NSCI 102 INTRODUCTION TO LIVING SYSTEMS
Fall 2009

Required texts and material:

- Krogh, D. A Brief Guide to Biology with Physiology, Pearson/Prentice Hall
- NSCI102 Concepts of Biology Laboratory Manual – (available at the Omicron coffee table 2nd floor of **Holt Hall**– in front of the Mountain Lion and next to Room 246) - **$15 CASH only**
- TurningPoint Clickers (Available at the ASU Bookstore – keep your receipt)
- Course Dedicated Notebook for Lab (preferably a lined Composition Book)

Our Purpose: Welcome to this class! The intent of NSCI 102 is to help you become more familiar with life on Planet Earth. We will strive to increase your awareness and provide you with a greater appreciation of the biological processes that surround your daily lives. We also want to introduce you to the scientific method of investigation that is the underpinning of biological research and has guided us to our current state of knowledge about biological systems. Importantly, we also want you to have fun participating in this course, incite your sense of wonder of your surroundings while at the same time helping you develop your critical thinking skills.

The overarching goal of the course is to provide you with a greater understanding of the major themes and concepts that portray our living world. To that end, we have divided the course content into three major themes: Ecology and Ecosystems, Evolution, and cell/molecular processes which you will explore in the Human Health and Diseases segment. Each of these major themes will be presented in the same format that consists of three components that are tightly integrated. The first component will be an on-line lecture which will be augmented by readings from the required text. You will access the lecture material using Vista through the University Portal site. There will be a weekly 10-point quiz that will accompany every lecture and it will be administered on-line. The quiz content will cover lecture material as well as text readings and lab material. It is an open-book quiz but you will also need to go through the on-lecture material before taking the quizzes.

The second important component of the course is the laboratory which is really the central component of the course with the lecture and text readings designed to enhance the laboratory. Many of us learn better by doing and the lab experience provides you with the opportunity to formulate hypotheses, conduct scientific investigations, and gain experience in presenting and writing up your results. The labs have been designed along the lines of the three major themes. Each theme will culminate with a presentation and paper prepared by you and a team of collaborators that provides you with the opportunity to synthesize across all of the major concepts that are presented in that particular theme.

Finally, there is a Discussion that accompanies each lecture/lab sequence. Discussion attendance provides the bridge between the other components. Discussion will be led by faculty and will provide the opportunity to clear up foggy concepts, introduce the upcoming lab and discuss current new topics that pertain to the weekly topic.

GRADING AND POINTS

- Your grade in NSCI 102 is determined on the basis of performance on 1) lecture quizzes, 2) exams, 3) discussion and 4) laboratory activities. Your laboratory instructor will monitor your lab performance, and your Discussion leader will monitor your lecture and discussion performance. There are three **Lecture exams based on material covered in lecture, discussion topics, readings AND labs – one exam for each of the three themes. The exams are not cumulative; however the information does build on previous material. Lecture exams will take place during your specific Discussion period for the first two exams and during the assigned time for the final for the third exam. NSCI 102 is a common final course. Tests will be multiple choice and short answer.**
- If you are unable to take a lecture exam because of a serious reason (serious illness, death in family, etc) you may take a makeup a) IF you have a documented serious and compelling reason AND b) IF you contact your Discussion leader within a week of the exam AND c) arrange to take the exam also within the week of the exam. Otherwise you will receive a 0. Makeup exams are not necessarily the same in content or format as the scheduled exam.
- Laboratories are important to your understanding biology – and your grade. Attendance is monitored. **FAILURE TO ATTEND LAB REGULARLY (MORE THAN 2 ABSENCES) WILL RESULT IN AN AUTOMATIC "F" REGARDLESS OF YOUR GRADES.** See the lab manual and your laboratory instructor for lab policy.
- Discussion attendance will be monitored and is also part of your grade. If you are unable to attend your Discussion you should attempt to visit another Discussion section **during the week** that you missed. You should let your Discussion leader know that you have attended another Discussion for the one you missed in a particular week in order to keep accurate records of attendance. Attending two discussions in one week after the week you missed DOES NOT COUNT, you must attend a discussion during the week of the missed discussion. **FAILURE TO ATTEND DISCUSSION REGULARLY WILL RESULT IN A LOSS OF DISCUSSION POINTS.**
- Each week's lecture will be accompanied by an on-line quiz using Vista. The quiz (worth 10 points) will cover the week's lecture topic, last weeks lab AND the current week's lab. Quizzes will open by mid-week of the week preceding the lecture topic and remain **open until Midnight on Monday of the week** following the weeks topic (See quiz schedule on-line). Lectures will remain on-line for the duration of the course. Quizzes are open book and are instantly graded upon your submission of your responses. Quiz grades will automatically be entered into your record and you will be able to access the quiz later under Assessments in Vista FOR REVIEW (but ONLY if you take the quiz!).

