Lake Michigan College
Principles of Biology I
Biol 111 Course Syllabus
Fall Semester 2014

I. Course Identification

A.	Discipline:	Biology
B.	Title & Number:	Principles of Biology I, Biology 111
C.	Credit Hours:	4
D.	Contact Hours:	6
E.	Meeting Days:	M-F 1:15-2:05
F.	Campus/Room:	Lake Michigan Catholic, Room 225
G.	Instructor:	Laura Jasper-Stump, MS
H.	Office Number:	Room 225
I.	Office Hours:	M-F 7:00-7:30 a.m. & 3:00-3:30 p.m.
J.	Phone Number:	269-983-2511
K.	Email:	ljasper@lmclakers.org
L.	Prerequisites:	English, Math, Reading and Biology 101 (or 2 years of high school biology, or one year of high school biology and one year of high school chemistry)

II. Textbooks

Reece, Urry, Cain, Wasserman, Minorsky, and Jackson, 2011, *Campbell Biology*, 9th Ed., Pearson with Mastering Biology Access

Vodopich, Darrell S. & Randy Moore, 2002, *Biology Laboratory Manual*, 10th Ed., WCB/McGraw-Hill

III. Course Description from Catalog

Emphasizes cell chemistry, cell structure and function, metabolism and energy, molecular biology, genetics, and biotechnology, as well as related laboratory experiences. For biology majors and minors, or students planning to transfer to pre-professional programs requiring biology.

Prerequisits: English, Math, Reading and Biology 101 (or recommend 2 years of high school biology, or one year of high school biology and one year of chemistry with a C or better).

IV. General Education Areas Met

2 – Communication, 3 – Critical Thinking, 5 – Mathematics, 6 – Sciences, and 7 – Technology

V. Goals and Objectives

General Objectives (2, 3, 5, 6, 7)

Develop the ability to read scientific literature for content, and to critique and analyze claims of others in a scientific context.
Ask scientific questions of their world and construct reasonable hypotheses.
Perform basic laboratory skills necessary to study cellular biology, molecular biology, genetics, and biotechnology.
Demonstrate the ability to use computers for data analysis and literature searches, and retrieval of data from reliable databases.
Demonstrate the application of biological concepts to personal issues, society, economics, technology and ethical issues.
Demonstrate an understanding of the scientific process, its limitations, null and alternative hypothesis, identify variables and distinguish between experimental and control groups.

Biochemistry Objectives (3, 6, 7)

Know vocabulary associated with biochemistry.
Understand the basic structure of atoms and the importance of valence electrons.
Distinguish between the four types of chemical bonds (covalent, ionic, hydrogen, and Van der Waals interactions).
Understand the differences between hydrophobic and hydrophilic substances.
Distinguish organic chemistry from inorganic chemistry.
Understand the biological significance of the seven major functional groups in the chemistry of life.
Apply and understanding of polymerization (dehydration reactions) and de-polymerization (hydrolysis) to formation and disassembly of biological molecules.
Recognize and describe the monomeric units, structure, and function of the four major macromolecules (carbohydrates, lipids, proteins, and nucleic acids).
Apply the structural levels of proteins to their function and diversity (primary, secondary, tertiary, and quaternary).

Cellular Biology Objectives (3, 5, 6, 7)

Know vocabulary associated with cellular biology.
Demonstrate the appropriate use of microscopes to observe microscopic entities and cells
Understand the purpose of different types of microscopy used in biology.
Compare and contrast prokaryotic and eukaryotic cells.
Understand the biological significance and abundance of prokaryotic cells.
Understand the function of eukaryotic cellular organelles, how they are compartmentalized and how they work together to carry out cellular functions such as protein trafficking.
Understand the role of the cytoskeleton (support, motility, and regulation) and its structural components (microtubules, intermediate filaments, and microfilaments).
Relate the roles of the extracellular matrix, including intercellular junctions to cellular structure and interaction.
Apply an understanding of the fluid mosaic model to cellular membranes.
Apply an understanding of passive and active processes to transport of ions and molecules across a cellular membrane.
Understand how cells metabolize nutrients and eliminate waste.
Explain how the laws of thermodynamics, Gibbs free energy, ATP, enzyme catalysis and enzyme regulation relate to the efficient functioning of the cellular processes.
Understand and describe the mechanisms cells use to harvest energy for metabolism during aerobic and anaerobic cellular respiration and fermentation.
Understand and describe the mechanisms involved in the photosynthetic process used to feed the biosphere.

Apply chemiosmosis to the roles oxidative phosphorylation and photophosphorylation.
Describe the roles of NAD^+, $NADP^+$ and FAD^+ in harvesting energy.
Understand the role of signal transduction pathways in cellular communication.
Compare and contrast G protein-coupled receptors, tyrosine kinase receptors, and ligand-gated ion channels.
Understand the advantages of multistep pathways in signal transduction and the role of second messengers.
Describe the role of apoptosis in development and degenerative diseases in vertebrates.
Understand the structural organization of the prokaryotic and eukaryotic genome.
Describe what takes place during the phases of mitosis and meiosis.
Compare and contrast mitosis and meiosis.
Explain how cell division is regulated through cell cycle checkpoints.
Compare and contrast cell division among prokaryotes, protists, plants and animals.
Apply the loss of cell cycle control to the progression of cancer.
Distinguish between asexual and sexual reproduction.
Understand the meiotic and fertilization contributions to genetic variation

Genetics Objectives (3, 5, 6, 7)

Know vocabulary associated with genetics.
Distinguish between Mendel's two laws of inheritance.
Use a testcross to determine the P_1 genotype of dominant trait.
Understand and apply the Multiplication and Addition Rules for solving complex genetic problems.
Describe variations of Mendelian genetics.
Explain how environmental effects can alter certain phenotypes.
Understand and apply pedigree analysis to determine the pattern of inherited disorders in humans.
Explain why lethal dominant genes are rarer than lethal recessive genes.
Apply the chromosomal basis of inheritance to inheritance patterns.
Understand how linked genes affect inheritance.
Describe how linked genes undergo recombination during Prophase I.
Demonstrate how recombination of linked genes is used to map genes on a chromosome.
Know the inheritance pattern of sex-linked genes.
Explain how and why the extra X sex chromosome in females is inactivated.
Apply an understanding chromosomal nondisjunction to aneuploidy and polyploidy.
Understand why nondisjunction with human sex chromosomes and autosomes result in a range of genetic disorders.

