Valdosta State University, BIOL 1107, Sections M, N, O (4 Credit Hours)
Principles of Biology I – Fall 2009
Syllabus & Course Policies

Lecture: BC 1023 - Mondays, Wednesdays, & Fridays - 10:00-10:50
Lab: BC 2071
Section M, Thursdays, 9:00-11:50
Section N, Thursdays, 1:00-3:50
Section O, Fridays, 11:30-2:20

Instructor: Dr. Emily Cantonwine
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Welcome to Principles of Biology I. This is the first course in a series designed to help you develop a strong foundation in the biological sciences to build on throughout your studies at VSU and beyond.

BIOL 1107 Course Description. An introduction to the principles of biology for science majors, with an emphasis on the cellular nature of life. Concepts covered include the origin and early evolution of cellular life; cell structure, function, metabolism, and reproduction; cell signaling; and gene regulation in bacteria and eukaryotes.

Why is learning the basics so important?
1. Upper-level biology courses often begin where this class ends!
2. Because the career path that you are choosing REQUIRES that you understand the basics!
3. It will make the rest of your life as a biologist, physician, science teacher, etc. easier!
4. The biology section of the MCAT and other professional entrance exams are based on this stuff!

There are no prerequisites for this course. BIOL 1100 is a co-requisite.

Required Text:

Sadava, D., Heller, H.C., Orians, G.H., Purves, W.K., & Hillis, D.M. 2008. LIFE: The Science of Biology. Eighth Edition. Sinauer Associates, Inc., Sunderland, MA, and W.H. Freeman & Co., Gordonsville, VA.

Course Objectives and Outcomes (refer to Outcome section at end of syllabus for more information)

By the end of this course, students will be able to
1) answer questions that demonstrate an understanding of fundamental concepts of biology, including the scientific method and experimental design; cellular structure, function, metabolism, and reproduction; the nature of the gene and its action; and the mechanisms of evolution (GEO 5; BEO 1-4)
2) perform a variety of standard lab techniques used in biological research (GEO 5)
3) use critical thinking skills and written communication skills to present the results and conclusions of data collected in the lab in standard scientific writing format (GEO 4 & 7; BEO 1)

Grade:	SCALE
Lecture (80% of grade):	A ≥ 90.0%
Exams (4): 100 points each	B ≥ 80.0%
Final Exam: 150	C ≥ 70.0%
	D ≥ 60.0%
	F ≤ 59.99%

Lab (20% of grade):
- Quizzes (13): 15 points each
- Lab Assignments (3): 50 points each
- Lab notebook: 50 points

Bonus (+10%)
- Homework (10): 10 points each unless otherwise stated

Grade = (average lecture grade * 0.8) + (average lab grade * 0.2) + (average HW grade * 0.1)

Explanation of Assessments:

Exams. (GEO 5; BEO 1-5) Each unit examination is worth 100 points. Make-up exams are an option for those with legitimate reasons, but will be more challenging than the original exam. Students wishing to take a make-up exam must contact me via email the day of the missed exam and must complete the make-up within 2 days of the missed exam, if physically possible. Students may not take exams early, with the exception of students with a University related excuse. The unit exams are not cumulative.

Final Exam. (GEO 5; BEO 1-5) The final exam is worth 150 points and is cumulative. All students are required to take the final exam.

Lab quizzes. (GEO 5 & 7; BEO 1) There will be a 15 point quiz at the beginning of each lab session, so do not be late for lab! The quizzes will be based on material from the previous labs, and you may use your lab notebook. More information about the lab notebook will be provided in lab.

Lab Assignments. (GEO 3, 4 & 5; BEO 1) Each assignment is worth 50 points. Information for each assignment will be provided in lab.

Lab Notebook. (GEO 5 & 7; BEO 1) Students are required to keep a lab notebook in a ½" 3-ring binder. Lab notebook will be used on weekly lab quizzed and will be turned in the last day of lab to be graded. Your notebook grade will be based on completeness, accuracy, and order. More information will be provided in lab.

