



## **Course Syllabus**

### **BIOL 1413 - General Zoology**

**Catalog Description:** Biol1413 offers an introduction to the animal kingdom providing the foundation for advanced studies in agriculture, medicine, zoology, and other biological sciences. Students will study the following principles defined in *The Academic Course Manual Guide 2012 (ACGM)* for the State of Texas: "Study of the principles of taxonomy, molecular biology, and ecology as they relate to animal form and function, diversity, behavior, and evolution." (Lab fee) (26.0701.51 03) Lecture hours = 3, Lab hours = 1

**Prerequisites:** None

**Semester Credit Hours:** 4

**Lecture Hours per Week:** 3    **Lab Hours per Week:** 3

**Contact Hours per Semester:** 96

**State Approval Code:** 2607015103

**Course Subject/Catalog Number:** BIOL 1413

**Course Title:** General Zoology

**Course Curriculum:** State Criteria (those marked with an X reflect the state-mandated competencies taught in this course) (*double-click on the box and choose 'checked' or 'not-checked'*)

#### **Basic Intellectual Competencies in the Core Curriculum**

- Reading
- Writing
- Speaking
- Listening
- Critical thinking
- Computer literacy

#### **Perspectives in the Core Curriculum**

- Establish broad and multiple perspectives on the individual in relationship to the larger society and world in which he/she lives, and to understand the responsibilities of living in a culturally and ethnically diversified world.
- Stimulate a capacity to discuss and reflect upon individual, political, economic, and social aspects of life in order to understand ways in which to be a responsible member of society.
- Recognize the importance of maintaining health and wellness.
- Develop a capacity to use knowledge of how technology and science affect their lives.
- Develop personal values for ethical behavior.
- Develop the ability to make aesthetic judgments.
- Use logical reasoning in problem solving.

- Integrate knowledge and understand the interrelationships of the scholarly disciplines.

### **Mathematics**

The objective of the mathematics component of the core curriculum is to develop a quantitatively literate college graduate. Every college graduate should be able to apply basic mathematical tools in the solution of real-world problems.

- To apply arithmetic, algebraic, geometric, higher-order thinking, and statistical methods to modeling and solving real-world situations.
- To represent and evaluate basic mathematical information verbally, numerically, graphically, and symbolically.
- To expand mathematical reasoning skills and formal logic to develop convincing mathematical arguments.
- To use appropriate technology to enhance mathematical thinking and understanding and to solve mathematical problems and judge the reasonableness of the results.
- To interpret mathematical models such as formulas, graphs, tables and schematics, and draw inferences from them.
- To recognize the limitations of mathematical and statistical models.
- To develop the view that mathematics is an evolving discipline, interrelated with human culture, and understand its connections to other disciplines

### **Natural Sciences**

The objective of the study of a natural sciences component of a core curriculum is to enable the student to understand, construct, and evaluate relationships in the natural sciences, and to enable the student to understand the bases for building and testing theories.

- To understand and apply method and appropriate technology to the study of natural sciences.
- To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses, and interpretation both orally and in writing.
- To identify and recognize the differences among competing scientific theories.
- To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.
- To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.

**Instructional Goals and Purposes:** To provide instruction in an atmosphere of mutual respect where students may develop their intellect and skills. To contribute to the development of students as responsible and informed members of society. To provide courses for students wishing to complete certificate programs, associate degree programs or wishing to transfer to a baccalaureate program

### **General Course Objectives:**

1. To help prepare students who wish to pursue upper division coursework in biology or biology-related fields.
2. To help students develop an appreciation for the history and development of science.
3. To help students become better informed citizens by providing opportunities to learn the differences between science as a way of knowing and other disciplines such as art, philosophy and religion
4. To provide students an opportunity to understand and appreciate the complexity and relationships of living systems.
5. To help students become better informed regarding the role of animals in the environment and the use of animals by humans.