Molecular Biology Objectives (3, 6, 7)

Know vocabulary associated with molecular biology.
Explain the three major experimental contributions (Griffiths, Avery, and Hershey/Chase) that gave evidence DNA is the hereditary molecule.
Describe the discovery process of the structure of DNA including the contributions of Erwin Chargaff, Rosalind Franklin, Francis Crick and James Watson.
Understand how the semi-conservative model for DNA replication was determined by Meselson-Stahl's experiment.
Explain the molecular process involved in DNA replication.
Distinguish between the leading and lagging strands of DNA replication.
Explain the formation of Okazaki fragments.
Understand how base pairing errors occur during DNA replication and mechanisms involved in correcting these errors.
Describe how telomeric ends of DNA are replicated and the effect of DNA replication on the length of the telomeres.

Apply the discovery by George Beadle and Edward Tatum to the relationship between genes and proteins.
Understand molecular roles of DNA, RNA, and enzymes in transcription and translation.
Describe what it means to say the genetic code is redundant and unambiguous.
Explain how polypeptides are processed during the production of functional proteins.
Know the key differences in gene expression between prokaryotes and eukaryotes.
Apply an understanding of point mutations to their effects on the resulting protein's structure and function.

Gene Regulation Objectives (3, 6, 7)

Know the vocabulary associated with gene regulation.
Understand the genomic organization of eukaryotes including chromatin structure and DNA packaging.
Explain the concept of an operon and its structural components.
Explain the adaptive advantage of grouping bacterial genes into an operon.
Differentiate repressible and inducible operons and the pathways they control.
Explain how DNA methylation and histone acetylation affect chromatin structure and regulate transcription.
Explain the role of promoters, enhancers, activators, and repressors in transcriptional control.
Understand coordinately expressed genes in eukaryotes.
Understand the importance of small RNAs on gene expression.
Describe the role of transcription factors in gene regulation.
Distinguish between benign tumors and malignant cancers.
Describe the two major classes of genes involved in the progression of cancer.
Describe the effects of mutations to the *p53* and *ras* genes in the progression of cancer.
Understand the multistep model of cancer development.

Biotechnology Objectives (3, 5, 6, 7)

Know vocabulary associated with biotechnology.
Apply the function of restriction enzymes in biotechnology.
Understand the steps involved in DNA cloning and distinguish it from organism cloning.
Distinguish between DNA and cDNA.
Describe the uses and steps involved in the polymerase chain reaction.
Demonstrate the use of gel electrophoresis in separating large biological molecules.
Understand the application Southern and Northern blotting, DNA sequencing, DNA microarrays and *in vitro* mutagenesis.
Explain the dideoxy chain-termination method used for sequencing DNA.
Explain how micro-arrays inform us about which genes are turned on and off, and their level of expression.
Be aware of the practical applications of DNA technology and how they affect our lives.
Discuss the safety and ethical concerns regarding biotechnology.

VI. Expected Student Outcomes

During the semester you will be assessed for learning outcomes. Some questions on your exams will be used for assessment. The questions will be based on the material listed in the Goals and Objectives. Assessments will be used to gauge comprehension and the data may lead to improvement of instructional technique.

VII. Instructional Methodology

A. Lectures (PowerPoint with embedded clicker questions)
B. Class Discussion and Collaborative Learning
C. Critical Thinking Strategies and Problem Solving
D. Practical Laboratory Applications and Assignments
E. Audio Visual Materials (Computer-assisted multimedia presentations)
F. Canvas LMS
G. MasteringBiology^{tm} Study Area for Campbell/Reece *Biology,* 9th Edition

VIII. Writing Across the Curriculum

Students are expected to write lab reports, assignments, quizzes, and test answers using appropriate grammar, sentence structure and spelling to aid in the development of their writing skills.

IX. Grading Criteria and Requirements

Student evaluation will be based on the outcome of scores from (4) exams, (1) final exam, (5) quizzes, (1) assignment, and (14) lab reports. The missed or lowest score of a 100 point exam and the missed or lowest score of one lab assignment will be dropped before calculating the final grade. Your scores will be posted on Canvas.

X. Grading Scale

(5) Exams	100 pts ea x 5	500	
(1) Final exam	150 pts		150
(5) Quizzes	10 pts ea x 5	50	
(15) Lab Reports	10 pts ea x 15	150	
	Subtotal	850	
Less (1) Lecture exam			-100
Less (1) Lab report		-10	
Total Points for Calculating Grade		740	

Percentage Letter Grade

90 – 100%	A
80 – 89%	B
70 – 79%	C
60 – 69%	D
0 – 59%	E

To calculate your grade at any point throughout the semester add the total points you earned and divide by the total possible points you could have earned, then multiply by 100; that will give you your percentage score. For example if you earned 420 points out of a possible 480: 420 points earned ÷ 480 points possible X 100 = 87.5% = B)

XI. Grading Policy (See College Catalog)

Exams, quizzes, homework assignments, and lab reports *must be your own work*. While you will work as groups in carrying out lab exercises, *you will be expected to complete your own lab reports without copying answers from others*. Any academic dishonesty will result in a score of zero for all parties involved. Late labs and assignments will be

accepted with a 10% point reduction (1 pt) for each weekday the lab or assignment is late.

