative applications core courses (CS)
- Humanities, Arts and Design core courses (HU)
- Social-Behavioral Sciences core courses (SB)
- Natural Sciences core courses (SQ/SG)
- Cultural Diversity in the United States courses (C)
- Global Awareness courses (G)
- Historical Awareness courses (H)

A complete proposal should include:

- ☐ Signed General Studies Program Course Proposal Cover Form
- ☐ Criteria Checklist for the area
- ☐ Course Catalog description
- ☐ Course Syllabus
- ☐ Copy of Table of Contents from the textbook and list of required readings/books

Respectfully request that proposals are submitted electronically with all files compiled into one PDF. If necessary, a hard copy of the proposal will be accepted.

Contact information:

Name: Scot Schoenborn Phone: 5-3721

Mail code: E-mail: scot.schoenborn@asu.edu

Department Chair/Director approval: *(Required)*

Chair/Director name (Typed): Mike Angilletta Date: 10/31/14

Chair/Director (Signature):

Arizona State University Criteria Checklist for

NATURAL SCIENCES [SQ/SG]

Rationale and Objectives

Public scientific literacy, critical for sound decisions on scientifically infused issues such as climate change, includes understanding of basic science concepts, such as the fundamental behavior of matter and energy. It also includes the understanding that "science" is not an encyclopedic collection of facts. Rather, it is a process of exploration that embraces curiosity, inquiry, testing, and communication, to reduce uncertainty about nature. Absent understanding of scientific concepts and of the nature of science, science and pseudoscience are difficult to distinguish, and normal scientific disagreements may be misinterpreted as ideological or political disputes. The goal of the natural sciences (SQ/SG) requirement, including the laboratory requirement, is to instill understanding of basic science content and of the nature of science in every ASU graduate.

10/1989
REV: 1/1991, 3/1991, 1/2000, 10/2008, 4/2014

Proposer: Please complete the following sections and attach appropriate documentation.

ASU--[SQ] CRITERIA

I. - FOR ALL *QUANTITATIVE* [SQ] NATURAL SCIENCES CORE AREA COURSES, THE FOLLOWING ARE CRITICAL CRITERIA AND MUST BE MET:

YES	NO		Identify Documentation Submitted
☒	☐	**A.** Course emphasizes the mastery of basic scientific principles and concepts.	syllabus & learning objectives
☒	☐	**B.** Addresses knowledge of scientific method.	syllabus & learning objectives
☒	☐	**C.** Includes coverage of the methods of scientific inquiry that characterize the particular discipline.	syllabus & learning objectives
☒	☐	**D.** Addresses potential for uncertainty in scientific inquiry.	syllabus & learning objectives
☒	☐	**E.** Illustrates the usefulness of mathematics in scientific description and reasoning.	syllabus & learning objectives
☒	☐	**F.** Includes **weekly** laboratory and/or field sessions that provide hands-on exposure to scientific phenomena and methodology in the discipline, and enhance the learning of course material.	syllabus & learning objectives
☒	☐	**G.** Students submit written reports of laboratory experiments for constructive evaluation by the instructor.	syllabus & learning objectives
☒	☐	**H.** Course is general or introductory in nature, ordinarily at lower-division level; not a course with great depth or specificity.	syllabus & learning objectives

II. - AT LEAST ONE OF THE FOLLOWING ADDITIONAL CRITERIA MUST BE MET WITHIN THE CONTEXT OF THE COURSE:

☒	☐	**A.** Stresses understanding of the nature of basic scientific issues.	syllabus & learning objectives
☒	☐	**B.** Develops appreciation of the scope and reality of limitations in scientific capabilities.	syllabus & learning objectives
☒	☐	**C.** Discusses costs (time, human, financial) and risks of scientific inquiry.	syllabus & learning objectives

NOTE: CRITERIA FOR |SG| COURSES BEGIN ON PAGE 4.

III. - [SQ] COURSES MUST ALSO MEET THESE ADDITIONAL CRITERIA:			
YES	**NO**		**Identify Documentation Submitted**
☒	☐	**A.** Provides a substantial, quantitative introduction to fundamental principles governing behavior of matter and energy, in physical or biological systems.	syllabus & learning objectives
		B. Includes a college-level treatment of some of the following topics **(check all that apply below):**	syllabus & learning objectives
☒	☐	**a.** Atomic and molecular structure	syllabus & learning objectives
☐	☐	**b.** Electrical processes	
☒	☐	**c.** Chemical processes	syllabus & learning objectives
☒	☐	**d.** Elementary thermodynamics	syllabus & learning objectives
☐	☐	**e.** Electromagnetics	
☐	☐	**f.** Dynamics and mechanics	
[SQ] REQUIREMENTS CANNOT BE MET BY COURSES:			
• **Presenting a qualitative survey of a discipline.**			
• **Focusing on the impact of science on social, economic, or environmental issues.**			
• **Focusing on a specific or limiting but in-depth theme suitable for upper-division majors.**			

Proposer: Please complete the following section and attach appropriate documentation.

