Alabama State University
Department of Mathematics and Science

GENERAL BIOLOGY LABORATORY (BIO 127) Credit Hour - 01
Fall/Spring Semester

Laboratory Manual: Inquiry into Life (Custom Edition for Alabama State University) by Sylvia Mader

<table>
<thead>
<tr>
<th>Lab Section</th>
<th>Lab Hour &amp; Day</th>
<th>Lab Room-SB 203</th>
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<thead>
<tr>
<th>Instructor</th>
<th>Office Extension</th>
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Supporting Services - Tutoring/Audio-Visuals/Computer software
Math & Science Tutorial Center, PH 132 (8:00 a.m.-5:00 p.m., M-F)

Attendance Policy: Each student is expected to attend all lectures, seminars, laboratories and field work for each registered course, including the first class session. Attendance is required to verify official enrollment and continuance in each course. When students are absent from class for authorized reasons such as death in the family, illness, hindrance by true emergency situations or University activities, they will be allowed to make up assignments/ examinations that they missed. Instructors, of course, are not obligated to provide makeup opportunities for students who are absent, unless the absences have been officially approved. Official excuses can be obtained from the Office of Student Affairs.

NOTE: Any student requiring alternative formats for testing and/or handouts for this course, or other types of accommodations, due to a handicapping condition, should advise the instructor within the first week of classes.

Course Description:
This general biology laboratory course is designed to correspond with the first part of the introductory biology. This course is contrived to expose students with the basic principles and theories of biology. Each laboratory exercise provides ample hands-on experience based on every day observations in life. This laboratory course will enable students to be familiar with biological instruments, chemicals, solutions, experimentation and some current techniques. The laboratory exercises range from the study of microscopes, plant and animal cells, mitosis, meiosis, and photosynthesis to recombinant DNA techniques.

Course Goals:
To provide students with the opportunity to receive “hands-on” experience with scientific techniques and methods, so that the student will be able to relate the information gained in this course to everyday life situations. This course has following major objectives:
1. To introduce and familiarize students with basic biological phenomena
2. To provide students an opportunity to be actively involved in carrying out an experiment
3. To encourage students to design their own ideas and experimentation based on biological principles
4. To develop the student’s skill in writing, reading, analytical thinking, problem solving, graphics and mathematical calculations.

To meet the above goals, this course will focus on the following topics. Each topic is diverse and covers different activities as described in detail description of the course.

<table>
<thead>
<tr>
<th>Topics*</th>
<th>Corresponding Labs in the Manual</th>
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<tbody>
<tr>
<td>1</td>
<td>Scientific Method Laboratory 1</td>
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<td>2</td>
<td>Metric Measurement and Microscopy Laboratory 2</td>
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<td>3</td>
<td>Chemical Composition of Cells Laboratory 3</td>
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BIO 127 LAB 1 Last updated, July 2011
4 Cell Structure and Function
5 Mitosis and Meiosis
6 How Enzymes Function
7 Cellular Respiration
8 Photosynthesis
9 Organization of Flowering Plants
10 Reproduction in Flowering Plants
11 Monera and Protista
12 Laboratory Assignments (See Page 7)

*Laboratory experiments may vary depending on the availability of instruments and supplies.

EVALUATION AND MINIMUM STANDARDS

Testing: During this laboratory course, students will be tested from each objective. The midterm and final exams will be comprehensive.

Number of Tests: There will be a total of four tests including midterm and final. Instructors may give additional quizzes during the semester.

Composition of Tests: Test items on the test may be multiple-choice (MC), fill in the blanks (FB), matching (MT), completion (CP), and calculations (CAL). Midterm and final exams will contain practical lab questions inclusive of identification (PR). The instructors will determine the number of these questions. Each objective will be weighed equally in terms of testing. Students will be tested on the terms discussed in each objective.

Minimum Standard for Passing: To pass the lab, students have to obtain a minimum total of 350 points.