XII. Make-Up Policy

Since you are able to drop a missed exam, no make-up exams will be given unless an original physician's excuse certifying illness is presented, or absence was due to death in the immediate family. College sanctioned events, such as participation in intercollegiate athletic or music events, will be excused only if a make-up exam is arranged in advance of the scheduled exam date. Labs cannot be made up. Since a missed exam (with the exception of the final exam) and a missed lab assignment may be dropped, permission for a make-up exam is rare. Car trouble, baby sitter problems, etc. are not valid reasons for missing an exam and will be considered your dropped exam and/or lab. Please check with me in advance concerning possible situations for which you may be unsure.

XIV. Attendance Policy/Withdrawal Policy

Attendance in this class is very important to your success. Your lack of attendance is likely to be reflected in your final grade. To review the college attendance policy, refer to the current catalog. **Last day to drop a class with a guaranteed "W" is November 24.**

Mindful of the diverse student body that Lake Michigan College serves, and the varied belief systems that its students represent, the College will make a reasonable effort to accommodate students who need to be excused from classes for the observance of religious holidays. This policy does not apply to students who knowingly register for classes scheduled to meet on days that consistently conflict with their day to worship, e.g., a student who sings up for Saturday classes when the student normally worships on Saturday.

XV. Student Behavior

Lake Michigan College students are expected to maintain behavior appropriate to a college environment. Students who fail to do so will be subject to the disciplinary action as published in the Student Handbook, which may range from expulsion from a class up to removal or permanent exclusion from the college. To reduce distractions and enhance learning, use of cell phones is not allowed without prior permission, this includes text messaging. Each violation will result in two (2) points being deducted from your overall score. This classroom provides laptops for student use during class. Inappropriate use of laptops, such as social networking, shopping, visiting off topic pages, etc. will result in two (2) points being deducted from your overall score for each violation.

XVI. Disability Statement

Should you have any questions about this course and your success, please arrange to meet with me. If you determine that disability related accommodations are necessary, please register with the Student Success Center-Disability Resources on the Napier Campus, and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations.

XVII. Course Schedule

The course schedule sequence can be found at the end of this syllabus. The schedule will be followed as closely as possible; however, changes may be made at the instructor's discretion.

Though everyone's studying needs are different, I have found that these steps serve students well to learn the material and prepare appropriately for the exam.

1. Read each chapter or section of chapter that will be covered during class prior to arriving for lecture. Chapter reading assignments are listed in the schedule at the end of the syllabus.
2. While reading each chapter, take notes (or create an outline) on vocabulary highlighted in the chapter.
3. Study the pictures in the text to understand the basics.
4. Download and/or print out the PowerPoint notes from Canvas prior to class for efficient note taking.
5. Examine PowerPoint notes to see what will be covered during lecture making an effort to understand the overall structure of the lecture and the breadth of the subject.
6. Come to class on time and take shorthand notes on the PowerPoint handouts you printed/downloaded.
7. Ask questions during lecture when explanations are not clear to you and/or write down questions that you will need answered to understand the material well.
8. When studying the material provide yourself with a quiet, well lit, stress free environment for optimal focus and understanding. No multitasking.
9. Go home and rewrite your notes in outline form or complete sentences as soon as possible (this is crucial!).
10. Reread the chapter to answer any questions you may have from lecture. This time pay less attention to vocabulary and more attention to concepts.
11. Be sure you understand the concept behind each figure.
12. When having difficulty come to my office during posted office hours (will arrange additional times if needed), or see a tutor with prepared questions you need answered.
13. Check out the online resources provided in Mastering Biology, these resources can be a great help. You may also find Khan Academy and Bozeman Science on You Tube to be of help.
14. Once you understand the material practice retrieval without your notes. Repeat even as you're learning new material.
14. Prior to the exam reread the text again and review your corrected notes.

BIOL 111
Fall 2015 Course Schedule

Note that reading assignments are to be completed before arriving to class as these are the topics that will be covered that day during class.

Tues., Sep. 8

Introduction: Introductions. Discussion: syllabus, importance of scientific literacy, and why study biology

Reading Assignment: Chapter 2 - The Chemical Context of Life

Concept 2.2 – An element's properties depend on the structure of its atoms
- Subatomic Particles
- Atomic Number and Atomic Mass
- Isotopes
- Electron Distribution and Chemical Properties
- Concept Check 2.2

Lab: Discussion regarding lab safety and signing of lab contract, labs and lab reports assigned from lab manual, and labs based on handouts

Thurs., Sep. 10

Reading Assignment: Chapter 2 - The Chemical Context of Life

Concept 2.3 – The formation and function of molecules depend on chemical bonding between atoms
- Covalent Bonds
- Ionic Bonds
- Weak Chemical Bonds (Hydrogen Bonds and Van Der Waals Interactions)
- Molecular Shape and Function
- Concept Check 2.3

Chapter 4: Carbon and Molecular Diversity of Life

Concept 4.3 A few chemical groups are key to the functioning of biological molecules

Lab:

1. Modeling covalent bonds and hydrogen bonds.
2. Introduction to cell culturing and A-431 epithelial skin cancer cells. You will be experimenting with this cell line intermittently throughout the semester.

Tues., Sep. 15

Reading Assignment: Chapter 5 - The Structure and Function of Large Biological Molecules

Concept 5.1 – Macromolecules are polymers, built from monomers
- The Synthesis and Breakdown of Polymers
- The Diversity of Polymers
- Concept Check 5.1

Concept 5.2 – Carbohydrates serve as fuel and building materials
- Sugars (Monosaccharides)
- Polysaccharides (Storage and Structural)
- Concept Check 5.2

Concept 5.3 – Lipids are a diverse group of hydrophobic molecules

Fats
Phospholipids
Steroids
Concept Check 5.3

Lab: Lab manual Exercise 3 - The Microscope
Pages 21-29.
Procedures 3.1, 3.2, *Alternate procedure* 3.3, 3.4, and 3.5.
The focus is on the appropriate use of a microscope and measuring the FOV, depth, and size of magnified specimens.