ASU--[SG] CRITERIA

I. - FOR ALL *GENERAL* [SG] NATURAL SCIENCES CORE AREA COURSES, THE FOLLOWING ARE CRITICAL CRITERIA AND MUST BE MET:

YES	NO		Identify Documentation Submitted
☐	☐	**1.** Course emphasizes the mastery of basic scientific principles and concepts.	
☐	☐	**2.** Addresses knowledge of scientific method.	
☐	☐	**3.** Includes coverage of the methods of scientific inquiry that characterize the particular discipline.	
☐	☐	**4.** Addresses potential for uncertainty in scientific inquiry.	
☐	☐	**5.** Illustrates the usefulness of mathematics in scientific description and reasoning.	
☐	☐	**6.** Includes **weekly** laboratory and/or field sessions that provide hands-on exposure to scientific phenomena and methodology in the discipline, and enhance the learning of course material.	
☐	☐	**7.** Students submit written reports of laboratory experiments for constructive evaluation by the instructor.	
☐	☐	**8.** Course is general or introductory in nature, ordinarily at lower-division level; not a course with great depth or specificity.	

II. - AT LEAST ONE OF THE ADDITIONAL CRITERIA THAT MUST BE MET WITHIN THE CONTEXT OF THE COURSE:

☐	☐	**A.** Stresses understanding of the nature of basic scientific issues.	
☐	☐	**B.** Develops appreciation of the scope and reality of limitations in scientific capabilities.	
☐	☐	**C.** Discusses costs (time, human, financial) and risks of scientific inquiry.	

[SG] REQUIREMENTS CANNOT BE MET BY COURSES:		
	• Presenting a qualitative survey of a discipline.	
	• Focusing on the impact of science on social, economic or environmental issues.	
	• Focusing on a specific or limiting but in-depth theme suitable for upper-division majors.	

Course Prefix	Number	Title	General Studies Designation
BIO	151	Biological Thinking	

Explain in detail which student activities correspond to the specific designation criteria. Please use the following organizer to explain how the criteria are being met.

Criteria (from checksheet)	How course meets spirit (contextualize specific examples in next column)	Please provide detailed evidence of how course meets criteria (i.e., where in syllabus)
SQB	Each section of the course covers the nature, process, and context of science.	Learning Objective from the Science and Reason section: Process of science - Identify, describe, and apply the scientific method, including basic techniques such as the use of controls
SQE	Where applicable, calculations are performed to illustrate biological concepts as they relate to probability and statistics.	Learning Objective from Genetics Module: - Calculate probabilities and make a prediction of probabilities of contingent and alternative outcomes
SQA	While focused in Biology, this course is grounded in the basic concepts of science and addresses biological concept through this lens.	Module: 1: Science and Reason covers the process in detail.
SQF	BIO 151 includes a weekly lab section that impacts a student's final grade.	From the syllabus: The Biology 100 Laboratory The laboratory is a critical part of BIO100. These are not cookbook exercises in which you are told to this, then that, and then that. Instead, you will be doing science in the lab, trying to solve problems, and formulate and test hypotheses scientifically with hands-on materials.

SQC	Biology is a multidisciplinary approach to science and covers many different areas. This course covers methods for each area	Topical areas covered in class with focus on the process/context of science: Biological Diversity, Ecology, Evolution, Genetics, Cells,& Molecular Biology,
SQG	The Lab is a graded part of the course .	From the Syllabus: You will be doing science in the lab, trying to solve problems, and formulate and test hypotheses scientifically with hands-on materials. The points you earn in lab are based on a mix of quizzes, homework, and a project assignment. Your lab teaching assistant (TA) will explain the details when you meet in lab. Because of the importance of the lab physical experience, you must attend all laboratory meetings.
SQD	Course emphasizes the role of finding new knowledge and how current knowledge is subject to change.	Learning Objective from the Science and Reason module under "Process of Science" -Recognize the role of uncertainty as a necessary feature of the nature of science
SQH	This is an intro level course for students interested in Biology	From the course description: The course uses an active learning approach to engage students in developing their scientific reasoning abilities and in grasping the fundamental concepts of major areas of biology. A hands-on laboratory provides opportunity for students to pursue open-ended investigations that build their mastery of content knowledge, scientific methodology, and data interpretation.