- To make students aware of changing technologies in science and the responsibilities and ethical decisions that come with the use of various technologies.
- To help students become better informed regarding environmental issues

### Specific Course Objectives:

#### Unit 1. Zoology: General Considerations, Basic Chemistry, Cells and the Organization of Life

##### Zoology: Evolutionary and Ecological Perspectives

- define biology, zoology and related terms ( eg. Specializations by sub-discipline and taxonomic categories)
- list the general characteristics of science as defined by U.S. District Court Judge William R. Overton
- and explain the circumstances in which these characteristics were defined
- explain the scientific method
- differentiate between the physiological sciences and evolutionary sciences
- discuss the difficulty in defining life
- identify the characteristics of life
- discuss the importance of being able to view living things from both an evolutionary and an ecological perspective
- explain what hypothesis is being made when zoologists classify animals into taxonomic groups

##### The Chemical Basis of Animal Life (from Online Learning Center or ESP CD)

- explain why understanding chemistry is important to an understanding of biology
- identify and describe atoms and elements
- discuss the structure of atoms and related concepts such as atomic number, atomic mass, energy-level shell
- differentiate between atoms, compounds and molecules
- explain the effect of the condition of the outer electron shell on bonding
- differentiate between covalent, hydrogen and ionic bonds
- explain the pH scale
- describe the general structure, essential elements, building blocks and functions of each of the four major groups of organic compounds and their various classes

Cells, Tissues, Organs, and Organ Systems (*NOTE: Most, if not all, of these concepts will be covered in the laboratory. However, the student will be responsible for this information on both lecture exams and lab quizzes.*)

- recognize or describe the modern cell theory
- define cells
- explain the importance of surface-to-volume ratio in cell size
- identify the cell membrane, describe its structure and function
- discuss the fluid-mosaic model of cell membrane structure
- list 6 major functions of cell membranes
- define *homeostasis* and *selective permeability*
- differentiate between *simple diffusion*, *facilitated diffusion*, *osmosis*, *filtration*, *active transport*, *endocytosis (pinocytosis, phagocytosis, receptor-mediated endocytosis)* and *exocytosis*.
- recognize the various organelles and structures of eukaryotic cells and their relative composition and functions.
- explain the composition and functions of the nucleus
- define *tissue*, *organ* and *organ system*.
- identify the 4 major types of tissues in animals and the various classes of those tissues.
- relate the composition of various tissues to their function.

#### Unit 2: Energy: Basic Concepts, Enzymes, and the Harvesting of Energy from Nutrients

##### Energy and Enzymes: Life's Driving and Controlling Forces

- discuss an animal's use of radiant energy from the sun

2. recognize or write the Laws of Energy Transformation
3. define *producers, primary and secondary consumers, food chain and related terms*
4. define energy
5. discuss the significance of activation energy as it relates to enzymes, chemical reactions and reaction rates.
6. compare and contrast exergonic and endergonic reactions; catabolic and anabolic reactions
7. define enzymes and recognize their structure, functions and relationship to a substrate
8. list factors affecting enzyme activity
9. define cofactors and coenzymes; include examples of each and their role in enzyme reactions
10. describe briefly the conversion of ATP  $\leftarrow \rightarrow$  ADP and the significance of the compound(s) to living cells
11. define substrate-level phosphorylation and oxidative phosphorylation

#### How Animals Harvest Energy Stored in Nutrients

1. identify and describe the major pathways in cellular respiration
2. describe the important by-products for each of the major pathways in aerobic respiration
3. discuss the metabolism of lipids and proteins
4. compare and contrast aerobic and anaerobic respiration
5. explain the control of metabolism
6. describe the significance of the metabolic pool

### Unit 3. Cell Division and Inheritance; Protection, Support and Movement

Cell Division and Inheritance Systems (*NOTE: Most, if not all, of these concepts will be covered in the laboratory. However, the student will be responsible for this information on both lecture exams and lab quizzes.*)