Lab report: Answer questions 1-6. This lab report is due on Thurs., Sept. 17.

Thurs., Sep. 17
Reading Assignment: Chapter 5 - The Structure and Function of Large Biological Molecules
Concept 5.4 – Proteins include a diversity of structures, resulting in a wide range of functions
Amino Acid Monomers
Polypeptides (Amino Acid Polymers)
Protein Structure and Function
Four Levels of Protein Structure
Sickle Cell Disease: A Change in Primary Structure
Protein Folding in the Cell
Concept Check 5.4
Concept 5.5 – Nucleic acids store, transmit, and help express hereditary information
The Roles of Nucleic Acids
The Components of Nucleic Acids
Nucleotide Polymers
The Structure of DNA and RNA Molecules

Lab:
1. Handout for observing A-431 cell cultures using an inverted phase-contrast microscope: determine confluency and visually distinguish between live and dead cells.
Note: You will use these observational techniques in subsequent experiments later in the semester.
2. Use amino acid kit to build a protein and model its primary, tertiary and quaternary structure

Lab report:
The lab report is located at the end of the handout. This is due on Tues., Sept. 22.

Tues., Sep. 22
Reading Assignment: Chapter 6 - A Tour of the Cell
Concept 6.1 – Biologists use microscopes and the tools of biochemistry to study cells
Microscopy
Concept Check 6.1
Concept 6.2 – Eukaryotic cells have internal membranes that compartmentalize their functions
Comparing Prokaryotic and Eukaryotic Cells
A Panoramic View of the Eukaryotic Cell
Concept Check 6.2

Concept 6.3 – The eukaryotic cell's genetic instructions are housed in the nucleus and carried out by the ribosomes
- The Nucleus: Information Central
- Ribosomes: Protein Factories
- Concept Check 6.3

Concept 6.4 – The endomembrane system regulates protein traffic and performs metabolic functions in the cell
- The Endoplasmic Reticulum: Biosynthetic Factory
- The Golgi Apparatus: Shipping and Receiving Center
- Lysosomes: Digestive Compartments
- Vacuoles: Diverse Maintenance Compartments
- The Endomembrane System: A Review
- Concept Check 6.4

Lab: Lab manual Exercise 4 - The Cell Structure and Function
Pages: 33 - 47 (skip procedure 4.7 on page 43)
Procedures: 4.1 - 4.6 and 4.8 - 4.10.
The focus is on identifying cellular structures and function, along with distinguishing cell types.
Note: You will be working on this lab today and on Thursday.

Lab report: Answer questions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13.

Thurs., Sep. 24
Reading Assignment: Chapter 6 - A Tour of the Cell

Concept 6.5 Mitochondria and chloroplasts change energy from one form to another
- The Evolutionary Origins of Mitochondria and Chloroplasts
- Mitochondria: Chemical Energy Conversion
- Chloroplasts: Capture of Light Energy
- Concept Check 6.5

Concept 6.6 The cytoskeleton is a network of fibers that organizes structures and activities in the cell
- Roles of the Cytoskeleton: Support and Motility
- Components of the Cytoskeleton
- Concept Check 6.6

Concept 6.7 Extracellular components and connections between cells help coordinate cellular activities
- Cell Walls of Plants
- The Extracellular Matrix (ECM) of Animal Cells
- Cell Junctions
- Concept Check 6.7

Lab: Continue Lab manual Exercise 4, The Cell Structure and Function
Pages: 33 - 47 (skip procedure 4.7 on page 43)
Procedures: 4.1 - 4.6 and 4.8 - 4.10.
The focus is on identifying cellular structures and function, along with distinguishing cell types.

Lab report: Answer questions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13. This lab report is due on Tues., Sept. 29.

Tues., Sep. 29
Exam 1: Chapters 2, 5, and 6

Reading Assignment: Chapter 7 - Membrane Structure and Function

- Concept 7.1 Cellular membranes are fluid mosaics of lipids and proteins
  - The Fluidity of Membranes
  - Membrane Proteins and Their Function
  - The Role of Membrane Carbohydrates in Cell-Cell Recognition
  - Synthesis and Sidedness of Membranes
  - Concept Check 7.1
- Concept 7.2 Membrane structure results in selective permeability
  - The Permeability of the Lipid Bilayer
  - Transport Proteins
  - Concept Check 7.2

Lab: Lab manual Exercise 9 – Diffusion and Osmosis
Pages: 93 – 102 (skip procedure 9.6)
Procedures: 9.1 - 9.5, 9.7 & 9.8.
The focus is on Brownian movement, factors that affect the rate of diffusion and osmosis, graphing and interpretation of results, and the effects of water potential (osmolarity) on plant and animal cells.
Note: You will be working on this lab today and on Thursday.

Lab report: Answer lab questions 1 – 6 and 8-10 and tables 9.1 and 9.3.