SQIIIA	Touched on in several topical areas of the course	From Respiration and Photosynthesis Science Content -Recognize various forms of energy in the physical world -Perform an energy balance of an organism. -Recognize the definition of Calorie -Relate the physical rules of energy balance to the biological problem of weight gain / loss via diet and exercise. -Recognize and apply the Laws of Thermodynamics in biological situations. -Explain and delineate the process of aerobic respiration, accounting for the molecules involved, including those consumed and produced. -Explain how aerobic respiration releases energy from sugars while capturing it in useful form. -Explain and delineate the process of photosynthesis, accounting for the molecules involved, including those consumed and produced.
SQIIIBacd	Two sections of molecular biology and a section on respiration and photosynthesis..	Molecular Biology 1 (What are genes made of?) Science Content -Evaluate various lines of evidence to determine whether DNA or protein is the molecule of inheritance. -Use evidence to explain the structure of DNA. -Understand how the structure of DNA lends itself to replication.

		-Understand how chromosomes, genes, alleles and DNA relate to one another. Molecular Biology 2 (How do genes work?) Science Content -Describe the central ' dogma' of molecular biology. -List the differences between RNA and DNA. -Understand the structure and functions of proteins. -Describe and accurately demonstrate the processes of transcription and translation -Predict the effects of mutations on an amino acid sequence. -Describe how DNA, genes, alleles and mutations relate to evolution by natural selection. -Delineate the similarities and differences between proteins and nucleic acids Respiration and Photosynthesis: Respiration and Photosynthesis Science Content -Recognize various forms of energy in the physical world -Perform an energy balance of an organism. -Recognize the definition of Calorie -Relate the physical rules of energy balance to the biological problem of weight gain / loss via diet and exercise. -Recognize and apply the Laws of Thermodynamics in biological situations.

Course description

The course uses an active learning approach to engage students in developing their scientific reasoning abilities and in grasping the fundamental concepts of major areas of biology. A hands-on laboratory provides opportunity for students to pursue open-ended investigations that build their mastery of content knowledge, scientific methodology, and data interpretation.

Student Learning Outcomes

Upon successful completion of this course,

- Students will understand the fundamental assumptions of science and be able to recognize and apply the primary components of scientific methodology.
- Students will be conversant in the major foundational concepts across key domains of biology and in their historical underpinnings.
- Students will appreciate the significance of biological understanding for a variety of areas important for human welfare, including medicine and the environment.

BIO151: Biological Thinking

A course about the science behind the science of life.

Instructor: James Elser

Lead TAs: Amanda Suchy and Liz Barnes

Fall 2014

BIO151 Course Contract READ ME!

Your instructor, teaching assistants, and other support staff will be available to answer any questions you have about the course. We are ready and eager to help. Our office hours and contact info are listed on the class Blackboard site. As far as we are concerned, there is no such thing as a stupid question. Don't let things slide. Ask for assistance if you need it. We really want you to succeed!

We pledge to come to class on time, to finish on time, to provide as good a learning experience as we are able, and to treat you with respect for whatever concerns you might have. In return, we ask that you respect your fellow students and us by observing proper in-class etiquette, including the following basic rules:

- Once a week we will have an "opening session" when we discuss the past week's work, set up the coming week, and, generally, have a visitor. During these sessions please do not use laptop computers, tablets, and such unless otherwise instructed. On active learning days, laptops and tablets can be used but must only be used in support of the day's activity. Thanks!
- Cell phones should be OFF during all class periods*. Gracias!
- No food in the classroom. And no drinks near the computers. Arigato!
- Please use courtesy in carrying on conversations - during active learning activities there will usually be a lot of discussion but there will be times when everyone needs to be listening. Xie xie!
- Please do NOT come late to class or leave early from them (bathroom emergencies excepted). If you do this for an active learning meeting (generally Wed and Fri), you will not receive credit for it. Coming late for Monday classes will probably lead you to miss the quiz. Danke!

*You are exempt from this if you are member of the US Secret Service, CIA, FBI, British MI-5, or other high security organization needing high-level communication with the outside world at all times. But we'll need documentation!

By enrolling in this class, you are agreeing to honor these requests.

Required Materials

You are required to purchase (in reality, "rent" since you can turn it back in when you're done) a Turning Point (TP) transceiver ("clicker"), available at the ASU bookstore. NOTE: if you are using this system in other classes, you need get only one; it will work for all your classes. For any problems with TP clicker malfunctions, please contact clickers.asu.edu. NOTE: We do not allow use Response-ware compatible devices because this makes it impossible to ensure that students are not unfairly accessing additional information during quizzes.

Students with Disabilities

We strive to make BIO151 accessible to all students at Arizona State University. However, in order for us to make accommodations for a student with a disability, that student must a) be registered with the Disability Resource Center (DRC) office, and b) must talk to us about the accommodations they need. If you are registered with DRC, please contact us as soon as possible so that we can make a plan of action.

