Lorraine Madsen Buckley

Sabbatical Report - Spring 2012

Through internet and library research, collegial discussion, and visitation at a distance education institution, I explored distance education for life sciences at Oxnard College. Our institution has a physical science distance education course, but this will be the first life science course to become distance education.

The first portion of my sabbatical was focused on general distance education pedagogy and philosophy (bibliography included in Appendix 1). This exploration was important for me to address specific concerns that I had regarding the differences between distance and traditional education. Furthermore, I needed to learn the basics of distance education in science. I am now convinced that distance ed is critical for well-motivated students with conflicts regarding classroom time such as child care and work.

One of the concerns that I retain regarding distance education is that students must have strong verbal skills, work ethics, and motivation to be successful in an online course. For these reasons I suspect, the course should have English composition and reading comprehension prerequisites.

Most of the sabbatical was devoted to developing content for the course. A bibliography of online activities and sources for reading assignments and other content is included in Appendix 2. One of the most important influences on the development of this course was the PULSE initiative. I had the good luck to meet the manager of this National Science Foundation project to improve undergraduate biology education. He made available extensive recent research results and the collaborative efforts of hand-picked biology professors called “Vision and Change.” In addition, he shared the educational resources from the Howard Hughes Medical Institute.

Finally, I developed the basis for the course outline that I plan to submit to the curriculum committee in the 2012/13 academic year. These outcomes included the topic outline (Appendix 3), the grading rubric (Appendix 4) and the course objectives and competencies (Appendix 5).

Sabbatical Report - Spring 2012

Results listed and numbered according to "Implementation and Timeline" sections of Proposal

1. Jan: Explore distance education pedagogy
   Appendix 1
2. Jan: Select a General Education science course in my discipline
   Biology 101
3. Feb: Research other online courses
   Oklahoma State Univ, Alan Hancock CC, Murray State Coll.
4. Feb: Review and select a textbook
   Online, non-copyrighted, resources
   Biology: Science for Life by Belk & Borden 2012
   Pearson Publishing Co.

5. Feb/Mar: Develop online questions/activities for textbook chapters
   Appendix 2
6. Feb/Mar: Develop online activities for course topics not in textbook
   Appendix 2
7. Mar: Find online reading assignments on current topics
   Appendix 2
8. Apr/May: Sequence topics/activities for a 18-week course
   Appendix 3
9. Apr/May: Write a grading rubric for online course
   Appendix 4
10. Summer Fall Semester 2012: Course Outline Development
    Appendix 5

APPENDIX 1

DISTANCE EDUCATION BIBLIOGRAPHY

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Kelly, Rob. 2011. The challenge of teaching across generations. *Online Classroom.* Magna. www.facultyfocus.com. Downloaded: 19.I.12.

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Panagopoulos, Lisa. 2011. Virtual sections: a strategy for managing large, online classes. *Online Classroom.* Magna. www.facultyfocus.com. Downloaded: 10.I.12.

Reavis, David and Charles Mohundro. 2011. Internal or External Email for Online Courses. *Online Classroom.* Magna. www.facultyfocus.com. Downloaded: 17.I.12.

Sull, Errol Craig. 2011. On the Road Again: Keep your computer happy! *Online Classroom.* Magna. www.facultyfocus.com. Downloaded: 12.I.12.

Tolan, Denise. 2011. Making Visible the invisible. Online Classroom. Magna. *www.facultyfocus.com.* Downloaded: 12.I.12.

APPENDIX 2

Online BIOL Media and Activites

Science and Pseudoscience

Church of the Flying Spaghetti Monster: http://www.venganza.org/index.htm

Scientists: www.scienceheros.com

Scientific Paper example: **http://www.scientificamerican.com/article.cfm?id=what-is-third-hand-smoke**

Random sampling: http://www.bbc.co.uk/schools/ks2bitesize/

Hypothesis Testing: **http://biology.clc.uc.edu/courses/bio104/sci_meth.htm**

Definition of Life

Are viruses alive? http://serc.carleton.edu/microbelife/yellowstone/viruslive.html

Chemistry of Life

Interactive Periodic Table that runs quickly: http://www.chemicalelements.com/

www.kahnacademy.org/organiccompounds

Cells

Microscopy

Introductory Lesson on Microscopy: http://www.microscopy-uk.org.uk/index.html?http://www.microscopy-uk.org.uk/primer/history.htm