<u>Thurs., Oct. 1</u>

Reading Assignment: Chapter 7 - Membrane Structure and Function

- Concept 7.3 Passive transport is diffusion of a substance across a membrane with no energy investment
  - Effects of Osmosis on Water Balance
    - Water Balance of Cells Without Cell Walls
    - Water Balance of Cells With Cell Walls
  - Facilitated Diffusion: Passive Transport Aided by Proteins
  - Concept Check 7.3
- Concept 7.4 Active transport uses energy to move solutes against their gradients
  - The Need for Energy in Active Transport
  - How Ion Pumps Maintain Membrane Potential
  - Cotransport: Coupled Transport by a Membrane Protein
  - Concept Check 7.4
- Concept 7.5 Buld transport across the plasma membrane occurs by exocytosis and endocytosis
  - Exocytosis
  - Endocytosis
  - Concept Check 7.5

Lab: Continue Lab manual Exercise 9 – Diffusion and Osmosis
Pages: 93 - 102 (skip procedure 9.6)
Procedures: 9.1 - 9.5, 9.7 & 9.8.

The focus is on Brownian movement, factors that affect the rate of diffusion and osmosis, graphing and interpretation of results, and the effects of water potential (osmolarity) on plant and animal cells.

Lab report: Answer lab questions 1 – 6 and 8-10 and tables 9.1 and 9.3. This lab report is due on Tues., Oct. 5.

Tues., Oct. 5 (Power Points for Chapter 8 are included in Chapter 9's Power Points)

Reading Assignment: Chapter 8 – The free-energy change of a reaction tells us whether or not the reaction occurs spontaneously

- Concept 8.2 – Free energy and metabolism
  - Exergonic and Endergonic Reactions in Metabolism
- Concept 8.3 – ATP powers cellular work by coupling exergonic reactions to endergonic reactions
  - The Structure and Hydrolysis of ATP
  - How the Hydrolysis of ATP Performs Work
- Concept 8.4 – Enzymes speed up metabolic reactions by lowering energy barriers
  - The Activation Energy Barrier
  - How Enzymes Speed Up Reactions
  - Substrate Specificity of Enzymes
  - Catalysis in the Enzyme's Active Site
  - Effects of Local Conditions on Enzyme Activity
    - Effects of Temperature and pH
    - Enzyme Inhibitors
- Concept 8.5 – Regulation of enzyme activity helps control metabolism
  - Feedback Inhibition

Reading Assignment: Chapter 9 - Cellular Respiration and Fermentation

- Concept 9.1 Catabolic pathways yield energy by oxidizing organic fuels
  - Catabolic Pathways and Production of ATP
  - Redox Reactions: Oxidation and Reduction
    - The Principle of Redox
    - Oxidation of Organic Fuel Molecules During Cellular Respiration
    - Stepwise Energy Harvest via NAD^+ and the Electron Transport Chain
  - The Stages of Cellular Respiration: A Preview
  - Concept Check 9.1
- Concept 9.2 Glycolysis harvests chemical energy by oxidizing glucose to pyruvate
  - Concept Check 9.2

Lab: Lab manual Exercise 12, Respiration

Pages: 125, 126 (stop after question 1), 129 (read paragraph on: oxygen consumption during aerobic respiration), 130 (start at: production of CO_2 during aerobic respiration), 131, 132 (stop after question 6).

Procedure: 12.3 (use gold fish in place of snails). We will complete rest of the lab on Thurs. The focus is on how different organisms have different respiration needs. To investigate, we will measure the difference in CO_2 production between a plant and animal.

Lab report: Answer lab questions 1, 5, and 6 and table 12.4. This is the first part of the lab report, we will complete Exercise 12 on Thurs.

Thurs., Oct. 7

Reading Assignment: Chapter 9 - Cellular Respiration and Fermentation

Concept 9.3 After pyruvate is oxidized, the citric acid cycle completes the energy-yielding oxidation of organic molecules
- Oxidation Of Pyruvate to Acetyl CoA
- The Citric Acid Cycle

Concept Check 9.3

Concept 9.4 - During oxidative phosphorylation, chemiosmosis couples electron transport to ATP synthesis
- The Pathway of Electron Transport
- Chemiosmosis: The Energy-Coupling Mechanism
- An Accounting of ATP Production by Cellular Respiration
- Concept Check 9.4

Concept 9.5 – Fermentation and anaerobic respiration enable cells to produce ATP without the use of oxygen
- Types of Fermentation
- Comparing Fermentation with Anaerobic and Aerobic Respiration
- The Evolutionary Significance of Glycolysis
- Concept Check 9.5

Lab: Lab manual Exercise 12, Respiration
Pages: 126 (start after question 1), 127, 128, 129 (stop at: oxygen consumption during aerobic respiration)
Procedure: 12.1. This completes lab Exercise 12.
The focus is on factors that affect anaerobic fermentation. To investigate, we will measure gas displacement by yeast treated with various activators and inhibitors of glycolysis.

Lab report: Answer lab questions 2 and 3 and tables 12.1, and 12.2. This completes lab Exercise 12. This report is due on Tues., Oct. 12.

Tues., Oct. 13

Reading Assignment: Chapter 10 - Photosynthesis

Concept 10.1 – Photosynthesis converts light energy to the chemical energy of food
- Chloroplasts: The Sites of Photosynthesis in Plants
  - Photosynthesis as a Redox Process
- The Two Stages of Photosynthesis: A *Preview*
- Concept Check 10.1 (1 and 3)

Concept 10.2 – The light reactions convert solar energy to the chemical energy of ATP and NADPH
- Photosynthetic Pigments: The Light Receptors
- Excitation of Chlorophyll by Light
- A photosystem: a reaction-center complex associated with light-harvesting complexes
- Concept Check 10.2

Lab: Lab manual Exercise 13, Photosynthesis
Pages: 137 - 141 (stop at Fluorescence)

Procedure: 13.1, and use a spectroscope for measuring absorption of light by chlorophyll (page 140). We will finish this lab on Thurs.
Focus is on separating and identifying pigments from plant extract using paper chromatography and observing/measuring the absorption of light by chlorophyll using a spectroscope.

Lab report: Answer lab questions 1, 2, 3, and 4.a., table 13.1 and complete absorption spectrum graph for chlorophyll (see graph on page 141). We will complete lab Exercise 13 on Thurs.