YOUR RESPONSIBILITIES

- **Complete the on-line lectures and quizzes in a timely manner.** Labs and Discussion build on the lecture material and if you fall behind in the on-line lecture and quiz portion you will under-perform in the course.
- **Attend your lab section.** Your lab grade is important as it reflects the opportunity for you to gain hands-on experience with many of the concepts that are stressed in lecture. The labs are also based on many different components, all of which receive credit whereas the lecture grade is based on 3 exams. Your lab instructor also has the opportunity to interact with you and monitor your participation in lab activities – be sure your impression is positive rather than negative.
- **Attend your discussion section.** If you do not attend a discussion section you will be unprepared for the upcoming lab. It is assumed that you will be prepared (have read the lab and attended Discussion) before going to lab and thus lab instruction can be minimal. If you

do not show up for lab prepared, you could easily get lost, make mistakes and cost your team of collaborators valuable time.

- **Clickers** – you will be using Clickers in the Discussion and they help form the core of information upon which the Discussion grade points are assigned. It is your responsibility to bring the correct clicker to Discussion and to ensure that it is working throughout the semester. Failure to do so will absolutely influence your grade.
- **Do not hesitate to ask questions.** With on-line lectures, you might feel a bit disconnected from the material. It is important that there be the multiple opportunities to ask questions - in the Discussion (before and after as well), in labs, via email and during faculty and lab instructor office hours. However, it is your responsibility to initiate the process. If you would like to question the grading structure of the course or your specific grade performance, it is in the purview of the faculty in charge to reevaluate your entire performance on the task in question.
- If you want or need to drop the class, you may do so for any reason during the first 2 weeks of the semester through TRACS and during the 3rd and 4th weeks by submitted a Change of Program (COP) form signed by your Discussion leader. After the 4th week, to drop a class, you must have a "serious and compelling" reason as defined by the University – see the University Catalogue or your advisor. (Reasons not considered serious and compelling include low grades, failure to attend class or take tests, dissatisfaction with course material, instructional method or instructor, difficulty of material, pressure of other classes or extracurricular activities!) The Department of Biological Sciences and the College of Natural Sciences interpret the "serious and compelling" rule strictly.
- **All University policies pertain to this course.** This course conforms and adheres to EM 08-40 Code of Student Rights and Responsibility

The point structure below is intended as guidelines. You will accumulate points throughout the semester but ONLY AT THE END of the semester will they be converted to a grade.

POINTS FOR GRADES:

3 Lecture Exams (50 pts each)	150 points
Lecture Quizzes (10 pts each)	150 points
Discussion	130 points
Laboratory (see lab notebook)	380 points
Surveys (on-line assessment)	60 points
Total	**870 points**

