BIOL 1310/1311 Concepts in Biology

Purpose/Goals:

This course is designed to give students the background needed to understand some of the mechanisms and issues related to modern Biology. Specifically, this course content reflects that needed to cover the Tennessee State Standards for K-6. Covering topics such as cell biology, genetics, ecology, and evolution will provide an appreciating of some of the critical issues in modern biology (i.e. stem cells, genetic testing, environmental effects, and evolution) Since many of this topics are currently being discussed and debated in our society, this course will provide the backgound for students to be part of the discussion. Being a one semester course, students can still get important biological concepts and be able to take another science course (Chemistry 1080 or Physics 1080) and stay within the 120 credit hour limit.

The course was designed based upon the Tennessee State Standards. Below is the list of content-standards that I designed and used in the course design:

Content Standard	**Grades**						
Biological Concepts	**K**	**1**	**2**	**3**	**4**	**5**	**6**
Cell Structure and Function							
Cell Theory	X	x	x	x	x	x	x
Cells make tissues					x		
Animal Cells					x	x	x
Plant Cells					x	x	x
Interactions Between Living Things/Environment							
Senses	X						
Plant and Animal Interrelationships		x	x	x			
Effect of pollution on environment		x	x	x			
Living vs non-living			x	x			
Specific ecosystems					x	x	
Oganisms change environment					x	x	
Symbiosis							x
Competition							x
Diversity and Adaptation Among Living Things							
Adaptation allows survival	X	x	x				
Diversity		x	x				
Classification				x	x		
Diversity of adaptation					x	x	x
Form and Function affects adaptation							x
Food Production and Energy for Life							
Basic need for food/water/light		x	x				
Relationship between plants and animal				x			
Structure of plants in relation to food production				x			
Animals use of food					x		
Function of structures utilized for obtaining nutrients					x	x	
Photosynthesis						x	
Food chains							x
Heredity and Reproduction							

Need for reproduction			x				
Offspring resemble parents			x				
Changes in organisms re: development			x	x			
Changes during development				x			
Similarities between parents and offspring				x			
Characteristics are transferred from parents to offspring					x		
All organisms have life-cycles					x	x	
Examine how plants reproduce						x	
Examine the concept of generations and populations						x	
Biological Change							
Plants and Animals go extinct		x	x				
Fossils represent connections between living and extinct organisms				x	x		
Organisms are endangered and/or threatened						x	
Investigate the fossil record in sedimentary rock							x
Evidence of life forms changing over time							x
Examine relationship between environment and extinction							x

Course Objective:

- PROVIDE CONCEPTUAL KNOWLEDGE OF MODERN BIOLOGY.
- PROVIDE UNDERSTANDING OF MAJOR BIOLOGICAL CONCEPTS.
- PROVIDE EXPERIENCE WITH THE SCIENTIFIC METHOD.
- PROVIDE STUDENTS WITH THE OPPORTUNITY TO DEMONSTRATE THEIR ABILITY TO FIND AND INTERPRET BIOLOGICAL INFORMATION.
- PROVIDE STUDENTS WITH A FOUNDATION TO UNDERSTAND 21ST CENTURY ISSUES RELATED TO BIOLOGY.
- PROVIDE STUDENTS WITH THE OPPORTUNITY TO RELATE LEARNED CONCEPTS TO CURRENT ISSUES.

Major Assignments:

- Students will take an exam after each section of the course. This exam will be short-answer, matching, and fill-in-the-blank formats.
- Students will prepare a "portfolio" on three dfferent topics. This exercise is meant to see if the students can use the concepts to futher their understanding of a specific topic. Students will orally present these "portfolios".
- Students will participate in weekly online discussions.
- During lab, students will complete assignments, write a lab report, demonstrate the ability to design simple experiments, and complete a comprehensive lab practcle at the end.

Method of Assigning Grades:

- Grades will be assigned according to this scheme:
  - Portfolios
    - first one-5%
    - second one 5%
    - third one-10%
  - Exams
    - 10% for each exam
  - Online discussion
    - 15%
  - Laboratory
    - 25%

Attendance Policy:

Attendance is expected in the lecture and required in the lab. If you know ahead of time you need to miss class, please contact me by e-mail. If you miss an exam, you must make that up within a week of the original exam date. Missed labs can not be made up and you will not be allowed makeup assignments, etc.

