SEP 1995

GRANDE PRAIRIE REGIONAL COLLEGE

SCIENCE AND TECHNOLOGY DEPARTMENT
BIOLOGY INSTRUCTIONAL GROUP

COURSE: BIOLOGY 1080 - ORGANISMS IN THEIR ENVIRONMENT

SECTIONS: Two sections are offered each term.
Each lecture section has two lab sections.

Lecture Section	A2/3	MWF	- 1100-1150
Lab Sections	AL1	T	- 0800-1050
	AL2	T	- 1500-1750
Lecture Section	B2/3	TR	- 1100-1250
Lab Sections	BL1	M	- 0800-1050
	BL2	M	- 1500-1750

TRANSFERABILITY:
U of A - Biology 108
U of C - TBA
U of L - TBA

INSTRUCTORS:

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DESCRIPTION:
BIology 1080 is an introduction to how the diverse organisms on this planet have been affected by their environment and how the current environment is the product of the activities of organisms. The course also examines how evolution has operated over long time periods to produce major groups of organisms and how evolutionary origins are reflected in their classification. The principles that underlie our understanding of the major lineages will be discussed using examples from monera, fungi, protists, animals, and plants. A description of the involvement of organisms in major ecosystem processes leads to an evaluation of the stability of those systems and of human impact on the processes.

REQUIREMENTS:

A. Since presence at lectures and laboratories, participation in classroom discussion and projects, and the completion of assignments are important components of this course, students will serve their interests best by regular attendance. Those who choose not to attend must assume whatever risks are involved. In this connection, the attention of the students is directed to the Academic Guidelines of the College.
B. MidTerm Exam
C. One final Lecture Exam (Scheduled by the Registrar's Office during Term Exam Week)
D. Final Lab Exam
E. Occasional Lecture and Lab Quizzes and Reports

EVALUATION:

A. Lecture/Lab Quizzes	- 15%
B. MidTerm Exam	- 25%
C. Final Lab Exam	- 20%
D. Final Lecture Exam	- 40%

RESOURCES:

(NOTE: The textbook and study guide recommended for this course are also used in Biology 1070)

Campbell, N. A. 1993. Biology. (3rd ed.). Benjamin/Cummings Publishing.

Caris, N., and H. T. Underwood. 1993. Class Notes for Campbell's Biology Third Edition. Benjamin/Cummings Publishing.

Lab Manual: TBA

Biological Sciences 108
Organisms in their Environment

Course Description

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Lecture 1: Introduction

1. There are many different kinds of organisms; their characteristics reflect the interactions of their ancestors with the environment. Biological systems may be studied on scales from molecular to planetary.
2. All organisms affect their current environment.
3. An organism's "environment" includes other organisms.

Lecture 2: Biological organization and the importance of water:

1. Why life needs water and adaptations to its conservation within the organism. Water as habitat.
2. Water as a medium for feeding from diffusion, to straining to hunting.
3. Water as a medium for reproduction and dispersal.

Lecture 3: Classification; Kingdom

Concepts:

1. Organisms can be classified into five Kingdoms,based on their nuclear and cell wall structure and mode of nutrition.
2. Organisms can be classified into three kingdoms based on their rRNA.
3. The kingdom is the most inclusive taxon (category) in the taxonomic hierarchy.

Lecture 4: Classification and taxonomic hierarchy.

Concepts:

1. Classification is the way of organizing and systematizing the diversity of organisms, both living and extinct.
2. Taxonomy is the naming and identification of organisms and the theory and practice of classification, and systematics is the study of diversity .

Lecture 5: Naming of organisms ; the relationship of classification to evolution.

1. Names are assigned to organisms according to strict rules of nomenclature, and these rules may vary according to kingdom.
2. Phylogeny is the geneology of a group of organisms and accurately determining lineages yields predictive classifications
3. Modern classifications attempt to reflect phylogeny and use a diverse set of data and analystical techniques in that endeavor.

Lecture 6: Genotype and phenotype

1. An organism's genotype is its genetic makeup.
2. Its phenotype is its observable characteristics.
3. Different phenotypes can develop from the same genotype because of the interaction between the genotype and the environment as the organism develops.