1. define *gene, genetics, inheritance* and related terms
2. differentiate between chromatin, nucleosome, sex chromosome, autosomes, heterochromatic and euchromatic regions
3. explain why not all chromatin is equally active
4. describe three different genotypes for gender determination and tell which organism(s) possesses which type
5. describe the diploid, haploid and polyploidy conditions
6. describe the major processes in the two types of cell division and the major events in each process [eg. cytokinesis, karyokinesis (mitosis, meiosis)]
7. describe the differences between mitosis and meiosis in terms of the cells which participate in each and the resulting ploidy of the offspring cells
8. define replication, transcription and translation; list the major events in each and relate the role each plays in the cell
9. describe the various types of changes that can occur in DNA
10. recognize various patterns of inheritance
11. explain the Law of Segregation and the Law of Independent assortment and their significance to genetic variation
12. recognize the molecular basis of various inheritance patterns

#### Protection, Support, and Movement

1. describe various representative integumentary systems
2. explain the structures and functions of the various integumentary systems
3. compare and contrast the skeletal systems of invertebrates
4. describe the major composition of the vertebrate skeletal system
5. compare the skeletal systems of fishes, tetrapods, and humans
6. compare and contrast muscular and non-muscular movements
7. describe the properties of animal muscles
8. compare and contrast the different types of animal muscles.
9. compare the various muscular systems and locomotion forms of invertebrates
10. describe the functions of tendons in the muscular system of invertebrates

11. compare the muscular systems of fish and other vertebrates
12. describe the structure of a skeletal muscle
13. give a basic explanation of the control of muscle contraction

#### **Unit 4. Communication: Nervous and Sensory Systems, The Endocrine System and Chemical Messengers**

##### Communication 1: Nervous and Sensory Systems

1. describe the importance of neurons and their properties.
2. describe the 3 functional types of neurons.
3. describe the 3 functional types of neurons.
4. explain neuronal communication.
5. compare and contrast resting potential and action potential in terms of the relative charges and ion concentration outside and inside the cell membrane.
6. describe the roles of the end bulb, synapse, synaptic cleft, electrical synapse, chemical synapse, neurotransmitters
7. give 2 examples of neurotransmitters
8. explain what happens to nerve transmission in cases of botulism poisoning.
9. describe the 5 general evolutionary trends in nervous systems development in invertebrates.
10. describe the characteristics of the vertebrate nervous system.
11. describe the 2 main divisions of the vertebrate nervous system, their subdivisions and the functions of each.
12. describe the structure and function of the spinal cord
13. relate the number of spinal nerves to the number of segments in the trunk and tail of a vertebrate.
14. describe the structure and function of the brain and its various parts
15. describe the main division of the autonomic nervous system and their functions
16. briefly describe the composition and processes of sensory receptors.
17. list 9 examples of receptors in invertebrates, identify their uses and identify the organism(s) in which they are found
18. List 11 examples or categories of vertebrate receptors, describe their function and indicate the organism in which they are found.

##### Communication 2: The Endocrine System and Chemical Messengers

1. Differentiate between endocrine and exocrine system (glands) and give an example of each.
2. describe the 5 categories of chemical messengers
3. define hormones and related terms
4. describe the biochemistry of hormones
5. explain feedback control of hormonal secretions
6. describe mechanisms of hormone activations
7. list some examples of hormones in invertebrates and some of their functions
8. provide a general description of a vertebrate endocrine system.
9. describe the basic composition of the endocrine system in vertebrates other than birds and mammals
10. briefly describe the endocrine system of birds
11. describe the endocrine system of mammals including a discussion of the various glands, their locations, and functions

#### **Unit 5: Circulation, Gas Exchange, Nutrition and Digestion, Temperature and Body Fluid Regulation**

##### Circulation and Gas Exchange

1. Write a general description of internal transport or circulatory system and the relationship of such a system to homeostasis.
2. contrast the various transport systems (circulatory-including lymphatic system and gas exchange) in invertebrates and vertebrates

