LAGUARDIA COMMUNITY COLLEGE

CITY UNIVERSITY OF NEW YORK

DEPARTMENT OF NATURAL SCIENCE

GENERAL BIOLOGY I SCB 201 Spring I, 2018

Lecture Instructor and lab Instructor:

Lecture times:

Office Hours:

Lecture Text: Biological Science (6th edition, 2017) by Scott Freeman; Pearson Benjamin Cummings, San Francisco, CA.
Biological Science, Books a la Carte Plus MasteringBiology with Pearson eText -- Access Card Package (Mastering Biology is not mandatory)
Freeman et al
ISBN: 9780134296029 (This is a loose leaf version carried by the bookstore and should be cheaper than the hardcopy version, new)

Students who want to purchase access with eText for 24 months can do so at www.masteringbiology.com for $115.95. (Note that this may be an option for students who plan on taking SCB 202 within the next year or so as the same book is used for both courses with SCB 202 using the sixth edition starting in the spring I. 2018 session)

Note that this is a new version of the text book. You may be unable to find this book used. The fifth edition of the text may be sufficient but note that the chapter numbers mentioned below refer to the sixth edition and may differ from the fifth. Note that the sixth edition will also be used for SCB 202 beginning in the spring I, 2018 session.

Academic calendar: Students should note important dates on the academic calendar. Including irregular days such as Sept 19th (Friday schedule), holidays, last day to drop with refund, etc… http://www.laguardia.edu/Academics/Academic-Calendar/

LECTURE OUTLINE (subject to change with notification). Note that the outline below lists TOPICS from each chapter. In some cases, we may not cover all of the content in each chapter so it is advisable to consult the lecture notes posted on blackboard as well

as your own notes from class then refer to the text for more in depth coverage of material rather than trying to memorize EVERYTHING in the book.

Date	Lecture topic (note: specific chapter title in book may vary from general topic listed here)
Week 1	Intro/basic chemistry (chapters 1 and 2)
Week 2	Biological chemistry, macromolecules, enzymes cells and cell membranes (Topics from chapters 2-6, 8)
Week 3	**QUIZ 1 (topics from ch 1-6, 8),** Cell structure and function (chapter 7), Cell respiration (Chapter 9)
Week 4	Cell respiration continued (chapter 9), Photosynthesis (chapter 10)
Week 5	**QUIZ 2 (Topics from ch 7, 9, 10)** Cell Cycle and Mitosis (chapter 12), Meiosis (chapter 13)
Week 6	Principles of Mendelism (chapter 14), DNA synthesis (Chapter 15)
Week 7	**MIDTERM (Topics from chapters 1-10,12-15)** How genes work (ch 16), Transcription (chapter 17)
Week 8	Transcription continued (chapter 17), Translation (chapter 17), Control of gene expression in Prokaryotes (chapter 18)
Week 9	**QUIZ 3 (Topics from ch 14-18)** Eukaryotic gene expression (chapter 19), Introduction to genetic engineering/biotechnology (chapter 20),
Week 10	The Genome (chapter 20) Principles of Development (chapter 21), animal Development (topics from ch 47)
Week 11	**QUIZ 4 (Topics from ch 19-21, and 47)** Principles of Evolution, Natural Selection (chapter 22), Evolutionary Processes, Speciation (chapter 23,24)
Week 12	**QUIZ 5 (Topics from ch 22-24, and 47)** History of life (chapter 25)
Finals week	**FINAL EXAM December 12th (Topics from chapters 16-25, and 47)**

GRADING CRITERIA

Attendance: Students are strongly encouraged to attend all lecture sessions. Text study alone is insufficient since many topics may be augmented or additional topics may be covered in lecture. Students are required to take all exams and no make-up quizzes will be given (without consultation). Laboratory attendance is mandatory.

Grades: Seven exams will be given in lecture: 5 quizzes, a midterm exam and a final exam. The midterm and final exams are each counted as two quizzes. Lecture quizzes and tests will consist of a mixture of multiple choice and short answer type questions.

Four exams will be given in laboratory (none dropped). Lab exams will consist of short answer type questions based on material covered in the LAB. Typically, these will ask you to understand WHY you did what you did in the lab. You can also expect a microscope practical (hands on) to appear on the final lab quiz.

Both the lecture average and laboratory average contribute to a single final average. The final grade is computed from the combined lecture and laboratory average, with 66% of the final grade from the lecture average and 34% from the laboratory average Effort in the laboratory will be considered in borderline cases.

Each Quiz = 8.25% of final grade (Total 33%) [The lowest quiz is dropped before averaging]

Midterm and Final each = 16.5% of final grade (Total 33%)

Laboratory exams (x4) each = 6% of final grade (Total 24%)
Laboratory reports (x4) = 2.5% of final grade (Total 10%)

Total Points/Percentage (rounded)	Final Grade
94-100	A
90-93	A-
87-89	B+
84-86	B
80-83	B-
77-79	C+
74-76	C
70-73	C-
67-69	D+
64-66	D
60-63	D-

Blackboard. Lecture notes will be posted in advance on blackboard as will other useful information including grades, review sheets, class announcements, etc. Students are

advised to check blackboard frequently for information related to class. Students are advised NOT to try and contact me via blackboard as it often does not work. You can reach me by the email listed at the top of this syllabus.