Bonus Homework. Homework assignments will be due each Friday by 3:00 to the box outside my office door. Homework may be turned in early, but cannot be turned in late unless it is accompanied with an approved excuse. Homework must be handwritten on the assignment printout, unless otherwise stated. This bonus opportunity may be terminated for any reason.

General Rules:

Attendance Policy: I do not monitor student attendance during lecture, but highly recommend that you attend all lectures unless you are sick. Attendance will be recorded for lab sessions using the lab quiz. If you are no more than 30 minutes late to lab, you may sign your name to a blank quiz to be counted as present. If you are later than 30 minutes to lab, you may complete the lab but will not be counted as present. Students who miss 2 labs without an excuse or 4 labs total cannot receive a grade above a D.

Food and Drink:

- LAB - No food, drink, or chewing gum is allowed in the laboratory.
- LECTURE - Drinks that are closed when not in use and snacks are allowed as long as their consumption and storage are not a disturbance to yourself or other students. Each student is responsible for cleaning up after him or herself; otherwise, this privilege will be revoked.

Cell phone use:

- LAB - cell phone use is not allowed, with the exception of keeping time.
- LECTURE - I strongly advise you to not bring your cell phone to class or to turn it "OFF" during class. However, I will

Student conduct: I expect your *full attention* during instruction.

- Enter the classroom on time and have all the materials you need when class begins.
- Always turn your cell phone off when you enter the classroom.
- Do not leave class early unless it is an emergency or you informed me before class of an early departure.
- Do not engage in off-topic conversations.
- Disruptions may result in your dismissal from the classroom.

Special Needs: If you have need for special arrangements to allow you to meet the requirements of this course, please contact the Access Office for Students with Disabilities in Nevins Hall, 245-2498. Also, please discuss this need with me before the end of the first week of classes.

Academic Integrity: As the instructor, I follow the Academic Honesty Policies and Procedures of the University and the Department of Biology's Policy on Plagiarism. For more information, refer to www.valdosta.edu/academic/AcademicHonestyPoliciesandProcedures.shtml and www.valdosta.edu/biology/documents/biologyplagiarism.doc "Academic Integrity/ Honesty" means performing all academic work without plagiarism, cheating, lying, tampering, stealing, receiving unauthorized or illegitimate assistance from any other person, or using any source of information that is not common knowledge.

Important information:

- For Biology majors, a grade of C or higher is required in this course before additional biology courses can be attempted.
- Midterm, October 8th, is the last day for withdrawing without penalty.

Tentative Lecture Schedule, BIOL 1107, sections M, N, O, Fall Semester 2009

Week	Subject	Chapters	HW Due Friday by 3:00
Aug 17	Introduction to Biology; Chemistry of Life	1-2	HW 1
Aug 24	Chemistry of Life; Macromolecules & origin of life	2-3	HW 2
Aug 31	Macromolecules & origin of life	3	HW 3
Sept 7	*Labor Day (Sept 7)*; **EXAM 1 (Sept 9)**; Cells	4	
Sept 14	Cells; Cell membrane	4-5	HW 4
Sept 21	Energy, Enzymes, & metabolism; Pathways that harvest chemical energy	6-7	HW 5
Sept 28	Pathways that harvest chemical energy	7	HW 6
Oct 5	Photosynthesis; **EXAM 2 (Oct 9)**	8	
Oct 12	Chromosomes, the cell cycle, and cell division	9	HW 7
Oct 19	*Fall Break (Oct 19)*; DNA and Role in Heredity	11	
Oct 26	DNA to protein	12	HW 8
Nov 2	Genetics of viruses & prokaryotes	13	HW 9
Nov 9	The Eukaryotic Genome; **EXAM 3 (Nov 13)**	14	
Nov 16	Cell signaling & communication; Recombinant DNA & biotechnology	15-16	HW 10
Nov 23	Recombinant DNA & biotechnology; *Thanksgiving (Nov 25 & 27)*	16	
Nov 30	Genome sequences, molecular biology, & medicine **EXAM 4 (Dec 4)**	17	
Dec 7	Review		
Dec 11	**Final Exam 8:00-10:00**		

