

PALOMAR COLLEGE
COURSE OUTLINE OF RECORD FOR
DEGREE CREDIT COURSE

___x___ Transfer Course ___x___ A.A. Degree applicable course
(Check all that apply)

COURSE NUMBER AND TITLE: Biology 102 – Molecules and Cells

UNIT VALUE: 4

MINIMUM NUMBER OF SEMESTER HOURS: 96

BASIC SKILLS REQUIREMENTS:

Appropriate language and computational skills

ENTRANCE REQUIREMENTS

PREREQUISITE:

COREQUISITE:

RECOMMENDED PREPARATION: MATH 50 – Beginning Algebra

SCOPE OF COURSE:

The basic principles of biological systems including the chemistry of life, cell structure and function, energy transfer, reproduction, and genetics.

SPECIFIC COURSE OBJECTIVES:

Successful students will be able to:

1. describe the structure of an atom;
2. compare proteins, lipids, carbohydrates and nucleic acids;
3. compare procaryotic and eucaryotic cells;
4. discuss transport of materials across biological membranes;
5. discuss the Laws of Thermodynamics;
6. compare mitosis and meiosis;
7. predict patterns of inheritance based on Mendel's Laws;
8. discuss human genetic disorders;
9. compare DNA and RNA;
10. describe the process of protein synthesis;
11. compare the regulation of genes in eucaryotic and procaryotic cells
12. use a compound microscope;
13. prepare physiologic solutions;
14. develop and test a hypothesis;
15. analyze scientific data;
16. demonstrate laboratory safety procedures.

CONTENT IN TERMS OF SPECIFIC BODY OF KNOWLEDGE:

I. Introduction

- A. Study Skills
- B. Characteristics of Living Organisms
- C. Levels of Biological Organization
- D. Classification of Living Organisms
- E. Scientific Method

II. Chemistry of Life

- A. Chemical Elements
- B. Atomic Structure
 - 1. Protons, Electrons and Neutrons
 - 2. Atomic Mass
 - 3. Electrical Charge
 - 4. Atomic Energy Levels
 - 5. Valence Electrons
 - 6. Atomic Structure of Atoms in Biochemically Important Molecules
 - 7. Ionization
- C. Molecules and Compounds
- D. Chemical Equations
- E. Chemical Bonds (Types and Strength)
 - 1. Covalent Bonds
 - a. Nonpolar
 - b. Polar
 - c. Bonding energy differences
 - 2. Ionic Bonds
 - 3. Hydrogen Bonds
 - 4. Van der Waals Forces
 - a. Ion-Dipole
 - b. Ion-Induced Dipole
 - c. Dipole-Dipole
 - d. Dipole-Induced Dipole
 - e. Dispersion Forces
 - f. Oxidation-Reduction Reactions
 - g. Water and Its Properties
 - 1. Structure
 - 2. Cohesive and Adhesive Forces
 - 3. Temperature Stabilization
 - 4. Density of Water
 - 5. Ionization in Water
 - 6. As a Polar Solvent
 - h. Acids and Bases
 - i. Salts
 - j. Buffers
 - 5. Names of Bonds (e.g. Peptide, Ester, Disulfide, Glycoside, etc.)

III. Organic Compounds

- A. Structure of Hydrocarbons
- B. Isomers
- C. Nomenclature of Organic Compounds
- D. Functional Groups (Structure, Polarity and Solubility Properties)
 - 1. Alkyl Group
 - 2. Methane, Ethane, Propane, etc.
 - 3. Hydroxyl Group
 - 4. Carbonyl Group
- E. Polymers

IV. Biologically Important Molecules (Structure and Function)

- A. Carbohydrates
 - 1. Monosaccharides
 - 2. Disaccharides
 - 3. Polysaccharides
- B. Lipids
 - 1. Neutral Fats