Grade Breakdown

As the semester starts, you have 1000 points and an A. Congratulations! Don't lose them!

Points distribution

Weekly quizzes: 30% (300 points out of 1000)
Lab: 30% (300 points)
In-class activities and preparation: 15% (150 points)
Mid-term Exam: 12.5% (125 points) Exam date: **10 October (re-take: 17 October)**
Final Exam: 12.5% (125 points) Exam date:**10 December at 9:50 - 11:40.**

At the end of the semester, students with 900 points or more will receive an A; 800–899 = B; 700–799 = C; 600–699 = D; fewer than 600 points = E. Note that 250 of these points are earned in lab. We do NOT use the +/- grading system in BIO151.

Weekly quizzes: There will be regular *weekly quizzes* on the first class day of each week (generally on Mondays but see class schedule at the end of this document). Each quiz involves five questions and deals with the preceding week's materials. Because we are not interested in memorization, you can bring one 3 x 5" index card of notes to the quiz (Yes both sides!). You will be able to drop your three lowest quiz scores; there are no "make-up" quizzes (but see Mastery information that follows).

IMPORTANT! You will have the chance to master the material and re-take the quiz within a specified period (about 1 week) to better demonstrate your mastery of the material. This will involve re-reading the assigned materials, re-viewing the mini-lecture videos, and completing some additional practice. Once you complete those mastery tasks, you will be able to re-take a new version of the quiz. If you scored a 4 of 5 on the first attempt, we will take the AVERAGE of your two scores (so BEWARE retaking if you score 4, no?) If you scored 3 of 5 or lower on the first attempt, we will take the HIGHER of the two scores. Yes, you can use a 3 x 5" card for the re-take too. Details of how and where to do the quiz re-take will be provided in class.

NOTE: you cannot take the Mastery quiz if you miss the regular quiz due to unexcused absence.

Your quiz point total will be based on the % of correct answers you get across all the quizzes you took, after dropping the three lowest scores.

In-class activities and preparation: For each week's Module there will be a series of assigned videos to watch and readings to complete *by a given day and time.* This will be tracked on line. The percentage of these you complete *on time* will be used in calculating your "preparation" grade. *Note that you should always complete these assignments anyway, even if you happen to be unable to meet the specific deadline for a given component.*

Each week (generally on Monday), we will have a visitor, either in person or by Skype. These will be really interesting and important people who are scientists and biologists and doing cool stuff that you will want to know about. Each week a set of students will be assigned to do a little research on the visitor and prepare a question to ask him/her. These will serve as "conversation starters" during the Monday visits. Completing this will be part of your participation grade.

Each week (generally on Wednesday and Friday) we will have in-class exercises and activities that will help you learn the material. Your "in-class activities" grade will be based on the percentage of these sessions that you satisfactorily engaged, as judged by your instructor and TAs who are involved in that session. Details about this will be explained in class. One way to be sure to be marked "unsatisfactory" is to arrive late, leave early, mess around, randomly surf the Internet, or otherwise fail to participate fully in the learning activity.

To get participation credit for Active Learning Activities, you must:

1) Be present for the full class period and check in with your clicker when the instructor asks
2) Be actively engaged in the activity during class
3) Turn in necessary documents for each activity

There is also the opportunity to earn "extra credit" during the Active Learning Activities. If your group does an exceptional job on the activity you turn in, you will receive one extra credit point for that activity.

Points Allocated	Present for full class period?	Engaged in activity?	Activity Completed
0	no	no	Turns nothing in
1	yes	yes	Completes activity; may have some misconceptions about material
2	yes	yes	Demonstrates exceptional understanding of material; answers are very thorough and thoughtful

Remember, you must complete ALL three components to receive credit. For example, if you are not present in class, but turn in the activity, you will NOT receive any credit. Sorry, but NO EXCEPTIONS. It is also your responsibility to make sure you are marked as present for class.

Mid-term exam: We will have one mid-term exam with about 25 questions, building on materials from the first part of the class. Because we are not interested in memorization, you can bring one 8.5 x 11" sheet of notes to the exam (yup, both sides!). This exam will be given during the regular class meeting on **10 October, with a re-take version on 17 October** (see below). DO NOT MISS THE 10 OCTOBER EXAM; you are not eligible for the re-take opportunity if you are unexcused from the 10 October exam.

IMPORTANT! Everyone will have the chance to re-take the mid-term exam the following week. To do the re-take, you must complete at least two of the weekly Mastery exercises from the preceding weeks during the period between the first mid-term and the re-take (feel free to do more than 2!). Once you complete those mastery exercises (and *you cannot do the re-take unless you have completed them)*, you will be able to re-take a new version of the mid-term. If your grade for the mid-term was >75%, your mid-term grade will be the AVERAGE of your two scores. If your grade for the midterm was ≤75%, then your mid-term grade will be the HIGHER of your two scores.