	GRADE PERCENTAGE
A	91%
A-	88%
B+	85%
B	81
B-	78
C+	75
C	71
C-	68
D+	65
D	60

NSCI 102 COURSE LECTURE SCHEDULE*

Week No	Week of	*Lecture*	Readings	Discussion and Laboratory
1	Aug 24	*Why is Wyoming so different than Florida? Patterns of ecological diversity.*	Pgs 389-391 Pgs 399-401 Pgs432–445	Introductions & Scientific Method
2	Aug 31**	*How to grow the biggest tomatoes. The environment matters*	Pgs 415-423	Abiotic factors and ecological diversity
3	Sept 7***	*Getting along: maybe - maybe not Biotic Interactions*	Pgs 401-08 Pgs 423-428	Biotic interactions
4	Sept 14	*What happens after the sky has fallen? Disturbance and succession*	Pgs 399-401 Pgs 408-410	Plant succession & disturbance
5	Sept 21	*But what about my brothers, sisters, aunts and uncles? Population ecology*	Pgs 391-399	Presentations and papers
6	Sept 28	*How Life was Shaped*	Pgs 252-269	**DISCUSSION EXAM 1** Lab Notebooks Due Dating sedimentary strata
7	Oct 5	*The Means of Evolution: Microevolution*	Pgs 270-287	Simulating natural selection
8	Oct 12	*The Origins of Species*	Pgs 288-305	**No Discussion or Lab – Campus Furlough**
9	Oct 19	*The History of Life on Earth*	Pgs 306-329	Investigating Common Descent
10	Oct 26	*Survey of the Diversity of Life*	Pgs 330-384	Presentations and papers Human flora
11	Nov 2	*My basic programming, how genes work?*	Pgs 50-52, 215-229, lab manual	Alcohol dehydrogenase & Human flora Part 2 **DISCUSSION EXAM 2** Lab Notebooks Due
12	Nov 9	*Genetic disease, how did I catch that?*	Pgs 137-151, 155-164, 187-198, lab manual	**No Discussion or Lab – Veterans Day**
13	Nov 16	*Yikes, pathogens naturally occurring on my body, I don't feel sick.* *On-line references:* *www.jlindquist.net/generalmicro/102bactid.html*	Pgs 55-66, lab manual	Alcohol dehydrogenase Human flora 3 Toxicology
	Nov 23	THANKSGIVING BREAK		
14	Nov 30	*Oh great, the environment contains molecules that can make me sick.* *On-line references:* *www.biology.arizona.edu/chh/* *www.ilpi.com/msds/index.html#Further* *www.cdc.gov/index.htm*	Pgs 449-458, 513-534, lab manual	Human flora 4 Toxicology
15	Dec 7	*OK, what are my chances of survival, am I doing anything to defend myself?*	Pgs 497-508, lab manual	Presentations and papers Lab Notebooks Due

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Student Learning Outcomes

By the end of each section students should be able to successfully accomplish each of the tasks listed below:

I. Ecosystems and Ecology

Week One: Why is Wyoming so different from Florida? Patterns of ecological diversity. pgs 389-391, 399-401, 432-445

1. Describe the importance of abiotic factors in patterns of ecological diversity.
2. Identify and describe the causes of global patterns in vegetation, the distribution of biomes and their general characteristics.
3. Identify how the interaction between climate and mountains influence vegetation patterns.
4. Describe causes of ecological diversity in aquatic systems.
5. Recognize patterns of ecological diversity at different scales and develop hypotheses as to what abiotic factors might cause the observed diversity patterns.

Week Two: How to grow the biggest tomatoes. The environment matters. pgs 415-423

6. Describe the biogeochemical cycles (carbon and nitrogen), explain the relevance and importance of these cycles in ecosystem processes and the affect humans have had on these cycles.
7. Explain the hydrologic cycle, explain its importance and relevance and human impacts.
8. Identify the causes of climate change, the current evidence that climate change is occurring and humans role.

Week Three: Getting along: maybe – maybe not. Biotic interactions. pgs 401-408, 423-428

9. Describe the relationship between trophic levels, food webs and energy flow. Students can identify and explain the importance if producers, consumers, decomposers, sunlight, and global patterns of productivity. Students will have a basic understanding of the structure and function of trophic levels and ecological food webs.
10. Distinguish the difference between niche and habitat, give examples. Students can provide examples of resource partitioning.
11. Describe how biotic interactions are important for ecological community patterns. They can define, identify and give examples of the following interactions: competition, predator/prey/, host/parasite, commensalism. Students can also distinguish between different types of mimicry and mutualism and their evolutionary basis.

Week Four: What happens after the sky has fallen? Disturbance and Succession. pgs 408-410, 428-432

12. Define ecological community, and know the role of and distinguish the difference between ecological dominant and keystone species.