Thurs., Oct. 15

Reading Assignment: Chapter 10 - Photosynthesis

- Concept 10.2 – The light reactions convert solar energy to the chemical energy of ATP and NADPH
  - Linear Electron Flow
  - Cyclic Electron Flow
  - A Comparison of Chemiosmosis in Chloroplasts and Mitochondria
- Concept 10.3 – The Calvin cycle uses the chemical energy of ATP and NADPH to reduce CO_2 to sugar
  - Concept Check 10.3

Lab:

1. Lab manual Exercise 13, Photosynthesis

Pages: 141 (start at Fluorescence) 142 and 143
Procedures: 13.2 and 13.4.
Focus is on observation of fluorescence produced in chlorophyll due to light absorption and observing CO_2 uptake during photosynthesis using a pH indicator.

Lab report: Answer lab questions 5 and 7.
This report is due on Tues., Oct. 20.

Tues., Oct. 20

Exam 2: Chapters 7, 8, 9 and 10

Reading Assignment: Chapter 11 - Cell Communication

- Concept 11.1 External signals are converted to responses within the cell
  - Evolution of Cell Signaling
  - Local and Long Distance Signaling
  - The Three Stages of Cell Signaling: A *Preview*
  - Concept Check 11.1
- Concept 11.2 Reception: A signaling molecule binds to a receptor protein, causing it to change shape
  - Receptors in the Plasma Membrane
    - G Protein-Coupled Receptors
    - Receptor Tyrosine Kinases
    - Ion Channel Receptors
  - Intracellular Receptors
  - Concept Check 11.2

Lab: Handout introducing growth factors and how they signal cells to divide. This will include a procedure for experimentally treating A-431 cells with growth factors.

Focus is on cell signaling stimulation/inhibition upon exposure to an epidermal growth factor, and special attention to designing and carrying out an experiment to test a hypothesis, controls, predictions and interpretation of the results.

Lab report: Handout on cell signaling, including write-up on experimental hypothesis, procedures, results and conclusions from experiment with growth factors and their effects on A-431 cells. This experiment will be completed on Thurs.

Thurs., Oct. 22

Reading Assignment: Chapter 11 - Cell Communication

- Concept 11.3 Transduction: Cascades of molecular interactions relay signals from receptors to target molecules in the cell
  - Signal Transduction Pathways
  - Protein Phosphorylation and Dephosphorylation
  - Small Molecules and Ions as Second Messengers
  - Concept Check 11.3
- Concept 11.4 Response: Cell signaling leads to regulation of transcription or cytoplasmic activities
  - Nuclear and Cytoplasmic Responses
  - Regulation of the response
    - Signal Amplification
    - The Specificity of Cell-Signaling and Coordination of the Response
    - Signaling Efficiency: Scaffolding Proteins and Signaling Complexes
    - Termination of the Signal
  - Concept Check 11.4
- Concept 11.5 Apoptosis integrates multiple cell-signaling pathways
  - Apoptotic Pathways and the Signals That Trigger Them
  - Concept Check 11.5

Lab: Examine A-431 cells from experiment on Tues., record observations and results, and make conclusions based on the results.

Lab report: Complete handout report on cell signaling, including your experimental hypothesis, procedures, results, and conclusions from experiment with growth factors and A-431 cells. Report due on Tues., Oct. 27.

Tues., Oct. 27

Reading Assignment: Chapter 12 - The Cell Cycle

- Concept 12.1 Most cell division results in genetically identical daughter cells
  - Cellular Organization of the Genetic Material
  - Distribution of Chromosomes During Eukaryotic Cell Division
  - Concept Check 12.1
- Concept 12.2 The mitotic phase alternates with interphase in the cell cycle
  - Phases of the Cell Cycle
  - The Mitotic Spindle: *A Closer Look*
  - Cytokinesis: *A Closer Look*
  - Binary Fission in Bacteria
  - Concept Check 12.2

Concept 12.3 The eukaryotic cell cycle is regulated by a molecular control system
The Cell Cycle Control System
The Cell Cycle Clock: Cyclins and Cyclin-Dependent Kinases
Stop and Go Signs: Internal and External Signals of the Checkpoints
Loss of Cell Cycle Control in Cancer Cells
Concept Check 12.3

Lab:
1. Handout introducing UV radiation and its effects on cells. This will include a procedure for experimentally treating A-431 cells with UV radiation.
Focus is on cellular proliferation, and designing and carrying out an experiment to test the effect of UV radiation on A-431 cells with special attention to designing and carrying out an experiment to test a hypothesis, controls, predictions and interpretation of the results.

Lab report:
1. Handout on UV radiation, including write-up on experimental hypothesis, procedures, results and conclusions from experiment on UV radiation and its effects on A-431 cells. This experiment will be completed on Thurs.

Thurs., Oct. 29
Reading Assignment: Chapter 13 - Meiosis and Sexual Life Cycle
Concept 13.1 Offspring acquire genes from parents by inheriting chromosomes
Inheritance of Genes
Comparison of Asexual and Sexual Reproduction
Concept Check 13.1
Concept 13.2 Fertilization and meiosis alternate in sexual life cycles
Sets of Chromosomes in Human Cells
Behavior of Chromosome Sets in the Human Life Cycle
Concept Check 13.2 (1-3)
Concept 13.3 Meiosis reduces the number of chromosome sets from diploid to haploid
The stages of Meiosis
Crossing Over and Synapsis During Prophase I
A Comparison of Mitosis and Meiosis
Concept Check 13.3
Concept 13.4 Genetic variation produced in sexual life cycles contributes to evolution
Origins of Genetic Variation Among Offspring
Independent Assortment of Chromosomes
Crossing Over
Random Fertilization
Concept check 13.4

Lab: Examine A-431 cells from experiment on Tues., record observations and results, and make conclusions based on the results.