Gallery of TEM, SEM and light microscopy: http://www.xtalent.com

SEM structure, function, gallery: http://www.mos.org/sln/sem/

www.kahnacademy.org/cellanatomy

DNA – Watson, Crick, Franklin, Wilkin

http://news.bbc.co.uk/2/hi/science/nature/2895681.stm

http://www.nature.com/nature/dna50/index.html

http://www.kcl.ac.uk/dna/scientists/franklin.html

http://www.americanfieldguide.com/wgbh/evolution/library/06/3/image_pop/l_063_01.html

http://www.phschool.com/science/science_news/articles/happy_anniv.html

http://news.bbc.co.uk/onthisday/hi/dates/stories/april/25/newsid_2932000/2932793.stm

http://osulibrary.orst.edu/specialcollections/coll/pauling/dna/pictures/franklin-typeBphoto.html

http://www.ba-education.demon.co.uk/for/science/dnamain.html

http://www.strangescience.net/rfranklin.htm

DNA – Transcription/Translation

http://biology.clc.uc.edu/courses/bio104/dna.htm

Mitosis

www.kahnacademy.org/mitosis

www.kahnacademy.org/stemcells

Cancer

http://www.insidecancer.org/

http://outreach.mcb.harvard.edu/animations_S03.htm

http://www.nature.com/nature/journal/v448/n7155/full/nature05985.html

Henrietta Lacks story:
http://www.hopkinsmedicine.org/news/publications/hopkins_medicine_magazine/hopkins_medicine_magazine_spring_summer_2011/web_extra_honoring_the_henrietta_lacks_legacy_at_hopkins

Meiosis

Bioflix: http://www.youtube.com/watch?v=kVMb4Js99tA&feature=related

Cells Alive: http://cellsalive.com/meiosis.htm

The Biology Project: http://www.biology.arizona.edu/cell_bio/tutorials/meiosis/main.html

NOVA: http://www.pbs.org/wgbh/nova/body/how-cells-divide.html

Spermatogenesis/Meiosis in male:

http://www.youtube.com/watch?v=k2kclHg0ohU&feature=related

http://www.youtube.com/watch?v=POpbN6RHOO0

live sperm:
http://www.youtube.com/watch?v=HxZwuXpS15g&annotation_id=annotation_537659&src_vid=DZKLko4hyog&feature=iv

The Great Sperm Race: documentary. www.wellcome.ac.uk

www.kahnacademy.org/meiosis

http://biology.clc.uc.edu/courses/bio104/meiosis.htm

Ovulation

http://www.youtube.com/watch?v=NkLUA05ExHA&feature=related

Review of recent research on cellular-level reproductive physiology

http://www.channel4.com/microsites/G/TGSR/PDF/Great-Sperm-Race.pdf

Reproduction

http://www.biotopics.co.uk/genes1/asexual_and_sexual_reproduction.html

www.kahnacademy.org/fertilization

Genetics

Tutorials: http://www.biology.arizona.edu/mendelian_genetics/mendelian_genetics.html

Lecture resources: http://www.mendelweb.org/

www.kahnacademy.org/punnettsquare

Genetic diseases: http://www.ncbi.nlm.nih.gov/books/NBK22183/

Photosynthesis

http://www.youtube.com/watch?v=mYbMPwmwx88

Bioflix – photosynthesis – www.mybiology.com

www.kahnacademy.org/photosynthesis

Respiration

Bioflix – respiration – www.mybiology.com

www.kahnacademy.org/respiration

Ecology

http://www.poodwaddle.com/worldclock.swf

Climate Change

http://www.epa.gov/climatechange/

evidence: http://climate.nasa.gov/evidence/

Application: http://www.powershow.com/view/bca3a-NWQ5N/Impacts_of_climate_change_on_key_aspects_of_freshwater_salmon_habitat_in_Washington_State_flash_ppt_presentation

Evolution

Flock of Dodos – film reported on Carol Brewers Lab site

National Academy of Sciences, Working Group on Teaching Evolution. 1998. Teaching about Evolution and the Nature of Science. National Academy Press, Washington, D.C. (Online at: http://www.nap.edu/readingroom/books/evolution98 accessed on September 10, 2005)

http://www.natcenscied.org

http://www.pbs.org/wgbh/evolution

http://evolution.berkeley.edu/evolibrary/home.php

www.kahnacademy.org/evolution

http://www.open.ac.uk/darwin/index.php

Diversity and Extinction

http://adsabs.harvard.edu/abs/2008CorRe..27..459V

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Alberts, Bruce. 2010. Key Terms in Undergraduate Biology Education. National Academy of Sciences. Video Lecture: downloaded 13 IV 12 from http://visionandchange.org/bruce-alberts/

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Futuyma, Douglas. 1982. Science on trial: the case for evolution. Pantheon Books, New York.