- 2. Phospholipids
- 3. Steroids
- 4. Carotenoids
- 5. Waxes
- C. Proteins
 - 1. Amino Acids (Specific R Groups and Significance)
 - 2. Polypeptide Chain
 - 3. Protein Structure
 - 4. Coagulation and Denaturation
- D. Nucleic Acids
 - 1. Nucleotide Subunits
- E. ATP, ADP and AMP
- F. Other
- V. Cell Structure and Function
 - A. The Cell Theory
 - B. Size of Cells
 - C. Prokaryotic Cells
 - D. Eukaryotic Cells
- VI. Biological Membranes
 - A. Studies of Membrane Structure
 - B. Fluid-Mosaic Model of Membrane Structure
 - C. Movement of Materials Across Membranes
 - 1. Diffusion
 - 2. Carrier-Mediated Transport of Small Molecules
 - 3. Transport of Large Molecules Across Membranes
 - D. Intercellular Contacts
- VII. Energy of Life
 - A. What is Energy?
 - 1. Potential and Kinetic Energy
 - 2. Measuring Energy
 - B. Law of Mass Action
 - C. Electrostatic Attraction and Repulsion
 - D. Entropy, Enthalpy and Free Energy
 - E. The Laws of Thermodynamics
 - 1. First Law of Thermodynamics
 - 2. Second Law of Thermodynamics
 - 3. Third Law of Thermodynamics
 - F. Chemical Reactions and Energy
 - 1. Random Molecular Motion and Collision in Chemical Reactions
 - 2. Exothermic and Endothermic Reactions
 - 3. Chemical Reactions Are Reversible
 - 4. Spontaneous Reactions
 - 5. Coupled Reactions
 - G. Metabolism
 - 1. Catabolism
 - 2. Anabolism
 - H. ATP = Energy Currency of Cell
 - 1. Enzymes and Activation Energy
 - 2. Naming Enzymes
 - 3. Enzymes As Catalysts
 - 4. Enzyme Specificity
 - 5. Mechanism of Enzyme Activity
 - 6. Cofactors
 - 7. Regulation of Enzymatic Activity
 - 8. Other Factors Affecting Enzyme Activity
- VIII. Catabolism and Biosynthesis
 - A. Aerobic Cellular Respiration
 - B. Fermentation
 - C. Catabolism of Other Nutrients
 - D. Biosynthetic Processes

IX. Cell Reproduction

- A. Prokaryotic Chromosomes and Binary Fission
- B. Eukaryotic Chromosomes
- C. Eukaryotic Cell Cycle
- D. Asexual versus Sexual Reproduction
- E. Meiosis

X. Mendelian Patterns of Inheritance

- A. Gregor Mendel
- B. Genes and Alleles
- C. Punnett Square
- D. Laws of Probability
- E. Monohybrid Cross
- F. Dihybrid Cross

XI. Chromosomes and Genes

- A. Multiple Alleles
- B. Incomplete Dominance and Codominance
- C. Epistatic Genes
- D. Polygenic Inheritance
- E. Pleiotropy
- F. Chromosomal Sex Determination
- G. Sex-Linkage
- H. Genetic Linkage and Chromosome Mapping
- I. Chromosome Mutations
- J. Changes in Chromosome Structure

XII. Human Genetic Disorders

- A. Karyotypes
- B. Chromosomal Abnormalities
- C. Mapping the Human Chromosome
- D. Autosomal Recessive Disorders
- E. Autosomal Dominant Disorders

XIII. DNA: The Genetic Material

- A. Structure of DNA
- B. DNA Replication
- C. Prokaryotic Versus Eukaryotic Replication
- D. Organization of DNA in Chromosomes
- E. Other Aspects of DNA Biochemistry
- F. Transformation
- G. Transduction

XIV. RNA and Protein Synthesis

- A. Structure of RNA
- B. The Genetic Code
- C. Transcription
- D. Translation
- E. Polysomes
- F. Comparison of Eukaryotic and Prokaryotic Protein Synthesis
- G. Definition of a Gene
- H. Gene Mutations

XV Gene Regulation

- A. Regulation of Gene Action
- B. Mechanism of Gene Control in Bacteria
- C. Eucaryotic Gene Control

XVI. Recombinant DNA and Biotechnology

- A. Recombinant DNA Methods
- B. Genetic Engineering of Cells
- C. Today's Biotechnology Products