Lab report: Complete handout report on UV radiation, including your experimental hypothesis, procedures, results, and conclusions from experiment with UVC treatment and A-431 cells. Report due on Tues., Nov. 3.

Tues., Nov. 3

Exam 3: Chapters 11, 12, and 13

Reading Assignment: Chapter 14 - Mendel and the Gene Idea

- Concept 14.1 Mendel used the scientific approach to identify two laws of inheritance
  - Mendel's Experimental, Quantitative Approach
  - The Law of Segregation
  - The law of Independent Assortment
  - Concept check 14.1
- Concept 14.2 The laws of probability govern Mendelian inheritance
  - The Multiplication and Addition Rules Applied to Monohybrid Crosses
  - Solving Complex Genetic Problems with the Rules of Probability
  - Concept check 14.2

Lab: Lab manual Exercise 17, Genetics
Pages: 181-184 (stop at Incomplete dominance), 187-189 (start at Other Human Traits and stop at Analyzing pedigrees)
Procedures: 17.1, 17.2, and table 17.1.
Focus is on Mendelian inheritance patterns (these also include human traits).

Lab report: Answer lab manual questions 1-5 and 12 and tables 17.1 and 17.3. We will complete lab Exercise 17 on Thurs.

Thurs., Nov. 5

Reading Assignment: Chapter 14 - Mendel and the Gene Idea

- Concept 14.3 Inheritance patterns are often more complex than predicted by simple Mendelian genetics
  - Extending Mendelian Genetics for a Single Gene
  - Extending Mendelian Genetics for Two or More Genes
  - Nature And Nurture: The Environmental Impact on Phenotype
  - Concept Check 14.3
- Concept 14.4 Many human traits follow Mendelian patterns of inheritance
  - Pedigree Analysis
  - Recessively Inherited Disorders
  - Dominantly Inherited Disorders
  - Multifactorial Disorders
  - Genetic Testing and Counseling
  - Concept check 14.4

Lab: Lab manual Exercise 17, Genetics
Pages: 184 -187 (start at Incomplete dominance and stop at Other Human Traits), 189 - 191(start at Sex-Linked Inheritance)
Procedures: 17.3, 17.4 17.5, 17.6, 17.7 and 17.8.
Focus is on variations from Mendenlian patterns of inheritance and pedigree analysis.

Lab report: Answer lab manual questions 6-11, and 13-17. This lab report is due on Tues., Nov. 10.

Tues., Nov. 10

Reading Assignment: Chapter 15 - The Chromosomal Basis of Inheritance

- Concept 15.1 Morgan showed that Mendelian inheritance has its physical basis in the behavior of chromosomes
  - Morgan's Choice of Experimental Organism
  - Correlating Behavior of a Gene's Alleles with Behavior of a Chromosome Pair
  - Concept check 15.1
- Concept 15.2 Sex-linked genes exhibit unique patterns of inheritance
  - The Chromosomal Basis of Sex
  - Inheritance of X-Linked Genes
  - X Inactivation in Female Mammals
  - Concept check 15.2

Lab: Handout on Hoechst dye staining of A431 cells. You will be staining A431 cells with Hoechst dye (a fluorescence dye) to observe the nucleus and to determine whether the cells are undergoing apoptosis (programmed cell death) using a fluorescence microscope.
Focus is on whether the cells are mitotic, not dividing, undergoing apoptosis or a combination of these and the use a fluorescence microscope.

Lab Report: Handout on this lab is due Thurs., Nov. 12.

Thurs., Nov. 12

Reading Assignment: Chapter 15 - The Chromosomal Basis of Inheritance

- Concept 15.3 Linked genes tend to be inherited together because they are located near each other on the same chromosome
  - How Linkage Affects Inheritance
  - Genetic Recombination and Linkage
  - Mapping the Distance Between Genes Using Recombination Data: *Scientific inquiry*
  - Concept Check 15.3
- Concept 15.4 Alterations of chromosome number or structure cause some genetic disorders
  - Abnormal Chromosome Number
  - Alterations of Chromosome Structure
  - Human Disorders Due to Chromosomal Alterations
  - Concept Check 15.4

Lab:
This is an in-class assignment. Using the student station laptops and working in pairs, go to the following sites and solve the chromosomal genetics problems. At minimum check out the Concept, Animation, and Problem tabs for each:
http://dnaftb.org/8/
http://dnaftb.org/9/
http://dnaftb.org/10/
After completing the above, get the Sex-Linked Chromosomal Genetics assignment from the instructor and begin working on the problems.

This focus is on solving sex-linked chromosomal genetics problems.

Assignment: Sex-linked chromosomal genetics problems is due Tues., Nov. 17.

Tues., Nov. 17

Reading Assignment: Chapter 16 - The Molecular Basis of Inheritance

- Concept 16.1 DNA is the genetic material
  - The Search for the Genetic Material: *Scientific Inquiry*
  - Building a Structural Model of DNA: *Scientific Inquiry*
  - Concept check 16.1
- Concept 16.2 Many proteins work together in DNA replication and repair
  - The Basic Principle: Base Pairing to a Template Strand
  - DNA Replication: *A Closer Look*
  - Replicating the Ends of DNA Molecules
  - Concept check 16.2

Lab: Lab manual Exercise 16, Molecular Biology and Biotechnology
Pages: 173-175
Procedures: 16.1 (see handout for organism change and directions), 16.2 and 16.3.

Lab report: Answer lab manual questions 1-3. This lab report is due on Thursday, November 19.