<table>
<thead>
<tr>
<th>Test</th>
<th>No. of Questions</th>
<th>Points</th>
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<tbody>
<tr>
<td>Test 1</td>
<td>50</td>
<td>100</td>
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<tr>
<td>Mid-term</td>
<td>50</td>
<td>100</td>
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<tr>
<td>Test 3</td>
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<td>100</td>
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<tr>
<td>Lab Assignments</td>
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<td>100</td>
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<tr>
<td>Final</td>
<td>50</td>
<td>100</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>500</strong></td>
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Grading Table

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range of total points</th>
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<tr>
<td>A</td>
<td>450-500</td>
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<tr>
<td>B</td>
<td>400-449</td>
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<tr>
<td>C</td>
<td>350-399</td>
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<tr>
<td>D</td>
<td>300-349</td>
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<tr>
<td>F</td>
<td>Below 300</td>
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All the students with D or F as a Final grade will be required to repeat the course, a university college core course requirement.

LABORATORY POLICIES

All students are expected to arrive for class ON TIME and leave ONLY after the work is completed. A student may not be allowed to attend the lab if he/she arrives late. You must abide by the University’s attendance policy. All students are expected to read each exercise before coming to class. This includes the introduction, procedures and all the terminology in bold face. You may be tested on these exercises. The students should read and follow the instructions in the lab manual while performing the experiment.

Attending one of the labs that meets during the week the lab experiment was missed can make up lab experiments. Examinations can be made up only at the end of semester (last week of labs), if an official excuse is presented. Unexcused absences from any examination or laboratory will count as zero.
LISTED BELOW ARE A FEW RULES TO FOLLOW IN YOUR LABORATORY WORK:
1. Read and follow directions given in your lab manual.
2. Handle all equipment with care.
3. Leave equipment, slides or preserved materials on the lab tables neatly arranged.
4. Discard materials as directed.
5. Do not remove solutions or other materials from demonstration table.
6. Always handle all the chemicals with care.
7. Always empty and rinse all glassware used and return it to your work place.
8. Beeperers and telephones are not allowed in the lab.
10. There will be a severe disciplinary action if any student is caught while cheating during the test.

Course Objectives

The following laboratory objectives are designed to meet the goals of this course. Each objective contains a variety of reading/writing exercises, mathematical calculations and scientific reasoning.

Objective 1. Understand concepts of scientific method. (Laboratory 1)

Students should be able to:
1. formulate and test hypotheses
2. design an experiment to answer questions

Terms to define: Theory, induction, deduction, hypothesis, variables, graphs.

Experiments: Toilet Paper Strength Exercise

Lab Assignment: Lab 1. Scientific Inquiry

Objectives 2 & 3. Understand concept of Metric Measurements and Microscopy (Laboratory 2 & 3)

Students should be able to:
1. recognize graduated cylinders, beakers, flasks, pipets, and test tubes
2. explain the concepts of measurements such as length, volume and mass
3. describe different measurement systems
4. convert units from one system to another
5. describe how to care for a microscope
6. recognize the parts of compound microscope and know their functions
7. define the principles of microscopy

Terms to define: Qualitative and quantitative observation, gram, meter, liter, degree Celsius (C°), Fahrenheit (F°), kilogram.

Equipment to identify: beaker, graduated cylinder, pipet, Erlenmeyer flask, balances, thermometers, and some other commonly used equipment.