13. Know how to interpret measures of species diversity as a measure of community composition and distinguish the difference between three measures of biodiversity: species diversity, geographic diversity and genetic diversity.
14. Define disturbance, list/identify the characteristics of disturbance and the three key sources of disturbance. Students can also create hypotheses of the interaction between disturbance and community patterns based on the intermediate disturbance hypothesis.
15. Define succession and describe the causes and differences between primary and secondary succession. Students can interpret the results from the Hubbard Brook experiment testing the relationship between disturbance, succession and nutrients. Student can also describe how life histories characteristics reflect how different species respond to disturbance.

Week Five: But what about my brothers, sisters, aunts and uncles? Population ecology.
pgs 391-399

16. Describe the difference between a community and a population. Students can explain the three things that are important for studying populations. Students can describe or identify the three basic types of population growth patterns, the role of carrying capacity.
17. Identify key life history characteristics that distinguish k-selected and r-selected species and explain how different life history strategies influence population growth patterns. Students can also describe how life history traits are related to successional patterns.
18. Describe the relationship between age distribution and a human population pyramid. Students can draw how human population size as changed in the recent past. Students can explain why human populations have experienced exponential growth. Students can also describe what current population growth trends are, and why. Students can provide an explanation for the difference for population size and resource use per person.

II. Evolution

Week One *"How Life was Shaped"* pgs. 252-269

1. Understand the important difference between "scientific theory" and the common vernacular use of the word "theory".
2. Understand the evolutionary concept of "decent with modification" as the process by which living organisms undergo change through long periods of time.
3. Understand the concept of natural selection and that populations are the fundamental unit that evolves.

Week Two *"The Means of Evolution: Microevolution"* pgs270-287

4. Understand that populations evolve by changes in the frequency of genetic alleles present within the gene pool.
5. Know the difference between evolutionary fitness and "survival of the fittest" concept.
6. Understand the modes of natural selection: stabilizing selection, directional selection, and disruptive selection.

Week Three *"The Origins of Species"* pgs288-305

7. Understand the biological meaning of species.
8. Understand how new species arise and the processes of specialization and adaptive radiation.
9. Gain knowledge of the basics of biological taxonomy and the nature of species relationships.

Week Four *"The History of Life on Earth"* pgs306-329

10. Gain knowledge of the hypothetical abiotic origins of life, including the physical environmental conditions on early earth.
11. Gain knowledge of the Cambian explosion of life, the movement of plants onto land followed by the animals.
12. Understand the evolutionary linage of humans.

Week Five *"Survey of the Diversity of Life"* pgs330-384

13. Gain knowledge of the diversity of life: Bacteria, Archaea and the Eucaryota.
14. Understand the diversity and importance of plant species.
15. Understand the diversity and importance of animal species.
16. Understand the evolutionary development that led to modern species.

III. Human Health Theme

Week One: My basic programming, how genes work? pp 50-52, 202-229, lab manual

1. Draw a crude molecular structure of DNA and explain how the structure of DNA enables DNA to store information.
2. List and describe the steps in gene expression, and use the genetic code to deduce the amino acid sequence of a protein from the gene or mRNA sequence.
3. Explain how enzymes are a subclass of proteins that catalyze biochemical reactions and how their action can lead to different phenotypes, such as alcohol intolerance.
4. Diagram a gene and explain the functions of the different parts of a gene, including non-transcribed regions such as promoters and introns, can describe the steps needed to turn DNA into protein, and can describe the basic properties of the human genome (number of genes, sizes of genes, 5 coding sequence in the genome).

Week Two: Genetic disease, how did I catch that? pp 137-151, 155-164, 187-198, lab manual

5. Explain how the structure of DNA allows it to be copied, how DNA is packaged into chromosomes and how the process of mitosis and meiosis ensure that daughter cells and offspring get a complete copy of all of the DNA.
6. Determine from a picture of a karyotype the ploidy of the cell and whether there are any chromosomal abnormalities, and can explain why chromosomal abnormalities occur and what their consequences are.
7. Analyze a pedigree for a genetic disease and use genotypes and Punnett squares to determine the probability of future children inheriting the genetic disease.
8. Describe the common methods of genetic testing and can interpret test results.