Final exam: We will have a final exam with about 50 questions, building on materials from the entire class but focusing a bit more on the second half. Because we are not interested in memorization, you can bring one 8.5 x 11" sheet of notes to the exam. This exam will be given on a particular day during finals week. Please check the ASU Exam Schedule. DO NOT MISS THIS EXAM. Unfortunately there will be no opportunity for a mastery re-take of the final.

Attendance and excused absences: You must attend all class meetings in order to take the quizzes and engage the active learning materials. However, illness and other matters can happen to all of us, so don't come to class sick. If you miss an in-class quiz, there are *no make-ups* but you can present us with written documentation from your doctor or the student health center *within one week* of missing the class to obtain an Excused Absence and then take that week's quiz during the following week as part the Mastery process. (Excused Absences can also be obtained due to family emergencies; these should also be documented.) Otherwise, that "miss" will be counted against the three "low score" quizzes that you are allocated to drop.

Unexcused absences from active learning sessions will affect your preparation/participation points as described above. *In addition, beyond three missed sessions, each one will cost you 2.5% of your overall grade in the class (e.g. 25 points).* If you have questions, please come see us. Note that Excused Absences can also be obtained if you miss class due to official university-sanctioned activity according to standard ASU policy. Note that accumulation of multiple *Excused* Absences will probably initiate a discussion of a medical withdrawal from the class.

If you have a documented illness that results in having Excused Absences from both offerings of the mid-term, your mid-term exam grade will be calculated based on your scores on the weekly quizzes and the final exam. Without that, you will get a zero for the mid-term. Similar rules hold for the Final Exam. It will not be possible be excused from both the mid-term and the final; such a case would entail a medical withdrawal.

Finally, note that it is your responsibility to keep up to date on all announcements and updates provided by the class Blackboard site.

The Biology 151 Laboratory

The laboratory is a critical part of BIO151. These are not cookbook exercises in which you are told to this, then that, and then that. Instead, you will be doing science in the lab, trying to solve problems, and formulate and test hypotheses scientifically with hands-on materials. The points you earn in lab are based on a mix of quizzes, homework, and a project assignment. Your lab teaching assistant (TA) will explain the details when you meet in lab. Because of the importance of the lab physical experience, you must attend all laboratory meetings. If you have a legitimate excuse to miss your scheduled meeting, you MUST make an arrangement with your TA to attend another lab section during that same week. If you miss or depart early from one lab exercise, you will lose 25 points. If you have two such unexcused absences, you will lose an additional 50 points from the course total. If you have three absences from labs, whether they are excused OR unexcused, you will receive a failing grade for the course (except for medical withdrawals). (Late-registering students who have missed a lab due to late registration must contact their lab TA regarding the absence policy as it applies to the first weeks of class.) *Please note*: If your lab falls on a holiday then you MUST sign up and attend a make-up lab within that week. Your TA will provide further information. Your TA will also have a more detailed syllabus that has useful information about what to expect in lab.

Academic Integrity

In the "Student Academic Integrity Policy" manual, ASU defines "'Plagiarism" [as] using another's words, ideas, materials, or work without properly acknowledging and documenting the source. Students are responsible for knowing the rules governing the use of another's work or materials and for acknowledging and documenting the source appropriately." You can find this definition at: https://provost.asu.edu/academicintegrity/defined

Academic dishonesty, including inappropriate collaboration and the uncredited use of other's written work will not be tolerated. We're quite serious about this. There will be severe sanctions for cheating, plagiarizing, and any other form of academic dishonesty, including an "EX" grade for the course and referral to the relevant University judicial body. It is the student's obligation to read and uphold the ASU Academic Dishonesty Policy and act with honesty and integrity and respect the rights of others in carrying out all academic assignments and examinations.

You are strongly encouraged to work in groups for appropriate activities in class and when studying. However, *graded assignments must always be your own independent work.* Students who submit identical or reworded papers or writings of others will be subject to disciplinary action. NOTE! Misuse of TP clickers that may be used in quizzes constitutes cheating and will be dealt with accordingly.

Bottom line: Don't cheat – you're a better person than that!

Threatening and Disruptive Behavior

This is just a small, hopefully superfluous, reminder that ASU has strict policies about student behavior that interferes with the peaceful conduct of university-related business or activities. Consult Student Services Manual sections SSM 104–01, SSM 104–02, and SSM 201–10.

SI (Supplemental Instruction)

SI seeks to help students process material presented in class through facilitated group discussion led by a trained peer who has already successfully completed introductory biology coursework and beyond. More information will be available on Blackboard under the SI Study Group or via our BIO151 SI facilitator Chaylee Kohler (Chaylee.Kohler@asu.edu).