Recommended Readings and Supplemental Materials:

Internet related resources such as:
www.mhhe.com/enger12
www.cellsalive.org

Course name and number

BIOL 1310 Concepts in Biology/ BIOL 1311 Concepts in Biology Lab

Required text

ENGER E. ROSS F, AND BAILEY D. CONCEPTS IN BIOLOGY, 12TH EDITION (2007) MCHILL, BOSTON MA.

Required technology

Students utilize web-based assignments. During the first year (fall 2005), I purchased an electronic portfolio program for all the students (TOOT). Unfortunately, I was unable to convince the students to use this software. (I think that in terms of using technology, freshman students seem less likely to venture into uncharted territory.)
This fall, I purchased a clicker-system for the classroom. It has taken several months to get the system installed but we are going to use the system fully during the spring semester.

Catalog description of the course including prerequisites and credit hours

BIOL 1310 (4 cr). Course designed for students needing one semester of biology. Covers basic themes of biology including cell theory, heredity, reproduction, energy conversion, interactions, and diversity. 3 lectures/week.

BIOL 1311 (0cr). Introduction to scientific method, use of microscopes, designing and implementing experiments; data collection and interpretation. 2 hours/week.

Course outcomes or goals

AFTER COMPLETING THIS COURSE THE STUDENT SHOULD BE ABLE TO:

- **UNDERSTAND HOW THE STRUCTURE OF THE CELL RELATES TO ITS FUNCTION.**
- **APPRECIATE THE DIFFERENCE BETWEEN ASEXUAL AND SEXUAL REPRODUCTION.**
- **EXPLAIN MITOSIS IN TERMS OF CHROMOSOMES.**
- **EXPLAIN MEIOSIS IN TERMS OF CHROMOSOMES.**
- **UNDERSTAND THE REQUIREMENT FOR ENERGY IN BIOLOGICAL SYSTEMS.**
- **APPRECIATE HOW PHOTOSYNTHESIS AND CELLULAR RESPIRATION INTERACT.**
- **UNDERSTAND THE OVERALL MECHANISM OF THE SENSES AND HOW THEY ALLOW ORGANISMS TO INTERACT WITH THEIR ENVIRONMENT.**
- **APPRECIATE THE CONCEPT OF COMMUNITY IN TERMS OF ECOLOGY.**
- **UNDERSTAND THE DIFFERENCES BETWEEN COMPETITION, PREDATIOIN, AND SYMBIOSIS.**
- **RELATE HOW INTERACTIONS BETWEEN ORGANISMS CAN AFFFECT ISSUES OF POPULATION SIZE AND DIVERSITY.**
- **UNDERSTAND THE BASIC CONCEPT OF EVOLUTIONARY CHANGE.**
- **APPRECIATE EFFECTS OF ENVIRONMENT ON THE ABILITY OF OPRGANISMS TO CHANGE.**
- **RELATE CHANGES IN TIME TO SIMPLE MODELS OF GENE AND EFFECTS ON GENES.**

a. Is the course designated as meeting a General Education requirement?

The course has been evaluated by the University General Education committee and is awaiting a decision from the TBR committee.

b. Outline of course content

Major Topics: **WEEK**	**LECTURE TOPICS**	**LAB**
1	**CELL THEORY**	**EXPERIMENTAL DESIGN**
2	**CELL STRUCTURE**	**USING THE MICROSCOPE**

3	CELL FUNCTION	MICROSCOPY BASICS AND ANIMAL TISSUES: AN INTRODUCTION
4	CELL REPRODUCTION	REPRODUCTION AND DEVELOPMENT
5	HEREDITARY	CHEMICAL COMPOSITION
6	HEREDITARY/DEVELOPMENT	PHOTOSYNTHESIS
7	ENERGY CONVERSION	DESIGN YOUR OWN LABS
8	ENERGY CONVERSION	Demonstrate your own labs
9	INTERACTIONS WITH INVRONMENT	TOUNGE TASTE ANALYSIS
10	INTERACTIONS WITH OTHER ORGANISMS	Data Analysis and Reporting
11	INTERACTIONS WITH INVRONMENT	DESIGN YOUR OWN LABS
12	EVOLUTION AND BIOLOGICAL CHANGE	THANKSGIVING HOLIDAY
13	EVOLUTION AND BIOLOGICAL CHANGE	DEMONSTRATE YOUR OWN LABS
14	EVOLUTION AND BIOLOGICAL CHANGE	LAB PRACTICAL

c. Information on projects, activities, exams used in evaluating student outcomes.

