

**Biology 121: General Biology**

**Professor: Leslie Samuelson**

**Teaching Assistant: Richard Maynard**

**Office Hours: Tues. 2:00-5:00pm & Thurs. 4:00-5:00pm, or by appointment**

**Phone: 892-5720**

**Webpage:** [http://www.trcc.commnet.edu/Prog\\_Study/Sciences/samuelson/index.htm](http://www.trcc.commnet.edu/Prog_Study/Sciences/samuelson/index.htm)

**Email:** [lsamuelson@trcc.commnet.edu](mailto:lsamuelson@trcc.commnet.edu)

**Course Prerequisites:**

Current enrollment, or passing grade ("C" or better) in English 101 or an equivalent course.

**Course Description:**

This course stresses the unifying themes in biology including the life processes common to all organism and their strategies for survival. Topics include scientific method, evolution, chemical basis for life, cell components and processes, cell cycles, molecular genetics and patterns of inheritance. A complete listing of concepts covered (*A BIG OLD STUDY GUIDE*) is attached.

**Course Objectives:**

Upon completion of this course, the student will be able to recognize terminology, specific biological facts, and utilize general principles associated with the structural and functional organization of living things. The student will also obtain a more fully developed series of computer-based skills. This course also stresses critical thinking skills which are designed to allow the student to: develop more meaningful learning beyond rote memorization; extend beyond lower levels of learning (knowledge and comprehension) to higher levels of learning (application, analysis, synthesis and evaluation); apply concepts and principles to real world experience and situations; and enhance problem solving skills.

**Methods of Instruction:**

These will include lecture, laboratory, on-line forum, computer activities, demonstration and/or multimedia presentation. Exam material will be taken from topics covered in lecture. A schedule of lectures, exams, homeworks and laboratories is attached.

**Text:**

Campbell & Reese. Biology. (seventh edition) 2005.

The study guide is STRONGLY recommended.

### Evaluation and Testing:

Your final course grade will be based on:

3 midterm exams- 100 pts. Each

8 laboratory write-ups- 50pts. Each

5 Homeworks – 30 pts. Each

4 forum posts- 5 pts. Each

4 forum replies- 5 pts. Each

1 office visit- 10 pts

1 final exam- 200 pts.

Total: 1200pts.

### Exams

Each **midterm** will consist of ~40 multiple choice, true/false, short answer or essay questions. The cumulative **final** will consist of ~80 similar questions. You will have 50 minutes to complete the exam individually. All exams will be collected. Then, there will be a 20 minute period where you will join 2 other students and retake the exam as a group. This exam will be handed in as well. Your individual exam will be graded, as will the group exam. If the group scores higher than the highest score for any one person within the group, the differential (up to 10 points) will be added to each group members individual exam score. For example, if the group score is 95, and the individual members scores are 60, 70, and 90, the group earns a 5 point bonus. I will add the bonus to each individual members grade, so the final grades would be 65, 75 and 95. If the group scores lower than the highest individual score, no points will be subtracted from the individual members scores. The maximum grade for any midterm exam is 100, for the final it is 200.

A #2 pencil is required for each exam. This item will not be supplied; you must bring it to each exam date. No make-up exams will be given without previous notification to the instructor. The final exam must be taken to pass this course.

**LAB WRITE-UPS** will be due the week following completion of the lab. Pages will be assigned during lab.

**Homework** will consist of case studies handed out in class. Homeworks must be turned in on time in order to earn full credit.

All but one (your “oops its late” assignment) of the assignments must be turned in on time. If more than one assignment is late, the work will not be graded unless the instructor has been notified prior to the due date.

### **NO INDIVIDUAL EXTRA CREDIT ASSIGNMENTS WILL BE GIVEN!!!**

Students may earn 1 point for every **MEANINGFUL post or reply** on our class forum (after the required 8 have been completed). The forum can be accessed through our class web page at [http://www.trcc.commnet.edu/Prog\\_Study/Sciences/samuelson/index.htm](http://www.trcc.commnet.edu/Prog_Study/Sciences/samuelson/index.htm) or at <http://lsamuelson.proboards25.com>. Be aware that the page is under construction; please report any problems to me. Please **email me** your user name so that I can keep track of the points you have earned. Be aware that the TA and I will “lurk”, and may enter the discussion at any time. If inappropriate materials are posted they will be removed. General cyberspace etiquette applies at all times.