Blackboard Help

You will be using Blackboard a lot this semester. Here are some resources to help if you encounter problems:

- Blackboard help for students: http://asu.force.com/kb/articles/Informational/Blackboard-Help-for-Students/
- Blackboard Test Survival Guide: http://asu.force.com/kb/articles/Informational/Blackboard-Test-Survival-Guide/
- You can search the student's knowledge base at http://asu.force.com/kb/ to locate links to other help articles.
- **For immediate assistance, call ASU at 1-855-278-5080. If you have technical problems, please call them!**
- Visit the My ASU Service Center (my.asu.edu/service) to get personalized support through 24/7 live chat or by submitting your request online.

Class Schedule

Week of:	Module	Monday	Wednesday	Friday
8/17/2014				C (no quiz)
8/24/2014	Module 1: Science & Reason	C (no quiz)	AL	AL
8/31/2014	Module 2: Diversity/Taxonomy	NO CLASS	C (quiz)	AL
9/7/2014	Module 3: Ecology	C (quiz)	AL	AL
9/14/2014	Module 4: Evolution 1	C (quiz)	AL	AL
9/21/2014	Module 5: Evolution 2	C (quiz)	AL	AL
9/28/2014	Module 6: Genetics	C (quiz)	AL	AL
10/5/2014	Module 7: Genetics (con't)	AL	C (cells) (quiz)	MIDTERM EXAM
10/12/2014	Module 8: Cells	NO CLASS	AL	MIDTERM EXAM (re-take)
10/19/2014	Module 9: Molecular Biology 1	C (quiz)	AL	AL
10/26/2014	Module 10: Molecular Biology 2	C (quiz)	AL	AL
11/2/2014	Module 11: Respiration & Photosynthesis	C (quiz)	AL	AL
11/9/2014	Module 12: Organismal Systems (diabetes)	C (quiz)	AL	AL
11/16/2014	Module 13 Global Systems (climate change)	C (quiz)	AL	AL
11/23/2014	Module 14: Science & Reason 2	C (quiz)	AL	NO CLASS
11/30/2014	Module 15: Synthesis & Integration	C (quiz)	AL	AL

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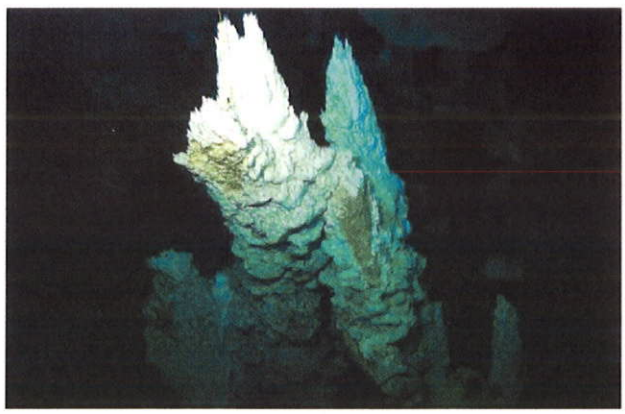
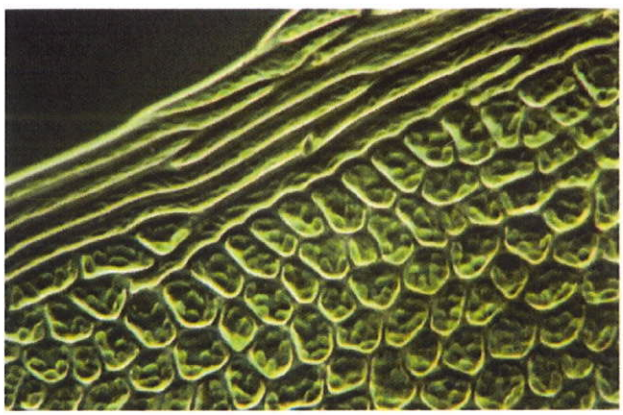
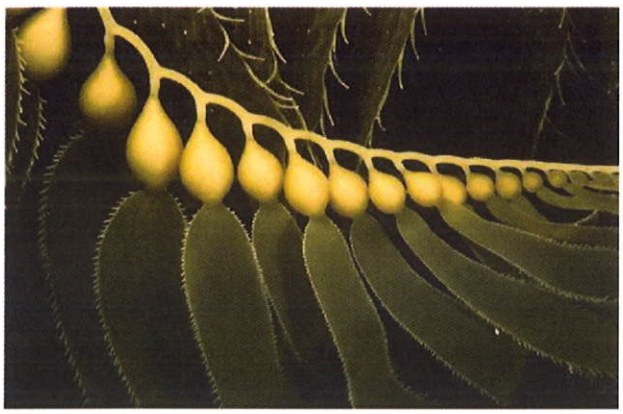
Detailed Contents