Wk 3 Yikes, pathogens naturally occurring on my body, I don't feel sick. pp 55-66, lab manual

9. Identify the groups of organisms within the "Domains" or "Kingdoms" of life on earth as either eukaryote or prokaryote and describe basic cellular differences between prokaryotes and eukaryotes.
10. Provide functions for prominent cell components, explain the steps in gene expression, define the term "enzyme" and explain the importance of 3-dimensional structure in enzyme function.
11. Describe with example how an antibiotic works. Use an example to explain how an antibiotic can be selective for prokaryote cells and provide an explanation for why it is difficult to find antibiotics that preferentially target viral pathogens.
12. Define the term "flora", explain why pathogens naturally occurring on the human body may or may not inflict disease, and explain mechanisms through which pathogenic bacteria cause disease.
13. Describe a set of experiments that would lead to the identification of an unknown bacterial organism and characterize its susceptibility to antibiotics. Use results from experiments that characterize bacteria to identify them.

Wk 4 Oh great, the environment contains molecules that can make me sick.
pp 449-458, 513-534, lab manual

14. Define the terms "element", "molecule", "toxin", "toxicant", "MSDS", "LD50", "dose", and "exposure". Describe or identify or give examples of potential sources of toxins. Recognize polarity in a molecule and make predictions on water solubility for a molecule when presented with the molecular structure. Describe or identify potential paths of toxicant movement within the environment and food chain.
15. List or identify sites of toxicant absorption, metabolism, and excretion within the human body. Describe the metabolism and pathway of example toxicants within the environment and the human body. Using examples explain at the molecular level how toxicants disrupt normal cellular function.
16. Analyze toxicity test panels on human samples and use material safety data sheets and the Centers for Disease Control to assess risks from exposure and identify any health threatening toxins that match symptomology displayed by the test subject.

Wk 5 OK, what are my chances of survival; am I doing anything to defend myself?
pp 497-508, lab manual

17. Explain the origin of mutations in DNA and how DNA proofreading and repair mechanisms work.
18. Describe with examples how toxicants can be eliminated from within the human body.
19. Describe or explain responses of the human immune system to viral and bacterial invaders.

NSCI 102
LABORATORY SCHEDULE
Fall 2009

Lab Period	Theme	Week of	Topic	Lab Manual Pages	Other
1	Ecology	Aug 24	Project Assignment, Scientific Method; Eco-Regions Homework, Develop Soil Hypothesis	1, 4, 8, 12	Student Safety Contract Collect soils for next lab
2	Ecology	Aug 31	Abiotic factors and Ecological Diversity	12	Collect galls for next lab
3	Ecology	Sept 7	Ecological Diversity Biotic interactions: Oaks, Gall Wasps,	21	Paper OutlineDue
4	Ecology	Sept 14	Plant succession & disturbance	29	Outlines Returned
5	Ecology	Sept 21	Presentations and Papers turned in		Peer and Group Review
6	Evolution	Sept 28	Varves: Dating Sedimentary Strata Project Assignment	37, 39	Notebooks Due Lecture Exam
7	Evolution	Oct 5	Simulating Natural Selection	43	
8	Evolution	Oct 12	Lab Cancelled due to Campus Furlough	54	Outline Due **emailed to TA**
9	Evolution	Oct 19	Investigating Common Descent	63	Outline Returned
10	Evolution	Oct 26	Presentations and Final Papers turned in Human Flora	90, 95	Peer and Group Review
11	Cell/ Molec	Nov 2	Alcohol dehydrogenase; Human flora - continued Case Study Assignment	79, 80, 98	Notebooks Due Lecture Exam
12		Nov 9	Labs Cancelled – Veterans Day Holiday		
13	Cell/ Molec	Nov 16	Alcohol dehydrogenase - Continued Human Genetics; Bacterial characterization ; Toxicology	85, 87 101,109	Outline Due
		Nov 23	THANKSGIVING BREAK		
14	Cell/ Molec	Nov 30	Antibiotic inhibition and Toxicology	107, 109	Outline Returned
15	Cell/ Molec	Dec 7	Presentations and Papers turned in		Peer and Group Review Notebooks Due