Experiments:
I. Length Lab 2.1
II. Mass Lab 2.2
III. Volume Lab 2.3
IV. Temperature Lab 2.4
V. TEST FOR STARCH, PROTEIN & GLUCOSE Lab 2.7
Lab Assignment: Lab 2. Measurements and Chemical Solutions

Microscopy (Laboratory 3)

Terms to define: Magnification, resolution, contrast, parfocal, parcentral, working distance
Equipment to know: Compound light microscope, dissecting microscope, know all the parts of the light microscope and their function.
Video tape: Using the compound Microscope

Experiments:
I. The compound light microscope
   A. Proper handling and care of microscopes Lab 2.1
   B. Parts of the Compound Light Microscope Lab 2.2
   C. How to use a microscope to observe a specimen Lab 2.2
   D. Measurement of the field of view Lab 2.4

Suggested Web Resources:


Objective 4. DNA: DNA Biology and Technology (Laboratory 22)

Students should be able to:
1. describe the components of DNA
2. distinguish between DNA and RNA
3. demonstrate the structure of DNA and RNA
4. read codons

Terms to define: DNA, RNA, replication, transcription, translation, purine, pyrimidine, codon, peptide bond, and amino acids.

Suggested Web Resources:

1. How Watson, the Nobel prize winner discovered the DNA double helix model: http://www.hhmi.org/biointeractive/media/DNAi_watson_basepairing-lg.mov
2. Bidirectional DNA replication: http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039869&showSelfStudyTree=true
3. DNA replication fork: http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039870&showSelfStudyTree=true
4. DNA replication: http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039871&showSelfStudyTree=true
5. DNA as genetic material: http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039872&showSelfStudyTree=true
7. Translation: http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039874&showSelfStudyTree=true
8. Transcription: http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039875&showSelfStudyTree=true

BIO 127 LAB 4 Last updated, July 2011
Objective 5. Chemical Composition of Cells. (Laboratory 4)

Students should be able to:
1. recognize different parts of the cell
2. differentiate between plant and animal cell
3. make plant and animal cell slides
4. state the function of different cellular components
5. state the properties of prokaryotic and eukaryotic cells

Terms to define: Cell, cell theory, prokaryotes, eukaryotes etc.

Objective 6. Understand the Mechanisms of Osmosis and Diffusion (Laboratory 6 & 7)

Students should be able to:
1. explain the significance of the concentration gradient
2. describe the significance of the selectively permeable membrane
3. distinguish between osmosis and diffusion
4. state the role of varying osmotic concentrations

Terms to define: Osmosis, diffusion, solvent, solute, tonicity, hypertonic, hypotonic, isotonic and selectively permeable membrane.

Experiments:
A. Diffusion of methylene blue and potassium
B. Osmosis with dialysis tubing
C. Demonstration of tonicity using raisins

Suggested Web Resources:


Objective 7. Photosynthesis (Laboratory 8 -10)

Students should be able to:
1. state the role of CO₂ and light in photosynthesis
2. explain the importance of colors based on their wavelength
3. identify the pigments found in the green leaf
4. explain the different plant cell structures involved in photosynthesis
5. describe the characteristics of vascular plants
6. understand the function of vascular plants
7. recognize the structure of flowering plants

Terms to define: Photosynthesis, autotrophs, heterotrophs, chromatogram, stroma, grana, thylakoid disk, seedless plants, gymnosperm, angiosperm, bryophytes, cones, seeds.

Experiments:
A. Floating Leaf Disk Assay
B. Paper Chromatography
C. Examination of leaf structure
Suggested Web Resources:

1. Calvin Cycle: http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039819&showSelfStudyTree=true

Objective 8. Mitosis and Meiosis (Laboratory 5)

Students should be able to:
1. state the stages of cell division
2. distinguish between cytokinesis and mitosis
3. recognize the changes in chromosome structure during mitosis and meiosis
4. differentiate between plant and animal cytokinesis
5. identify the similarities and differences between mitosis and meiosis
6. illustrate the gamete constitution of body cells and sex cells
7. describe the genetic process of egg and sperm formation

Terms to define: Cell cycle, mitosis, prophase, metaphase, anaphase, telophase, cytokinesis, DNA replication, chromatid, spindle apparatus, fertilization, zygote, sperm, egg, meiosis, homologue, diploid, haploid, allele, gamete etc.