Weekly learning objectives for BIO151 Biological Thinking

Science & Reason

Nature of Science

- Identify and describe the philosophical assumptions and limitations of science
- Differentiate among claims/approaches that are scientific and non-scientific
- Use evidence to rank scientific explanations
- Recognize some defining attributes of scientific knowledge
    - It can be biased, but the rules of science are geared to minimize bias.
    - It is stronger when it has multiple lines of evidence.
    - It is always open to change with compelling new evidence.
    - It is established through "fair tests." ("controls")
    - It is not about achieving complete certainty, but rather about achieving relatively low degrees of uncertainty.

Process of science

- Identify, describe, and apply the scientific method, including basic techniques such as the use of controls
- Differentiate among facts, hypotheses and theories.
- Recognize the role of uncertainty as a necessary feature of the nature of science
- Describe why the outcome of a single experiment is rarely sufficient to establish a knowledge claim
- Recognize and explain the differences between a hypothesis and a prediction

Context of science

- Recognize and demonstrate the use of scientific reasoning in personal and societal contexts

Biological Diversity & Taxonomy

Science Content

- Recognize the extent and patterns of distribution of species diversity on Earth.
- Understand the nested hierarchy of shared characteristics
- Use observations and data to classify organisms
- Recognize and use the Linnean system of biological classification

Process of science

- Describe the science of taxonomy and the role of biological classification

Context of science

- Recognize the historical context of taxonomy during "Age of Discovery," Linneaus, etc.

Ecology

Science Content

- Understand some of the major hypotheses for observed variation in species diversity in ecological communities.

- Understand concepts of exponential vs logistic growth and explain the concept of carrying capacity in an ecosystem.
- Understand the effects of limiting factors on population distributions and dynamics.
- Analyze possible causes of population fluctuations
- Describe competitive, mutualistic, predator/prey, and parasitic/disease relationships

Process of science

- Use a model to generate and test hypotheses
- Describe and apply concept of multiple causality

Context of science

- Recognize implications of concepts such as exponential growth, carrying capacity, and limiting factors for human society.

Evolution 1 and 2 (From whence diversity?)

Science Content

- Describe and distinguish creationism, spontaneous generation, and evolution
- Understand and evaluate evidence including the fossil record, homologous traits, vestigial traits, biogeography, and experimental data to assess the validity of the three hypotheses.
- Describe the theory of uniformitarianism and understand its contribution to the development of the theory of evolution.
- Understand how evolution/diversification can account for hierarchy of shared characteristics (including homologous traits, vestigial traits)

Natural Selection

- Describe Darwin's theories and explain how heritable variation and limits on reproductive success lead to differential reproduction (natural selection)
- Propose explanations for the rise of adaptations that are consistent with evolution by natural selection.
- Understand the differences between Lamarck's hypothesis of evolution by inheritance of acquired characteristics and Darwin's theory of evolution by natural selection.

Speciation

- Describe Darwin's theories and how principles of natural selection can lead to speciation
- Define and differentiate between allopatric and sympatric speciation
- Propose and analyze scenarios by which speciation might occur.
- Describe the biological species concept

Process of science

- Distinguish between a theory and a fact in the context of evolution.
- Understand how creationism violates the assumptions of science and identify and articulate the misconceptions/logical flaws of arguments from intelligent design.

Context of science

- Understand the key elements of the historical context within which Darwin's ideas emerged and the events in his life leading to his theory.
- Distinguish between societal controversy about evolution and scientific status of evolution within biology
- Recognize relevance of constitutional limits regarding public school instruction about origins.

Genetics 1 and 2 (Inheritance)

Science Content

Probabilities

- Calculate probabilities and make a prediction of probabilities of contingent and alternative outcomes
- Recognize common misconceptions about randomness (e.g. representativeness, recency, effects of sample size)
- Describe the law of large numbers and its implications for sample size and replicates.

Introduction to Mendel and single trait crosses

- Recognize the historical context within which Mendel's ideas emerged.
- List the aspects of Mendel's experiments that enabled him to postulate his laws of inheritance.
- Understand the assumptions and limitations of Mendel's model of inheritance.
- Make predictions and interpret results of single trait crosses.
- Recognize the role of Mendelian inheritance in various genetic diseases affecting humans.

Extension to two traits (dihybrid)

- Understand Mendel's law of independent assortment and make predictions of two- trait crosses.