Tentative Laboratory Schedule, BIOL 1107, section M, N, O, FALL 2009

LABORATORY EXERCISES:

Lab	Week:	Topic:	Due Dates
1	August 20-21	Laboratory Introduction "The Black Box"- Scientific Method.	
2	August 27-28	Basics of the Light Microscope.	
3	Sept 3-4	Living Cells	
4	September 10-11	Group Microscope Project: Proposal	
5	September 17-18	Group Microscopy Project: Data collection lab *(Lab assignment 1)*	
6	September 24-25	Cellular Water Relations	Assignment 1 due Friday by 3:00
7	Oct 1-2	Measuring metabolic activity	
8	October 8-9	Protein extraction & quantification *(Lab assignment 2)*	
9	October 15-16	Enzymology Lab: basics of α-amylase activity	Assignment 2 due Friday by 3:00
--	October 22-23	**Fall Break – no lab**	
10	October 29-30	Enzyme Regulation: Investigation of the effects of temperature on enzyme activity *(Lab assignment 3)*	
11	November 5-6	Cell division: Mitosis & Meiosis	Assignment 3 due Friday by 3:00
12	November 12-13	Genetic engineering I: DNA fingerprinting	
13	November 19-20	Genetic engineering II: Genetically Modified Organisms	
--	November 26-27	**Thanksgiving Holiday**	
14	December 3-4	Genetic Engineering II, continued;	*Notebooks DUE in lab*

Valdosta State University General Educational Outcomes (GEO)

1. Students will demonstrate understanding of the society of the United States and its ideals. They will possess the requisite knowledge of the society of the United States, its ideals, and its functions to enable them to become informed and responsible citizens. They will understand the connections between the individual and society and the roles of social institutions. They will understand the structure and operational principles of the United States government and economic system. They will understand United States history and both the historical and present role of the United States in the world.
2. Students will demonstrate cross-cultural perspectives and knowledge of other societies. They will possess sufficient knowledge of various aspects of another culture, including the language, social and religious customs, aesthetic expression, geography, and intellectual and political history, to enable them to interact with individuals within that society from an informed perspective. They will possess an international viewpoint that will allow them to examine critically the culture of their own nation and to participate in global society.
3. Students will use computer and information technology when appropriate. They will demonstrate knowledge of computer concepts and terminology. They will possess basic working knowledge of a computer operating system. They will be able to use at least two software tools, such as word processors, spreadsheets, database management systems, or statistical packages. They will be able to find information using computer searching tools.
4. Students will express themselves clearly, logically and precisely in writing and in speaking, and they will demonstrate competence in reading and listening. They will display the ability to write coherently in standard English; to speak well; to read, to understand, and to interpret the content of written materials in various disciplines; and to listen effectively and to understand different modes of communication.
5. Students will demonstrate knowledge of scientific and mathematical principles and proficiency in laboratory practices. They will understand the basic concepts and principles underlying scientific methodology and be able to collect, analyze, and interpret data. They will learn a body of scientific knowledge and be able to judge the merits of arguments about scientific issues. They will be able to perform basic algebraic manipulations and to use fundamental algebraic concepts to solve word problems and equations. They will be able to use basic knowledge of statistics to interpret and to analyze data. They will be able to evaluate arguments based on quantitative data.
6. Students will demonstrate knowledge of diverse cultural heritages in the arts, the humanities, and the social sciences. They will develop understanding of the relationships among the visual and performing arts, literature and languages, and history and the social sciences. Students will be versed in approaches appropriate to the study of those disciplines; they will identify and respond to a variety of aesthetic experiences and engage in critical thinking about diverse issues. They will be able to identify the components of and respond to aesthetic experiences in the visual and performing arts. They will develop knowledge of world literature within its historical and cultural frameworks. They will understand modem issues within a historical context and the role of the individual in various forms of societies and governments.
7. Students will demonstrate the ability to analyze, to evaluate, and to make inferences from oral, written and visual materials. They will be skilled in inquiry, logical reasoning, and critical analysis. They will be able to acquire and evaluate relevant information, analyze arguments, synthesize facts and information, and offer logical arguments leading to creative solutions to problems.
8. Students will demonstrate knowledge of principles of ethics and their employment in the analysis and resolution of moral problems. They will recognize and understand issues in applied ethics. They will understand their own value systems in relation to other value systems. They will judge values and practices in a variety of disciplines.