3. compare the characteristics of invertebrate coelomic fluid , hemolymph, and blood cells
4. describe the transport systems of vertebrates.
5. describe the composition of body fluids
6. describe and compare various circulation systems
7. describe the mammalian heart and trace the path of blood through the heart beginning with deoxygenated blood
8. describe the circulatory vessels
9. describe and compare various respiration systems
10. describe the structure and function of mammalian respiratory systems

#### Nutrition and Digestion

1. describe organisms by their energy sources and carbon sources
2. identify the steps of processing foods
3. compare feeding adaptations and of animals
4. describe the process of digestion and the organization of the alimentary canal
5. explain regulation of food intake
6. describe nutritional requirements of animals, especially compare micro- and macronutrients
7. explain how the energy value of food is measured
8. describe the physiological roles of various essential minerals (macronutrients) and various trace minerals (micronutrients)
9. list or recognize the various water-soluble vitamins, their characteristics, functions, sources (selected vitamins )
10. describe the various digestive structures and their structures (invertebrates, mammals and other selected vertebrates)
11. list or recognize the major digestive glands, secretions and enzymes in mammals.

#### Temperature and Body Fluid Regulation

1. define homeostasis
2. describe the birth of the concept of homeostasis
3. describe the 2 sources of potential changes in an organism's internal environment
4. describe and compare osmotic regulation in marine, freshwater, and terrestrial organisms.
5. describe various invertebrate excretory structures and explain their functions
6. describe the vertebrate kidney and explain its functions
7. explain the different forms of temperature regulation
8. describe some adaptations for coping with temperature fluctuations
9. describe some adaptations for coping with hot environments

### **Unit 6: Reproduction and Development, Embryology**

1. differentiate between various forms of asexual and sexual reproduction
2. define hermaphroditism
3. describe 2 types of parthenogenesis
4. explain the advantages and disadvantages to sexual reproduction
5. compare the plans of reproduction systems in various vertebrates
6. describe the human male reproduction system
7. describe the human female reproduction system
8. explain gametogenesis in male and female
9. describe the process of oocyte maturation, fertilization and activation
10. compare and describe cleavage and the early stages of embryonic development
11. compare the various patterns of cleavages in invertebrate and vertebrate zygote
12. describe blastulation and gastrulation
13. describe the mechanisms of development
14. explain the development of systems and organs in vertebrates by discussing derivatives of ectoderm, endoderm, mesoderm
15. compare various reproduction patterns

16. describe major events in mammalian development

## Unit 7: Evolution: A Historical Perspective, Gene Frequencies, and Ecology: Preserving the Animal Kingdom

### Evolution: A Historical Perspective

1. define evolution, phylogeny
2. recognize the main players in the development of evolutionary theory, their contributions, (or criticisms) as well as the relative time period in which their ideas were presented
3. discuss Darwin's theory of evolution
4. list examples of the evidence for Darwin's theories
5. discuss the concept and evidence for perpetual change ( interpretation of fossil records, geologic time, evolutionary trends)
6. briefly explain common descent
7. list examples of multiplication of species
8. discuss gradualism and natural selection
9. briefly explain neo-Darwinism and emergence of the synthetic theory
10. define micro-evolution
11. define macro-evolution
12. discuss evolutionary processes
13. discuss human evolution

### Evolution and Gene Frequencies

1. define organic evolution in modern genetic theory
2. explain the advantage of genetic variation in a population
3. define *gene pool*
4. Define the Hardy-Weinberg Theorem; include a discussion of its assumptions and explain what it contributes to the science of population genetics
5. define balanced polymorphism and give an example
6. define *speciation (and its various forms)* and *reproductive isolation*.
7. define *genetic drift* and *neutral selection*
8. re-examine mutation and natural selection from Ch. 3
9. contrast *phyletic gradualism* and *punctuated equilibrium*