Process of science

- Recognize the historical context of genetics concepts leading up to and as transformed by Mendel

Context of science

- Recognize the medical and ethical implications of Mendelian inheritance for human disease

Cells (Cell Theory, mitosis and meiosis)

Science Content

- List the differences between eukaryotic and prokaryotic cells.
- Delineate the components of Cell Theory
- Name where chromosomes are found in the eukaryotic cell and explain why chromosomes come in pairs.
- List the "purposes" for mitosis (growth, repair, asexual reproduction)
- Understand the function of mitosis in terms of the genetic composition of progeny cells
- Explain the importance of meiosis and sexual reproduction in how it relates to Mendelian inheritance.
- Explain the differences between somatic cells, gametes, and embryos, while also understanding how they are related to one another.
- Be able to identify which cells are diploid or haploid (in an average eukaryote)

Process of science

- Recognize the historical events leading to the development of Cell Theory
- Understand the design and interpretation of Pasteur's experiments with "spontaneous generation"

Context of science

- Understand the nature of different categories of stem cells and their potential medical implications

Molecular Biology 1 (What are genes made of?)

Science Content

- Evaluate various lines of evidence to determine whether DNA or protein is the molecule of inheritance.
- Use evidence to explain the structure of DNA.
- Understand how the structure of DNA lends itself to replication.
- Understand how chromosomes, genes, alleles and DNA relate to one another.

Process of science

- Recognize the historical events leading to the discovery of the structure of DNA

Molecular Biology 2 (How do genes work?)

Science Content

- Describe the central 'dogma' of molecular biology.
- List the differences between RNA and DNA.
- Understand the structure and functions of proteins.
- Describe and accurately demonstrate the processes of transcription and translation
- Predict the effects of mutations on an amino acid sequence.
- Describe how DNA, genes, alleles and mutations relate to evolution by natural selection.
- Delineate the similarities and differences between proteins and nucleic acids

Context of science

- Understand the societal (moral / ethical, economic) implications of genomic technologies for medicine, agriculture, industry, criminology, etc

Respiration and Photosynthesis

Science Content

- Recognize various forms of energy in the physical world
- Perform an energy balance of an organism.
- Recognize the definition of Calorie
- Relate the physical rules of energy balance to the biological problem of weight gain / loss via diet and exercise.
- Recognize and apply the Laws of Thermodynamics in biological situations.
- Explain and delineate the process of aerobic respiration, accounting for the molecules involved, including those consumed and produced.
- Explain how aerobic respiration releases energy from sugars while capturing it in useful form.
- Explain and delineate the process of photosynthesis, accounting for the molecules involved, including those consumed and produced.

Process of science

- Recognize the historical events surrounding "phlogiston" theory and how it was transformed to our modern understanding of respiration and photosynthesis

Context of science

- Understand the complexities and societal implications associated with increasing obesity in the USA.

Organismal systems: Homeostasis and health

Science Content

- Analyze and understand the physiological mechanisms of glucose regulation as a homeostatic system.
- Explain diabetes as a failure of homeostatic regulation.
- Describe and explain the structure and nature of positive and negative feedback systems.
- Diagnose interactive systems as involving positive or negative feedback

Process of science

- Understand the key findings and experiments leading to our modern understanding of diabetes

Context of science

- Recognize the impact of current trends in diabetes in modern society.

Ecological systems: Global change

Science Content

- Evaluate the controversy surrounding global climate change by examining scientific evidence.
- Explain the roles of photosynthesis and respiration in the global carbon cycle.
- Distinguish between anthropogenic and "natural" sources of variation in the climate systems.
- Understand the roles of different atmospheric components, including H2O, CO2, and CH4, in altering the radiative balance, and thus temperature, of the atmosphere.
- Analyze changes in atmospheric CO2 concentrations in terms of input and output models.

Process of science

- Read and interpret graphs.
- Understand the role of computer models in scientific investigations

Context of science

- Understand the process of peer review and the meaning of scientific consensus in the context of climate change.

Science & Reason 2

Science content

- Use a chi-square test to estimate the probability that a given outcome is just due to chance.

Process of science

- Apply critical thinking and scientific reasoning to evaluate medical claims
- Explain and distinguish important study design components involved in testing medical (and other) claims: randomization, placebos, double-blind design

- Understand and apply the components of the SEARCH formula to extraordinary claims
- Recognize the limitations of "post hoc" analysis in the context of claims of prophecies of future events.
- Use evidence and the Criteria of Adequacy to rank competing explanations
- Identify, describe, and apply the scientific method, including basic techniques such as the use of controls
- Recognize the role of uncertainty as a necessary feature of the nature of science

Context of science

- Recognize and demonstrate the use of scientific reasoning in personal and societal contexts
- Recognize the role of government regulation in products making medical claims and the limitations of such regulations

Wrap-up

The main objective for this week is:

- to gain a broader perspective on our class, on the role of science in an industrialized economy, and on the role of critical thinking in the functioning of a democracy