Lecture 7: Natural selection and evolution:

1. Natural selection refers to the fact that, giving the phenotypic and genetic diversity among individuals in a population, not all will contribute equally to subsequent generations .
2. Selection can act on a continuously varying characteristic in three different ways: to change its mean, to decrease its variance or to split the distribution into two.
3. Natural selection acts on the phenotype, but its effect is on future genotypes.

Lecture 8: Species concept and Speciation:

1. There is a range of species concepts which vary among taxonomic groups.
2. Speciation can occur following geographic isolation (allopatric) or without isolation.
3. Rates of speciation and evolution depend on the strength of selection and on the generation time of the organism.

Lecture 9: Changing planet; first organims:

1. The distribution of land masses, the composition of the atmosphere and the global climate have changed over geological time.
2. Life evolved in a primeval world where the atmosphere possessed no free oxygen. Those first organisms obtained their energy from chemical sources, using something other than oxygen as the terminal electron acceptor.
3. There are still extant organisms that live under similar conditions and in similar ways , some of the Prokaryotes .

Lecture 10: Classification of prokaryotes:

1.All organisms need to get energy and material (such as Carbon, Nitrogen and so on) from their environment.The greatest diversity of modes of nutrition is found in the prokaryotes.

2. Traditional methods of defining prokaryotic taxa rely on mode of nutrition, morphology, staining reactions, and biochemistry while current methods employ molecular genetics.

3. Prokaryotes-may be grouped into the Archaebacteria, and Eubacteria which is interpreted as including the cyanobacteria, and Prochlorophyta.

Lecture 11: Modes of nutrition:

1. Energy can be derived initially from light or from reduced chemicals such as organic matter, Sulfur, Ammonium, Nitrite , Hydrogen or Iron (2+).
2. Thermophilic bacteria: ecosystems not based on photosynthesis
3. Fermentations (& industrial applications).

Lecture 12: Prokaryotes in their environment.

1. Methanogenic bacteria (fuel, greenhouse gas) .
2. Iron and sulfur bacteria (iron deposits later mined)
3. Photobeterotrophs (an unusual "mixed" metabolism).

Lecture 13: Photosynthesis in prokaryotes - effect on atmosphere.

1. There are a variety of prokaryotes which are photosynthetic but do not produce oxygen.
2. The photosynthesis of the Cyanobacteria slowly polluted the atmosphere with oxygen (i.e., the organisms altered the environment of the planet).
3. The presence of oxygen made different kinds of metabolism possible (e.g. chemoautotrophy) and the accumulation of ozone in the upper atmosphere allowed the diversification of aquatic unicellular organisms.

Lecture 14: Endosymbiosis: Examples from living protists, origin of eukaryotes.

1 Some organelles of eukaryotic cells resemble prokaryotic cells. These may have originated by endosymbiosis, e.g., chloroplasts and mitochondria.

2. Some living organisms, the Prochlorophytes, may be considered closely related to green plant chloroplasts.

3. The endosymbiotic origin of chloroplsts helps in understanding relationships among photosynthetic eukaryotes.

Lecture 15: Evolution and classification of eukaryotes.

1. Eukaryotic organisms are classified based on their mode of nutrition and cellular organization and biochemistry.
2. Eukaryotic organisms include autotrophs and heterotrophs.
3. Eukaryotic organisms have a great diversity of life cycles.

Lecture 16: Meiosis and the alternation of generations.

1. Meiosis is an important prerequisite for sexual reproduction.

2. Sex provides an important source of variation for natural selection to act on.
3. Different groups of organisms place greater or lesser emphasis on stages in the alternation of generations.

Lecture 17: Multicellularity: Different advantages for different groups.

1. Multicellularity gives greater flexibility of growth form and enables an organism to exploit the environment in different ways.
2. Multicellularity provides physical advantages to a plant such as structures that enable it to maintain its position in turbulent water and escape from some herbivores.
3. Multicellularity provides similar advantages to predators and the potential to feed on multicellular plants.

Lecture 18: The Fungi

1. The fungi are distinguished by their cell walls and absorptive mode of nutrition.
2. Some fungi have a dikaryotic phase in their life cycle.
3. Fungi are important as decomposers and as agents of fermentation producing a wide range of products.
4. Lichens represent a widespread symbiosis between green algae and fungi.