### Ecology: Preserving the Animal Kingdom

1. define *ecology, habitat, tolerance range, range of optimum, limiting factor taxis*
2. contrast *autotroph and heterotroph*
3. explain how thermoregulatory needs influence many habitat requirements
4. define *biotic* and *abiotic*
5. define *population, community, ecosystem, biome*
6. describe the various types of population growth including a discussion of *environmental resistance*
7. explain density-dependent and density-independent factors and their effect on population regulation
8. compare intraspecific and interspecific competition and how they affect a population and/or community
9. define *coevolution*
10. explain the various types of symbiotic relationships and give an example of each
11. describe some interspecific adaptations
12. define *communities, ecological niche, dominant species, diversity(richness)*
13. explain succession and the associated terms: pioneer community, sere, seral stage, climax community and describe at least one type of succession
14. explain the difference between food chain and food web
15. explain trophic levels
16. describe at least one of the biogeochemical cycles: carbon cycle, nitrogen cycle, water cycle

17. explain the significance and impact of ecological problems related to human population growth, pollution, resource depletion, biodiversity

### Laboratory Objectives

#### **General Laboratory Objectives** (Other objectives listed by topic/week)

For each taxonomic category specified in an exercise the student may be required to:

1. identify the designated taxa associated with particular organisms
2. describe the evolutionary history and relationships, phylogeny
3. describe the morphology of an organism, typical body plans, characteristics of various taxa, etc.
4. identify organelles or organs and their functions
5. describe typical habitats
6. describe ecological relationships
7. discuss the economic and/or medical importance of groups of organisms

Objectives: The student must be able to

#### Microscopy and Lab Safety

1. describe and apply appropriate and safe lab procedure
2. identify the parts of the microscope
3. identify the functions of the microscope parts
4. demonstrate appropriate care and use of the microscope
5. define the electromagnetic spectrum and its main parts
6. explain how transmission, absorption, reflection, refraction and diffusion affect our use of the microscope and explain the procedures and mechanisms that compensate for these effects

#### Cell structures and functions

1. discuss the history of the cell concept and biologists who were instrumental in its development
2. define and identify the cell theory
3. briefly describe instruments used in the study of cells
4. identify the components of Eukaryotic cells and their functions
5. discuss the surfaces of cells and their specializations
6. identify the cell membrane and its functions
7. discuss the fluid-mosaic model of cell membranes
8. compare and contrast prokaryotic and eukaryotic cells

#### Histology: Tissue structure and function

1. Name the four kinds of tissues found in animal systems and describe their functions
2. recognize and describe the composition, function and location of the following types of epithelium:
  - a. simple squamous epithelium
  - b. simple cuboidal epithelium
  - c. simple columnar epithelium
  - d. stratified epithelium
3. describe the functions of general and special connective tissues
4. recognize and describe the function and location of
  - a. dense connective tissue
  - b. loose connective tissue
  - c. adipose tissue
5. recognize and describe the composition, function and location of the various types of muscle tissue

#### Aspects of Cell Function: Membrane Transport

1. explain the importance of membrane transport
2. describe or recognize the processes involved in: diffusion, osmosis, pinocytosis, phagocytosis, Exocytosis

3. differentiate between active transport, passive transport, bulk transport, facilitated transport
4. describe the role of the plasma membrane in transport processes.

#### The cell cycle

1. discuss the processes of cell division
2. define and identify the characteristics of: cell cycle, interphase, cytokinesis, karyokinesis, meiosis, mitosis
3. define and recognize the function of chromatin, chromosome, chromatids, homologues, kinetochore, centromere, spindle fibers, polar fibers, kinetochore fibers, asters, centrioles, cleavage furrow

#### Genetics

1. describe, recognize and/or model the various stages of meiosis
2. predict the results of crosses involving one or two autosomally linked traits
3. predict the results of crosses involving single X-linked traits
4. analyze data using a simple statistical test (Teacher's option)
5. describe the principles of segregation and independent assortment and use these principles in solving problems involving monohybrid, dihybrid, and X-linked crosses.