Video Tape: Cell division

Experiments:

I. The Cell cycle Lab 5.1
II. Observing Onion root tip slides Lab 5.2
III. Observing mitosis models Lab 5.3
IV. Observing Gametogenesis models Lab 5.5

Lab Assignment: Lab 5. Mitosis and Meiosis
Sketches of Cell Cycle

Suggested Web Resources:

Objective 9. Understand the basic concepts of Mendelian and human Genetics (Laboratory 21)

Students should be able to:
1. solve monohybrid problems
2. solve dihybrid problems
3. describe the inheritance of characteristics generation to generation
4. determine the phenotype of an individual based on the genotype
5. define genetic abnormality and disorder

Terms to define: Genetics, dominance, recessive, complete dominance, incomplete dominance, true breeding, gamete, allele, homozygous, heterozygous, monohybrid cross, dihybrid cross, sex-linked traits, multiple alleles, phenotype, genotype, Punnett square

Experiments:
I. The Monohybrid Cross
II. The Dihybrid Cross
III. Exceptions to the Mendel’s Laws
IV. Genetic Abnormalities
V. Karyotype Analysis

Lab Assignment: Lab 21. Mendelian Genetics

Suggested Web Resources:
3. Dihybrid cross: [http://trc.ucdavis.edu/biosci10v/bis10v/media/ch08/dihybrid_v2.html](http://trc.ucdavis.edu/biosci10v/bis10v/media/ch08/dihybrid_v2.html)
4. Karyotype analysis: [http://trc.ucdavis.edu/biosci10v/bis10v/media/ch08/karyotype.html](http://trc.ucdavis.edu/biosci10v/bis10v/media/ch08/karyotype.html)

Objective 10. Understand the basic concepts of Molecular Biology and Recombination of DNA technology (Laboratory 22)

Students should be able to:
1. state the definitions of plasmids
2. understand how modern technology influences the current understanding of research

Terms to define: genetic engineering, autosomal dominant inheritance, mutation, DNA ligase, and deletion.

Lab Assignment: Lab 21 & 22

Suggested Web Resources:
1. PCR: [http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039879&showSelfStudyTree=true](http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039879&showSelfStudyTree=true)
4. DNA fingerprinting: [http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039878&showSelfStudyTree=true](http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039878&showSelfStudyTree=true)
5. Protein synthesis: [http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039876&showSelfStudyTree=true](http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072986751&alaid=ala_1039876&showSelfStudyTree=true)
Objective 11. Understand the Taxonomy-Monerans and Protists (Laboratory 24)

Students should be able to:
1. distinguish common names from scientific names
2. illustrate the importance of scientific names in biology
3. identify the genus and specific epithet in scientific name
4. identify and classify different bacterial species and protozoans
5. define the different forms of bacterial shapes
6. understand the economic relevance of monerans and protists

Terms to define: common name, scientific name, binomial nomenclature, genus, specific epithet, decomposer, decomposer, producer, consumer, gram stain, antibiotic, cilia, flagella, pseudopodia, micronuclei, and macronucleus.

Experiments:
I. Kingdom Monera
II. Kingdom Protista

Lab Assignment: Lab 24.

Suggested Web Resources:

Objective 12. Laboratory assignments (writing exercises, quizzes, and assignments)

Individual instructor will determine format, frequency, and scoring of writing exercise(s), quizzes and assignments.

At the end of each laboratory there are lab assignments. These lab assignments are to be completed after your instructor has taught the lab. You will be graded on the assignment that will contribute to a total if 100 points. You must answer 70% of the questions correctly to pass an assignment. Your instructor will determine the number of lab assignments. Following are some of the ways that can be used by your instructor to grade the lab assignments:

You may be required to turn in Ten (10) assignments each worth 10 points
OR
You may be required to turn in Five (5) selective lab assignments each worth 20 points

In order to pass this objective, you must earn 70 points