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Appendix 3

Topic Sequence

1 Intro

2 Scientific Method

3 Experiments – penicillin and bread mold; Fleming

4 Atom/molecule; Bohr

5 organic compounds/nutrition

6 diabetes & obesity

7 trophic ecology of communities - Smitty

8/9 Test 1

10 Cell anatomy

11 Diffusion/Osmosis

12 Membrane Transport and hormones

13 Enzymes

14 Photosynthesis

15 respiration

16 Ecosytem ecology - Climate change

17/18 Test 2

19 DNA and Watson/Crick

20 Cell division –

21 cancer

22 reproduction

23 genetics: Punnett square; Mendel

24 Transcription/translation

25 Genetics of behavior; Wilson

26/27 Test 3

28 Natural Selection; Darwin

29 Micro- and macroevolution; Gould

30 Diversity/Taxonomy; Linnaeus & Randall

31 Extinction events; Eldredge

32 Ecology of Population growth;

33/34 Test 4

35 Review

36 Final

37 Recap

Appendix 4

Grading Rubric for Online Biology Course

10 % Online discussions/chats: weekly participation required

30% Written assignments on reading and online media: 30

10% Quizzes: 10 - 15

40% Tests: 4

10% Final Exam

Appendix 5

Core Competencies, Core Concepts, & Lesson Objectives

for General Biology Online

Core Competencies

1. Ability to apply the process of Science
2. Ability to use quantitative reasoning
3. Ability to use modeling and simulation
4. Ability to tap into the interdisciplinary nature of science
5. Ability to communicate and collaborate with other disciplines
6. Ability to understand the relationship between science and society
    a. Value of science in society
    b. Application of biology for global challenges
    c. Preparation of future workforce
    d. Ethical implications of biology

Core Concepts

1. Evolution
2. Structure and function
    a. Molecular to ecosystem
    b. Information exchange

3. Pathways and transformation of energy and matter
    a. Laws of thermodynamics
    b. Application of biological systems to human engineering challenges
4. Systems
    a. Connectivity/interaction

Lesson Objectives

1. Process of Science

- Describe the meaning of the term "science;"
- Define the domain and limitations of science;
- Distinguish between science and non-science;
- Defend the importance of scientific thinking in society and in everyday life.

- Give examples of three philosophies of science and briefly distinguish each:
- Describe, explain, and give examples of the observational method of science;
- Describe, explain, and give examples of the comparative/descriptive method of science;
- Describe, explain, and give examples of the experimental method of science;
- Define, explain, and construct hypotheses;
- Define, understand, and identify the different types of variables, groups, and comparisons of data used in both comparative and experimental studies in science;
- Describe and diagram the scientific peer-reviewed publication process and explain the function of each element of the process;
- List the typical major parts and sections included in scientific papers and explain the purpose of each;
- Explain why statistics are necessary in the analysis of data and valid conclusions;
- Define bias and denial and to give examples of the ways they can result in erroneous conclusions;
- Define the scientific meanings of the terms theory, principle and law, and to distinguish the difference in the layperson's use of the term theory versus the scientific use of that term.
- Distinguish between science and pseudoscience

2. <u>Evolution</u>

- Explain reasons that evolutionary biology is a true science in relation to the criteria of the process and methods of science
- Define evolution including examples;
- Explain how bias can corrupt logical thinking in considering scientific explanations with which a person may not personally agree;
- Give an overview of evolutionary change at the molecular level;

- Summarize the range of phenomena in nature that are explained naturally within the framework of evolution
- Summarize the major influences, including observations from his travels, that affected Darwin's thinking about nature and that led him to discover the Theory of Evolution by Natural Selection and its main components.
- list and explain each component of natural selection theory;
- State natural selection theory from the gene/molecular viewpoint;
- Define fitness and explain how there can be multiple fitness strategies in individuals of the same species;
- Recognize conditions that would favor one reproductive strategy over another in terms of fitness;
- Give examples of a variety of fitness strategies;
- Define common terms and facts associated with the topic of natural selection and fitness.

3. Chemistry of Life

- Understand that life processes obey the natural laws of chemistry and physics;
- Identify examples of relevance of chemistry in your personal life
- Identify examples of applications of chemistry of life in society, such as in medicine, environmental science, and basic research.
- Briefly explain the first two laws of thermodynamics and their relationship to life.
- Give the names and symbols for important elements in living things;
- Draw the atomic structure using a Bohr diagram of oxygen, carbon and hydrogen
- Write the molecular and structural formula for water, carbon dioxide, sodium chloride and oxygen
- Explain radioactive isotopes and their affects, good and bad, in biology;
- Describe the uses for radiocarbon and other radioisotope dating techniques;
- Give five examples of properties of water that are important in living systems;
- Define the nature of the hydrogen bond and its importance in the properties of water and DNA
- Define acids and bases, explain the pH scale, and to describe the significance of pH in living systems;
- Distinguish between organic and inorganic molecules
- Name four major classes of organic molecules important in life and give examples of each
- Describe the nature of a polymer and identify the monomers (building blocks) of carbohydrates, lipids, proteins, and nucleic acids
- Classify an unknown compounds as inorganic or as one of the four major classes of organic compounds based on chemical and/or structural formulas;

- Discuss the health and/or environment significance of such compounds as steroids, saturated fats, transfats, and organic pollutants;
- Explain how basic chemistry is critical to better understanding other topics on cell structure and function, inheritance, evolution, and ecology;
- Define common terms and facts associated with basic chemistry and chemistry of life.