LABORATORY OUTLINE

- I. Laboratory Safety - Department Safety Policies
- II. Library Research and Learning Resources Tour
- III. Metric System, Measurements and Scientific Method
- IV. Osmosis and Diffusion Principles
- V. Physiological Solutions
- VI. Microscope I: Compound and Dissecting Microscope
- VII. Microscopy Techniques
- VIII. Microscope: Measuring Cells
- IX. Enzyme Action and Regulation
- X. Cell Division: Mitosis and Meiosis
- XI. Mendelian Genetics
- XII. Human Genetics
- XIII. Biochemical Genetics

REQUIRED READING:

Mader, S. and P. Tillery. Inquiry Into Life/General Chemistry. 3rd Edition. Dubuque, IA: W. C. Brown, 1994.

OR

Lygre, . General, Organic & Biological Chemistry. 1995 edition. Belmont, CA: Wadsworth Publishing, 1995.

Purves, . and . Orians. Life: The Science of Biology, Volume I. 4th edition. Sunderland, MA: Sinauer/Freeman Publishing, 1996.

Ross, F. Foundations of Allied Health Sciences Laboratory Manual. 4th edition. Dubuque, IA: W.C. Brown, 1997.

SUGGESTED READING:

REQUIRED WRITING:

Students are required to answer short answer/essay type questions on each of their lecture examinations.

Students may be required to critique several scientific articles, prepare short (two pages) research papers, write laboratory reports, or maintain a journal in which entries include drawings, computations and one page essays.

OUTSIDE ASSIGNMENTS:

Students are expected to spend a minimum of three hours per unit per week in class and on outside assignments, prorated for short-term classes.

Outside assignments include required readings and preparation for lecture and laboratory examinations. Outside assignments include critiques of scientific articles, research papers, journal entries, or laboratory reports.

INSTRUCTIONAL METHODOLOGY:

The following instructional methods will be used: lecture, discussion, demonstration, laboratory observation and investigation, films, video tapes, biological charts and models.

Check all that apply:

- lecture
 laboratory
 lecture-laboratory combination
 directed study

DISTANCE LEARNING:

This course may be offered as a distance learning course and meets Title 5 regulations 55370, 55372, 55374, 55376, 55378, and 55380.

Yes No

If yes, check all that apply:

- Television Course (Video one-way, e.g. ITV, video cassette, etc.)
 Online Course (Text one-way, e.g. newspaper, correspondence, electronic file, etc.)
 Two-Way Video Conferencing (Two-way interactive video and audio)
 One-Way Video Conferencing (One-way interactive video and two-way interactive audio)
 Computer Assisted Instruction (A specialized form of mediated instruction relying primarily on student access to information and prepared lessons or teaching materials through a computer terminal, but not under immediate supervision of a qualified instructor.)

GRADING POLICY AND STANDARDS (include methods of determining whether the stated objectives have been met by students):

Lecture examinations typically include a combination of multiple choice objective questions, diagrams, matching, as well as a short answer essay. Laboratory quizzes typically include drawings and short answer questions. 75% of the final grade is based on the lecture assignments, while the remaining 25% is based on the laboratory assignments. In a typical course, 50% of the course grade = lecture exams (5-7); 25% of the course grade = other assignments, which may include lecture quizzes, research papers, critiques of scientific articles or journal entries; 25% of the course grade = laboratory assignments which may include laboratory quizzes or laboratory reports. Make-up examinations will be allowed only in extreme cases, and will be administered during final examination week. Late papers are not acceptable.

IS COURSE REPEATABLE FOR REASON(S) OTHER THAN DEFICIENT GRADE?

Yes No Number of times course may be taken for credit:

If yes, identify specific provision of Title 5 Division 2 section(s), 55761-55763 and 58161 which qualifies course as repeatable:

CONTACT PERSON: DANIEL SOURBEER, x 2775

SIGNATURES:

By signing this form, I certify that this course outline of record meets all the minimum requirements for associate degree credit courses as specified in Title 5 Section 55002.

SIGNATURES ON FILE