Thurs., Nov. 19

Reading Assignment: Chapter 16 - The Molecular Basis of Inheritance

- Concept 16.3 A chromosome consists of a DNA molecule packed together with proteins
  - Concept check 16.3

Reading Assignment: Chapter 17 - Gene Expression: From Gene to Protein

- Concept 17.1 Genes specify proteins via transcription and translation
  - Evidence from the Study of Metabolic Defects
  - Basic Principles of Transcription and Translation
  - The Genetic Code
  - Concept check 17.1
- Concept 17.2 Transcription is the DNA-directed synthesis of RNA: *A closer look*
  - Molecular Components of Transcription
  - Synthesis of an RNA Transcript
  - Concept check 17.3
- Concept 17.3 Eukaryotic cells modify RNA after transcription
  - Alteration of mRNA Ends
  - Split Genes and RNA Splicing
  - Concept check 17.3

Lab: TED Talks (this will take place in a non-lab classroom, so feel free to bring food and drinks)
Lab report: None

Tues., Nov. 24

Exam 4: Chapters 14, 15, and 16
Reading Assignment: Chapter 17 – Gene Expression: From Gene to Protein

Concept 17.4 Translation is the RNA-directed synthesis of a polypeptide: *A closer look*
- Molecular Components of Translation
- Building a Polypeptide
- Completing and Targeting the Functional Protein
- Making Multiple Polypeptides in Bacteria and Eukaryotes
- Concept check 17.4

Concept 17.5 Mutations of one or a few nucleotides can affect protein structure and function
- Types of Small-Scale Mutations
- New Mutations and Mutagens
- Concept check 17.5

Lab: Handout on RNA microarrays. You will carry out a simulated RNA microarray and analyze the results.
The focus is on how RNA microarrays can be used to determine levels of gene expression.

Lab report: This lab report will be due when you return on Tues., Dec. 1.

Handout for PCR of genetically modified organisms. We will be genetically testing food this Thursday in lab to determine if it has been genetically modified. To prepare for the lab we'll discuss the types of food each group will be bringing in and a handout will be distributed to introduce you to the PCR method we'll be using.

Thurs., Nov. 26 – No class, Thanksgiving Break

Tues., Dec. 1
Reading Assignment: Chapter 18 - Regulation of Gene Expression

Concept 18.1 Bacteria often respond to environmental change by regulating transcription
- Operons: The basic concept
- Repressible and Inducible Operons: Two Types of Negative Gene Regulation
- Positive Gene Regulation
- Concept Check 18.1

Concept 18.2 Eukaryotic gene expression is regulated at many stages
- Differential Gene Expression
- Regulation of Chromatin Structure
- Regulation of Transcription Initiation
- Mechanisms of Post-Transcription Regulation
- Concept Check 18.2

Lab: Handout on PCR of GMOs. Today you will isolate DNA from the food source your group brought to class, use the isolated DNA to set up the PCR reaction mixes, and begin the PCR process in the thermal cycler. You will also practice loading gels to prepare for gel electrophoresis of your results on Tuesday.
The focus in today's lab is how the PCR technique is able to amplify DNA.

Lab report: Handout. This will be completed on Thurs.

Thurs., Dec. 3

Reading Assignment: Chapter 18 - Regulation of Gene Expression

Concept 18.3 Noncoding RNAs play multiple roles in controlling gene expression
- Effects on mRNAs by MicroRNAs and Small Interfering RNAs
- Chromatin Remodeling by ncRNA
- Concept check 18.3

Concept 18.5 Cancer Results from genetic changes that affect cell cycle control
- Types of Genes Associated with Cancer
- Interference with Normal Cell-Signaling Pathways
- The Multistep Model of Cancer Development

Lab: Handout on PCR of GMOs. Today you will use gel electrophoresis to observe and analyze your PCR results. Complete questions on handout.
The focus is whether your PCR of your tester food gives any evidence your food source is genetically modified.

Lab report: The handout questions are due on Tues., Dec. 8

Tues., Dec. 8

Reading Assignment: Chapter 20 - Biotechnology

Concept 20.1 DNA sequencing and DNA cloning are invaluable tools for genetic engineering and biological inquiry
- DNA Sequencing
- Making Multiple Copies of a Gene or Other DNA Segment
- Using restriction enzymes to make recombinant DNA
- Amplifying DNA *in Vitro*: The Polymerase Chain Reaction (PCR)
- Concept check 20.1

Lab: Lab manual Exercise 16, Molecular Biology and Biotechnology and handout
Pages: 176 (start at Genetic Transformation), through page 179
Procedure: 16.4 – use handout
The focus is on genetically transforming *E. coli* with antibiotic resistance using a plasmid vector.

Lab report: Lab manual question 4, diagrams with predictions from page 178 and diagrams with reasons from page 179 of your lab manual. This lab will be completed on Thurs.

Thurs., Dec. 10

Reading Assignment: Chapter 20 - Biotechnology

Concept 20.2 Biologists use DNA technology to study gene expression and function
- Analyzing Gene Expression
- Determining Gene Function
- Concept check 20.2

Concept 20.3 Cloned organisms and stem cells are useful for basic research and other applications
- Cloning Animals: Nuclear Transplantation
  - Reproductive Cloning of Mammals

Faulty Gene Regulation in Cloned Animals
Stem Cells of Animals
Embryonic and Adult Stem Cells
Induced Pluripotent Stem Cells
Concept check 20.3

Lab: Lab manual Exercise 16, Molecular Biology and Biotechnology
Pages: 176 (start at Genetic Transformation), through page 179
Procedure16.4. The focus is on observing and analyzing the results of your transformation experiment.

Lab report: Lab manual question 4, diagrams with predictions from page 178 and diagrams with reasons from page 179 of your lab manual. This lab will be due on Tues., Dec 15.

Tues., Dec. 15 Study Session for Final Exam (bring your previous exam answer sheets)

Thurs., Dec. 17 Final Exam