4. Cells

- Describe the main points of the cell theory;
- List three main types of microscopes (one light and two electron) and state the capabilities and limitations of each;
- Identify the parts of a light microscope, describe their functions
- Recognize images of microscopy and identify the type of scope that made the image
- Define cell organelle;
- Name, define, and summarize the structure, function, and location of each of eight cell organelles;
- Define and contrast prokaryotic and eukaryotic cells and to give examples of each;
- Define the endosymbiotic hypothesis for the evolution of the eukaryotic cell and explain at least three examples of evidence that supports this hypothesis.

5. Cell division: Mitosis/Meiosis

- Define mitosis and meiosis, where each occurs and its function;
- Explain the phrase "reduction division" and “mitotic division”
- Identify the kind of cells produced by mitosis and meiosis;
- Define diploid and haploid chromosome numbers and explain the significance of the haploid number;
- Explain the significance of meiosis and fertilization in the production of genetic variation in offspring;
- Compare/contrast mitosis and meiosis;
- Describe the life cycle of a human at the cellular level the terms: fertilization, mitosis, meiosis, gametes, zygote, haploid, diploid, male, female
- Explain crossing over and its significance.

6. Genetics

- Define alleles and describe where in the cell they are located;
- Use and manipulate a model of DNA;
- Differentiate between genotype and phenotype;
- State the name of the "Father of Genetics" and give the type of organisms that he studied;
- Use a Punnett Square to calculate proportions of genotypes from crosses;
- Infer parental genotypes based on data from offspring genotypes and vice versa;

- Name and explain examples of human genetic disorders that show Mendelian patterns of inheritance;
- Define common terms associated with the topic of Mendelian genetics including dominant/recessive and homozygous/heterozygous
- Define, explain, and give examples of multiple alleles, polygenic inheritance, linkage, sex-linked traits, epistatic genes, pleiotropic genes, incomplete dominance, and codominance;
- Explain abnormalities in chromosome number and give a specific example of a syndrome caused by abnormal numbers;
- Describe the meaning and value of genetic counseling and genetic therapy;
- List and briefly explain methods of determining and identifying genetic risks in both preganancies and adults;
- Define karyotyping;
- Suggest pros and cons for parents' descisions to do fetal testing or not to do fetal testing
- Define common terms and facts associated with the topic of modern genetics.
- Write a description of a genetic disease and how DNA affects the symptoms of the disease
- Define microevolution, population and gene pool;

7. Diversity of Life

- Define natural history; explain why it is called “natural”
- Explain the importance of natural history and its relationship to the study of certain biological levels of organization;
- State the range for number of species estimated to exist on Earth today and the approximate number of extant (living) species named already in scientific literature;
- Name, describe, and give examples of each of the five kingdoms of life;
- Define taxonomy and state its importance in the study of life;
- List and define each major hierarchal category in the modern Linnean system of classification of life;
- Describe the meaning and use of binomial nomenclature and identify common sources of names;
- Write scientific names in proper style and state the reason for that style;
- Define phylogeny and understand its purpose in the study of life;
- Define cladistics and understand its function in the study of life;
- Know common terms and facts that relate to diversity, taxonomy, classification and phylogeny;
- Know specific terms important in cladistics and describe their role in the construction of cladograms.

8. Ecology

- Define ecology; relate its several subdisciplines with biological levels of organization.

- Define symbiosis; distinguish among predation, parasitism, commensalism, and mutualism and explain examples of each.
- Explain the difference between r and K selected populations; relate population growth of humans to r and K selection using examples of other species.
- Describe connectivity of populations within communities and of biotic and abiotic components of ecosystems.
- Discuss energy cycling in ecosystems and relate to energy use by humans;
- Distinguish between renewable and nonrenewable energy and give examples.

*Core competencies and concepts are those recommended by the Taskforce for Vision and Change of Undergraduate Biology Education (NSF, HHMI, NIH). Lesson objectives include original phrases and those selected from similar courses at other institutions (NCC, UVI, UTM, MSC, JSCC, VC).