**To utilize your computer account at school:**

Username= Your student ID number (no @ sign) (ex. 123456789)

Password= The first 3 letters of your birth month (first letter capitalized, other two lower case), the "&" sign, the last four numbers of your social security number (ex. Mmm&1234)

The grade distribution will be as follows:

90%-100%=A

80%-89%=B

70%-79%=C

60%-69%=D

Less than 60%=F

This percentile grade distribution will be based on the highest total points earned by a student. Generally this "curve" is only a few percentage points lower than a grade distribution based on the total points possible. At the end of the semester, any student within 20 points of the next higher or lower grade will receive a "+" or "-" as appropriate. The exceptions are A+, F+ and F- as the administration disallows the assignment of these grades.

**To determine your grade at any time during the semester**, I suggest keeping 2 columns of scores. The first is the high score for each assignment; the second is the points you earned on that assignment. To determine your grade, add up each column and divide your score total by the high score total. This will let you know within a percentage point or so where you stand in the class. For example:

High scores	my scores
9	6
45	43
88	72
<hr/>	<hr/>
142	121

$$121/142=.85$$

This student has an 85% or solid B in the course at this time.

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General Information:

If you must miss a class, please notify me prior to the date of absence so that work and notes may be arranged.

Students are responsible for defining and making progress toward their educational goals. If at any time you are having difficulties with course related materials, **PLEASE** come see me or the teaching assistant. There are a multitude of learning tools available to all students—we will just have to figure out which ones will be the most helpful for you.

Academic dishonesty and plagiarism will not be tolerated.

**YOUR GRADE IS YOUR RESPONSIBILITY!!!!**

Last day to drop without my signature is March 30.

Last day to drop with my signature is April 23.

Last day to apply for summer graduation is April 15, for fall it is June 15.

Electronic devices (cell phones, pagers etc.) will be put in “**Silent Mode**” or turned off during both lecture and laboratory.

If you need assistance or modification of class procedure owing to any type of disability, please let me know so that arrangements for accommodation can be made.

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*Course Objectives:*

1. Distinguish between living organisms and non living things by describing the features and characteristics of life.
2. Using the procedure and terminology, describe the scientific method through examples.
3. Identify the principal elements that make up the body, give their chemical symbols and summarize the main functions of each.
4. Demonstrate knowledge of the atomic structure and its relationship to the interaction of atoms to form molecules.
5. Demonstrate knowledge of ionic, covalent and hydrogen bonds and give examples of each, Compare them in terms of the mechanisms by which they are formed and their relative bond strengths.
6. Define pH in terms of hydrogen ion concentration and be able to identify any given pH as acid, base, or neutral and discuss their properties. Describe how pH changes are minimized by buffers.
7. Describe the types and functions of organic and inorganic compounds found in the body.
8. Demonstrate knowledge of the cell organelles and their functions.
9. Demonstrate knowledge of the various mechanisms of active and passive transport relative to the plasma membrane.
10. Discuss the effect of the first and, second laws of thermodynamics and relate how they affect organisms and the ecosphere.
11. Explain the composition, classification, and function of enzymes. Explain and describe factors influencing an enzymes regulation.
12. Define and explain anabolic and catabolic mechanisms. Explain how anabolic and catabolic reactions are essential to a cell.
13. Explain how chemical energy (ATP) is released by respiratory processes (anaerobic and aerobic).
14. Explain the process of photosynthesis
15. Demonstrate knowledge, and comprehension of mitosis and meiosis
16. Explain the role of genes in inheritance and how they are passed from one generation to the next.

17. Demonstrate a knowledge of the Mendelian Laws of Genetics and solve genetic problems involving monohybrid and dihybrid crosses.
18. Demonstrate a knowledge of the various forms of gene interaction.
19. Demonstrate basic knowledge of genetic engineering,
20. Discuss some common forms of human genetic disease.
21. Explain the role of DNA and RNA in inheritance, protein productivity and life processes.