In the lecture, the students take several in-class exams that are short-answer, concept-based questions. In addition, the students complete several D2L based exercises that involve posting in various discussion boards. Another mode of evaluation is the production of "portfolios" based on specific state standards. In these "portfolios" students must demonstrate how they would approach specifc state standards with specific concepts to be covered and hands-on activities to be used. The students give a brief oral presentation on their "portfolios" and are evaluated by the following matrix: In the lab, students collect data from a 5-week long experiment utilizing *Brassica rapa* growth under different conditions. This data is then collected and each student writes a lab report on the experiment. In addition, the students are provided the opportunity to design their own experiments/exercises that are geared toward a specific state standard.

The final evaluation is a lab practical that is developed to allow the students to demonstrate skills such as using the microscope.

Examples of student work can be found at http://faculty.etsu.edu/millerh/1310

2. A chart or narrative on these courses indicating when they have been offered so far or will be offered. It is also possible that a syllabus has not yet been developed, but a date has been projected for when the course will be offered. Are any of the courses offered at branch campuses? Enrollment by semester beginning the academic year before the grant (04F-05Spring) would be helpful. For general education courses taken by other majors as well as education majors, the enrollment is not as important. However, perhaps, you have increased access to these courses by offering them in summer. If so, then indicate this.

Course	Fall 06`	Spring 07	Fall 07
BIOL 1310	25	13	17
BIOL 1311	25	13	17

Note: this course did not exist until fall 2006. We are planning to offer at least 2 sections of this course in the near future, pending ongoing discussions of TA support.

Staffing
2. Who is teaching the revamped courses? Any new people, reassignments, adjuncts?

Hugh Miller III, PhD, Associate Professor in Biological Sciences developed and taught the BIOL 1310/1311 course. Grant funds were used to support part-time instructors who assisted Dr. Miller with teaching the 2 lab sections.

Facilities and materials
1. Describe changes in space allocation
2. Purchases using grant funds

I purchased a license for each student in my Fall 06 section to the TOOT electronic portfolio software. I also purchased 30 clickers for use in the Habitat classroom.

3. Storage of materials

Each instructor has a cabinet assigned in the Habitat classroom.

4. Smart classrooms, instructional technology

Instructional delivery--may be included in syllabi
1. Interviews with faculty on what they feel they are doing differently

I have taken a different approach with designing and teaching this course. Having read the literature on science education and realizing that elementary school teachers must cover many different subjects, I decided that this course needed to be concept driven instead of the usual terminology driven science course. These students must understand concepts in order to teach biology, the specific content and terminology is always available especially with the Internet. I also realized that as we are covering these critical concepts, I should provide the students with the opportunity to use the state standards and the learned concepts to describe how they might teach these concepts to K-6

students. The other advantage to requiring these "portfolios" is that the students acquire skills needed to search the Internet for high-quality activities that are useful for supporting the state standards.

2. *Use of clickers, math manipulatives, computer simulation of science labs*

I purchased clickers for the Habitat and plan on incorporating them into the spring 2008 section of the course.

3. *Electronic portfolios/personal websites for students*

As outlined above, I require students to develop "portfolios" that outline how they might teach a specific state standard and set of concepts that go along with those standards. These "portfolios" must include the following:

- **Identification of a specific grade and the associated state standard.**
- **A discussion of the concepts to be covered linked to the state standards.**
- **A list of resources.**
- **Examples of "portfolios" are available at http://faculty.etsu.edu/millerh/1310**

4. *Changes in classroom assessment*

I decided to utilize multiple levels of assessment: 1) Concept driven short-answer exams, 2) discussion posting on the D2L course site, 3) various types of homework including assigning a chapter to read and each student provides three questions from their reading which defines the lecture for that chapter, and 4) the "portfolios" as described above.