Department of Biology Educational Outcomes (BEO)

1. Develop and test hypotheses, collect and analyze data, and present the results and conclusions in both written and oral format used in peer-reviewed journals and at scientific meetings.
2. Describe the evolutionary process responsible for biological diversity, explain the phylogenetic relationships among the other taxa of life, and provide illustrative examples.
3. Demonstrate an understanding of the cellular basis of life.
4. Relate the structure and function of DNA/RNA to the development of form and function of the organism and to heredity
5. Interpret ecological data pertaining to the behavior of the individual organism in its natural environment; to the structure and function of populations, communities, and ecosystems; and to human impacts on these systems and the environment.

Generalized Eukaryotic Cell

A. NUCLEUS

1. Defining characteristics: membrane bound nucleus, presence of organelles, meiotic division
2. Nucleus: compartmentalization, storage of genetic information
3. Nucleolus: location and function
4. Nuclear envelope, nuclear pores

B. MEMBRANE-BOUND ORGANELLES

1. Mitochondria
   a. site of ATP production
   b. self-replication
   c. inner and outer membrane
2. Lysosomes: membrane vesicle containing hydrolytic enzymes
3. Endoplasmic reticulum:
   a. rough and smooth components
   b. rough endoplasmic reticulum site of ribosomes
   c. double membrane structure, role in membrane biosynthesis
   d. role in biosynthesis of secreted proteins
4. Golgi apparatus: general structure and role in packaging and secretion

C. PLASMA MEMBRANE

1. General function in cell containment
2. Protein and lipid components, fluid mosaic model
3. Osmosis
4. Passive and active transport
5. Membrane channels
6. Sodium/potassium pump
7. Membrane receptors
8. Membrane potential
9. Exocytosis and endocytosis
10. Cell-cell communication (General concepts of cellular adhesion)
    a. gap junctions
    b. tight junctions
    c. desmosomes

D. CYTOSKELETON

1. General function in cell support and movement
2. Microfilaments: composition and role in cleavage and contractility
3. Microtubules: composition and role in support and transport
4. Intermediate filaments, role in support
5. Composition and function of eukaryotic cilia and flagella
6. Centrioles, microtubule organizing centers

Biological Molecules

A. CARBOHYDRATE

1. Description
   a. nomenclature and classification, common names
   b. absolute configuration
   c. cyclic structure and conformations of hexoses
   d. pimers and anomers
2. Hydrolysis of the glycoside linkage

B. AMINO ACIDS AND PROTEINS

1. Description
   a. absolute onfiguration at the α position
   b. amino acids as dipolar ions classification
   c. classification
   i. acidic or basic
   ii. hydrophobic or hydrophilic
2. Reactions
   a. peptide linkage
   b. hydrolysis
3. General principles
   a. 1° structure of proteins
   b. 2° structure of proteins

C. LIPIDS

Description; structure
a. steroids
b. terpenes
c. triacyl glycerols
d. free fatty acids

D. PHOSPHORUS COMPOUNDS

1. Description
   a. structure of phosphoric acids (anhydrides and esters)
2. Important reactions
   a. Wittig reaction

MITOSIS

1. Mitotic process: prophase, metaphase, anaphase, telophase, interphase
2. Mitotic structures:
   a. centrioles, asters, spindles
   b. chromatids, centromeres, kinetochores
   c. nuclear membrane breakdown and reorganization
   d. mechanisms of chromosome movement
3. Phases of cell cycle: G_0, G_1, S, G_2, M
4. Growth arrest