## *Topic Outline.*

### I. Life and science

- a. Life
- b. Characteristics of life
- c. The scientific method
- d. Development of the scientific attitude
- e. Biology today
- f. Biology as a science

### II. Chemistry

- a. Matter and elements
- b. How elements differ
- c. Structure of matter
- d. Electron arrangement
- e. Electron arrangement vs. Reactivity
- f. Chemical bonding
  1. Ionic bonding
  2. Covalent bonding
    - a) polar
    - b) non-polar
  3. Hydrogen bonding
  4. VanderWaals Forces
- g. Inorganic compounds
  1. Acids
  2. Bases
  3. Salts
  4. Water
- h. Organic compounds
  1. Carbohydrates
  2. Lipids
  3. Proteins
  4. Nucleic acids

### III. Cells

- a. The cell theory
- b. The cell and its parts (structure and function)
  1. Membrane
  2. Endoplasmic reticulum
  3. Ribosomes
  4. Golgi complex
  5. Mitochondria
  6. Vacuoles
  7. Plastids

- 8. Centrioles
- 9. Cilia and flagella
- 10. Nucleus
- c. Prokaryotic and eukaryotic cells
- d. Compare and contrast between plant and animal cells;

#### IV. The cell membrane/wall

- a. The cell membrane/wall structure and function
- b. The transport of materials across the membrane
  - 1. Passive transport
    - a) osmosis
    - b) diffusion
    - c) dialysis
  - 2. Active transport
  - 3. Endocytosis
    - a) pinocytosis
    - b) phagocytosis
  - 4. Exocytosis
  - 5. Filtration

#### V. Energy transformations

- a. Chemical directions
  - 1. The first law of thermodynamics
  - 2. The second law of thermodynamics
  - 3. Entropy and enthalpy
- b. Cells energy
  - 1. ATP
- c. Metabolism
  - 1. Anabolic reactions
  - 2. Catabolic reactions
- d. Enzymes
  - 1. Characteristics
  - 2. Chemical and physical properties
  - 3. Classification
  - 4. Action
  - 5. Inhibition
- e. Cellular respiration
  - 1. Glycolysis (aerobic and anaerobic respiration)
  - 2. Transfer reaction
  - 3. Krebs's cycle (citric acid cycle)
  - 4. Electron transport chain and chemiosmosis
  - 5. Fermentation
- f. Photosynthesis
  - 1. Requirements

2. Light reaction (photophosphorylation)
3. Dark reaction (carbon fixation)

## VI. The cell cycle

- a. Control of cycle
  1. Cancer
- b. Interphase
  1. (G1) Gap I phase
  2. (S) Synthesis phase
  3. (G2) GapII phase
- c. Mitosis
  1. Prophase
  2. Metaphase
  3. Anaphase
  4. Telophase
- d. Meiosis
  1. Gametogenesis
    - a) spermatogenesis
    - b) oogenesis

## VII. Genetics

- a. Genes
  1. Composition
  2. Function
- b. Chromosomes
  1. Structure
  2. Role
  3. Number
- c. Mendelian inheritance
  1. Dominance
  2. Independent assortment
  3. Segregation
- d. Monohybrid and dihybrid crosses
  1. Homozygous organism
  2. Heterozygous organism
  3. Genotype
  4. Phenotype
  5. Alleles
  6. Dominance
  7. Recessive
- e. Laws of Probability
  1. The sum law
  2. The product law
  3. Application

- f. Gene interaction
  - 1. Incomplete dominance
  - 2. Epistasis
  - 3. Codominance
- g. Quantitative genetics
  - 1. Polygenic inheritance
  - 2. Multiple alleles
  - 3. Pleiotropy
- h. Sex-linked traits
  - 1. The sex determining chromosome
  - 2. X-linked (and influenced) genes
    - a) color blindness
    - b) hemophilia
  - 3. Y-linked genes

## VIII. Human genetics

- a. Chromosomal abnormalities
  - 1. Irregular numbers (aneuploid)
  - 2. Monosomic cells
  - 3. Trisomic cells
- b. Genes and disease
  - 1. Sickle cell
  - 2. Cystic fibrosis
  - 3. Neurofibromatosis
  - 4. Huntington disease
  - 5. Tay-Sachs disease
  - 6. PKU
  - 7. Trisomy 21 (Down's syndrome)
  - 8. Turners syndrome
  - 9. Klinefelters syndrome
  - 10. Super male
  - 11. Meta female
- c. Chromosomal aberrations
  - 1. Mutation
  - 2. Deficiency
  - 3. Duplication
  - 4. Inversion
  - 5. Translocation

## IX. DNA and the genetic code

- a. Protein synthesis
  - 1. DNA
  - 2. Transcription

### 3. Translation

#### X. Gene regulation (operon theory)

- a. Operator gene
- b. Promoter region
- c. Regulator gene
- d. Structural gene

#### XI. Genetic engineering

- a. Enzymes involved
- b. Common Techniques