#### Embryology

1. describe the goals of embryological studies
2. describe the events of fertilization and early embryology for the sea urchin and the frog
3. explain how the yolk influences patterns of cleavage
4. recognize stages in the embryology of the sea urchin and the frog
5. describe the significance of the three embryonic: germ layers—ectoderm, endoderm, and mesoderm. List the variety of structures that each forms in the adult animal

#### Phylogeny and Classification of Organisms

1. describe a classification system as a reflection of the order present in nature
2. describe systematics, or taxonomy, as the study of the kinds of organisms and their evolutionary relationships.
3. explain the bases for the 3-domain, 6-kingdom classification system
4. describe a species as a single kind of organism that is given a distinctive name by taxonomists
5. describe other levels of classification as reflecting the relatedness among different species
6. interpret and describe the usefulness of cladograms in modern taxonomic studies
7. construct a cladogram using simple block animals
8. assign names to simple block animals using a few basic rules of zoological nomenclature

For each taxonomic category specified in an exercise the student may be required to:

1. identify the designated taxa associated with particular organisms
2. describe the evolutionary history and relationships, phylogeny
3. describe the morphology of an organism, typical body plans, characteristics of various taxa, etc.
4. identify organelles or organs and their functions
5. describe typical habitats
6. describe ecological relationships
7. discuss the economic and/or medical importance of groups of organisms

#### The Animal-like Protists

##### Phylum Porifera

##### The radiate animals:

Phylum Cnidaria

Phylum Ctenophora

##### The acoelomate animals:

Phylum Platyhelminthes  
Phylum Nemertea  
Phylum Gnathostomulida

The pseudocoelomate animals:

Phylum Rotifera  
Phylum Nematoda  
Phylum Mollusca

Phylum Annelida  
Phylum Arthropoda  
    Subphylum Chelicerata  
    Subphylum Crustacea  
    Subphylum Uniramia

Phylum Echinodermata  
Phylum Chordata  
    Subphylum Urochordata  
    Subphylum Cephalochordata  
    Subphylum Vertebrata  
        Class Cephalaspidomorphi  
        Class Chondrichthyes  
        Class Osteichthyes  
        Class Amphibia  
        Class Reptilia  
        Class Aves

**Course Content:**

Course content will be taken from the adopted text and lab manual, scientific journals, current popular periodicals, appropriate online sources and pertinent reference literature.

**Methods of Instruction/Course Format/Delivery:** Instruction for this course will include formal instructor lectures, question/answer sessions, small group discussions, videos and interactive software.

**Assessment:**

Lecture assessment may include face-to-face and online testing including multiple choice, fill-in-the-blank, short answer and short essay questions as well as short reports. Lab assessment may include observations of student work, written and/or oral quizzes, graded exercises and/or reports.

**Course Grade:**

40% from average of Unit Exams (5 or 6 exams)

20% from assignments

20% from the Final Exam (comprehensive over all but the last unit)

20% from the Laboratory Average (50% from quizzes, 50% from written or observed activities)

**Service Learning:** Students are expected to complete a course-related service learning project which they select and have approved by the instructor. Points will be awarded based on the nature of the project, quality of the effort, the number of hours required by the project and the appropriate completion of the required documentation and reflection paper. Points will be added to a low unit test score. Failure to complete the service learning project will result in 10 points being deducted from a unit test score.

**Texts, Materials, and Supplies:**

Text: Zoology 8<sup>th</sup> Edition; Miller/Harley; 2010 McGraw-Hill Companies

Lab: Zoology Laboratory Laboratory Manual 5<sup>th</sup> Edition; Miller/Harley; 2010 McGraw-Hill Companies

**Other:**

To locate textbooks, ISBN's and materials contact: <http://www.panolacollegestore.com>  
Information about Panola College Testing Centers can be found at : <http://www.panola.edu/testing>  
eLearning Support can be found at: <http://www.panola.edu/support>