Molecular Biology: Enzymes and Metabolism

A. ENZYME STRUCTURE AND FUNCTION

1. Function of enzymes in catalyzing biological reactions
2. Reduction of activation energy
3. Substrates and enzyme specificity

B. CONTROL OF ENZYME ACTIVITY

1. Feedback inhibition
2. Competitive inhibition
3. Non-competitive inhibition

C. BASIC METABOLISM

1. Glycolysis, anaerobic and aerobic, substrates and products
2. Krebs cycle, substrates and products, general features of the pathway
3. Electron transport chain and oxidative phosphorylation, substrates and products, general features of the pathway
4. Metabolism of fats and proteins

Molecular Biology: DNA and Protein Synthesis

I. DNA STRUCTURE AND FUNCTION

A. DNA STRUCTURE AND FUNCTION

1. Watson-Crick model of DNA; double helix
2. DNA composition: purine and pyrimidine bases, sugars, phosphate
3. Base pairing specificity: A w/ T, G w/ C
4. Function in transmission of genetic information

B. DNA REPLICATION

1. Mechanism of replication: separation of strands, specific coupling of free N. acids
2. Semi-conservative nature of replication

C. REPAIR OF DNA

1. Repair during replication
2. Repair of mutations

D. RECOMBINANT DNA

1. Restriction enzymes
2. Hybridization
3. Gene cloning

II. PROTEIN SYNTHESIS

A. GENETIC CODE

1. Central Dogma: DNA → RNA → protein
2. Codon-anticodon relationship
3. Missense, nonsense codons
4. Initiation, termination codons

B. TRANSCRIPTION

1. Messenger RNA
2. tRNA, rRNA
3. Mechanism of transcription

C. TRANSLATION

1. Roles of mRNA, tRNA, rRNA
2. Role and structure of ribosomes

Molecular Biology: Eukaryotes

A. EUKARYOTIC CHROMOSOME ORGANIZATION

1. Chromosomal proteins
2. Telomeres, centromeres

B. CONTROL OF GENE EXPRESSION IN EUKARYOTES

1. Transcription regulation
2. DNA binding proteins, transcription factors
3. Cancer as a failure of normal cellular controls, oncogenes
4. Post-transcriptional control [GEC]

Genetics

A. MENDELIAN CONCEPTS

1. Phenotype and genotype
2. Gene
3. Locus
4. Allele: single and multiple
5. Homo- and heterozygosity
6. Wild type
7. Recessiveness
8. Complete dominance
9. Co-dominance
10. Incomplete dominance, leakage, penetrance, expressivity
11. Gene pool

B. MEIOSIS AND GENETIC VARIABILITY

1. Significance of meiosis
2. Important differences between meiosis and mitosis
3. Segregation of genes
   a. Independent assortment
   b. linkage
   c. recombination
   d. single crossovers
   e. double crossovers
4. Sex-linked characteristics
   a. very few genes on Y chromosome
   b. sex determination
   c. cytoplasmic inheritance
5. Mutation
   a. general concept of mutation-error in DNA sequence
   b. types of mutations: random, translation error, transcription error, base substitution, inversion, addition, deletion, translocation, mispairing
   c. advantageous vs. deleterious mutation
   d. inborn errors of metabolism
   e. relationship of mutagens to carcinogens]

C. ANALYTIC METHODS

1. Hardy-Weinberg Principle
2. Test cross: back cross, concepts of parental, F1 and F2 generations

Evolution

A. EVOLUTION

1. Natural selection
   a. fitness concept
   b. selection by differential reproduction
   c. concepts of natural and group selection
   d. evolutionary success as increase in percent representation in the gene pool of the next generation
2. Speciation
   a. definition of species
   b. polymorphism
   c. adaptation and specialization
   d. concepts of ecological niche, competition
   e. concept of population growth through competition
   f. inbreeding
   g. outbreeding
   h. bottlenecks
   i. divergent, parallel, and convergent evolution
   j. Symbiotic relationships
   a. Parasitism
   b. Commensalism
3. Ontogeny recapitulates phylogeny
4. Evolutionary time as measured by gradual random changes in genome
5. Origin of life