Lecture 19: Plants: Major trends in plant evolution:

1. Reduction of gametophyte generation
2. Less reliance on liquid water
3. Development of conducting tissue

Lecture 20: Changing terrestrial environments: land plants and mycotrophy,

1. Mycotrophy involving plants and fungi was integral in the origin and development of land plants.
2. Relict groups of fungi are currently widespread in association with almost all plant groups and recently evolved groups (e g., orchids, ericads) have experimented with new types of mycotrophism.
3. Land plants display structural, transport, and reproductive modifications, and various groups have dominated the planet through time.
4. Land plants diversified in the Devonian and possibly effected the climate.

Lecture 21: The flowering plant in its environment:

1. Water relations, gas exchange and soil nutrients are all important i nteractions with the environment.
2. Modifications of plant parts deal with these interactions in different envirnmental conditions.

3. Plants have a major affect on the environment experienced by other organisms.

Lecture 22: Major trends in animal evolution:

1. The [illegible] of invertebrates
2. The continued success of insects
3. Vertebrate geneology

Lecture 23: Animals and their evolution in terrestrial environments:

1. Animals and their diversification - responses to the changing environment.
2. Extinction events and their causes:Extinctions appear to be periodic. There are many theories about the extinction of dinosours. Different processes may cause extinctions.
3. Relict species.

Lecture 24: The environment of a terrestrial vertebrate:

1. Temperature control, nutrition and gas exchange are important aspectes of interaction with the environment.

2. Some such animals can affect their environment at the landscape scale (elephants, beavers).

Lecture 25: Interactions force strong selection: predation, competition.

1. The interaction between a predator and its prey can drive the evolution of both (the deer flees; the wolf pursues).
2. Competition is also a strong selective force (that's why trees are tall).
3. An organism's environment contains many selective pressures, and evolutionary changes may reflect a balance.

Lecture 26: Interaction and selection: coevolution, mutualism.

1. Coevolution is the evolution in two or more species of adaptations caused by selection imposed on the other.
2. Many plant/insect relationships exist (food plant/herbivore, food plant/pollinator, nest site provider/defender from grazers).
3. Most host/parasite, predator/prey, cleaner/cleaned relationships are likely to involve coevolution.

Lecture 27:

1. Some examples of symbiosis, parasitism, etc., involve the following: fungi - smuts and rusts, alkaloid producing fungi that discourage herbivory of plants; plants - heterotrophy - Indian pipe, orchids, dodder, mistletoe etc.; animals - tapeworms.

3. How do long lived, slowly evolving species deal with parasites, herbivores and pathogens that evolve more quickly?

Lecture 28: Concept of ecosystem: an organism's environment at a large scale.

1. Ecosystems consist of living and nonliving components. The living components are of a great range of evolutionary ages.
2. The components function together and energy flows through the system.
3. Elements and minerals cycle in ecosystems

Lecture 29. The carbon cycle: biotic and abiotic processes.

1. Most reduced carbon enters ecosystems as a result of carbon dioxide fixation by photosynthesis.
2. Reduced carbon moves through ecosystems as a results of herbivory, carnivory and decomposition, becoming oxidized to carbon dioxide.
3. The cycling of carbon is closely linked to the flow of energy through the trophic levels.
4. The balance between physical and biological parts of the carbon cycle is being disrupted as a result of human activity.

Lecture 30: The Nitrogen cycle

1. Nitrogen in the atmosphere is not available to most plants.
2. Nitrogen fixation is carried out by eubacteria (cyanobacteria, legume nodules, Frankia etc.)
3. Other steps in the Nitrogen cycle are mediated by other micro-organisms.

Lecture 31: Humans in the environment. (pre)historical effects. 1. Hunter-gatherers and "ecological harmony" (sustainability).

2. General impacts of agriculture and deforestation on natural communities (crop plants, e.g., corn (maize), wheat, rye; domestication of animals - grazers).
3. Historical aspects (e.g., Mediterranean, Mesopotamia, Central America, Iceland).

Lecture 32: How scientific knowledge can help solve environmental problems:

1. Scientific knowledge can be used to ameliorate negative affects on the environment.
2. Eutrophication can be a natural process, but cultural eutrophication can be reversed.
3. There are many examples of invasions of "pests" due to human disposal and knowledge of organism's biology can help solve some problems of invasions.