LaGuardia email: For some reason, students don't like to check their LaGuardia email. This is the only way I have to reach you. Please check it frequently. I would recommend checking it before you leave for class every day in case there is some last minute announcement or cancellation. You may often find announcements about events, scholarships, or other happenings at the college here so it is in your best interests to get in the habit of checking it frequently!

ePortfolio: Note that students will be required to deposit at least one laboratory assignment in their personal ePortfolio. If you are unfamiliar with ePorftolio, basic info and tutorials can be found here: http://www.eportfolio.lagcc.cuny.edu/students/

Laboratory Text: SCB201 General Biology I, Keller. Alzeory and Fuentes (2016) Bluedoor publishing 2nd edition. Note that is a custom lab manual and may be difficult to find outside of the LaGuardia Bookstore. Students are encouraged to have this on the first day of lab class.

LABORATORY OUTLINE (subject to change by lab instructor)

. **Lab**	**Topic**	**Lab Text Reference**
1	The Microscope and Measurements	pp. 1-11 and 15-31
2	Organic Molecules	pp. 33-46
3	Diffusion and Osmosis	pp. 49-62
4	Exam I on Labs 1, 2 and 3 , lab report 1 due Enzymes	pp. 65-78
5	Cell Respiration	pp. 81-90
6	Exam II on Labs 4 and 5, lab report 2 due Photosynthesis	pp. 93-108
7	Mitosis and Meiosis	pp. 111-123
8	Introduction to genetics	pp. 127-140
9	Exam III on Labs	pp. 143-150

	6, 7 and 8, lab report 3 due	
	Biotechnology and intro to PCR	pp. 154-160, pp. 167-184
10	PCR-based forensics lab	167-184 contd.
11	Evolution	pp. 187-200
12	Evolutionary mechanisms	pp. 203-216
Finals Week	Exam IV, lab report 4	

The College's regulations regarding cheating will be strictly enforced. The policy on academic integrity is available at the following address: http://library.laguardia.edu/files/pdf/academicintegritypolicy.pdf

FUNDAMENTALS OF BIOLOGY I -- SCB 201 COURSE OBJECTIVES

These are some of the core concepts you will be expected to learn from each hour of class. Of course, there are not the ONLY concepts you will be expected to learn but they can help serve as a framework to guide your studying and learning.

NOTE: Each session generally corresponds to 1 class hour. General topics listed may differ from specific chapter titles found in your textbook. Subject to change WITH notice from your instructor.

SESSION 1 - INTRODUCTION Chapter 1

State the Cell Theory and describe the experiments that support it.

Describe the Darwinian theory of Evolution.

Describe the levels of organization in living systems and some of the methods of classification.

List the steps of the scientific method and apply them to a specific problem.

Define hypothesis, experiment, control, theory, and scientific law.

SESSION 2 - BASIC CHEMISTRY Chapter 2

Describe how the Universe formed and the origin of the molecules of life.

Define what is meant by the terms, matter and energy.

List the stages in the development of the Earth and the formation of Life on Earth.

Define the terms, elements, atom, proton, electron, neutron, isotope and ion.

Define atomic number, and atomic mass.

SESSION 3 - BASIC CHEMISTRY (cont'd) Chapter 2

Draw and describe an electron shell configuration.

Define molecule, compound, single and double bonds.

Describe ionic, covalent, polar, non-polar, hydrogen bonds.

Describe how bonds are formed and broken through the transfer of energy.

Define the term chemical energy and how it relates to bond strength.

Describe the properties of water and its importance in chemical evolution.

SESSION 4 - BIOLOGICAL CHEMISTRY Chapters 2

Describe the relationship and properties of acids, bases and salts.

Describe the importance of the carbon atom to organic chemistry.

List the four main classes of biological macromolecules (carbohydrates, lipids, proteins and nucleic acids), stating their chemical elements, subunits, and role they play in living systems.

Describe the structure of the functional groups: amino, carboxyl, sulfhydryl, aldehyde, alcohol, and ketone.

SESSION 5 – PROTEINS AND NUCLEIC ACIDS Chapters 3, 4 and topics from chapter 8 regarding enzymes

Define monomer, polymer, amino acid, peptide bond, polypeptide, and protein.

Describe the four levels of protein structure.

Describe the mechanism by which enzymes work as organic catalysts.

Define nucleotide, nucleic acid, complementary base pairing.

Compare and contrast the structures of RNA and DNA.

Describe the role of RNA and DNA in the synthesis of macromolecules.

SESSION 6 – CARBOHYDRATES Chapters 5

Define carbohydrate, monosaccharide, disaccharide, polysaccharide, starch, glycogen, cellulose, and pentose and hexose sugars.

Describe the role of carbohydrates in cell structure and metabolism.

SESSION 7 - CELLS AND MEMBRANES Chapter 6

Describe the basic chemical structure of the biological membrane.

Define lipid, glycerol, fatty acid, triglyceride, saturated, unsaturated, phospholipid, and steroid.

Describe how phospholipids assemble spontaneously to form the basic membrane.

Define what is meant by the terms permeability and semi permeability.

List and describe methods by which molecules cross the membrane; impermeable, selective permeability, passive transport, diffusion, facilitated diffusion, carrier proteins, pores, osmosis, active transport, sodium-potassium pump, phagocytosis, and pinocytosis.

Describe the three relationships of solute concentration of solutions.

Describe the Fluid Mosaic Model.

SESSION 8 - CELL STRUCTURE AND FUNCTION Chapter 7

Define prokaryote, eukaryote, unicellular, multicellular, nucleus, cytoplasm, and organelles.

Describe the different methods used to study cells and their organelles.

Describe the main differences between prokaryotic and eukaryotic cells, as well as between plant and animal cells.

SESSION 9 - CELL STRUCTURE AND FUNCTION Chapter 7

Describe the structure and function of the following nuclear organelles: nucleus, chromosome, nucleolus, and nuclear envelope.

Describe the structure and function of the following organelles: ribosome, endoplasmic reticulum, Golgi complex, Lysosome, peroxisome, mitochondrion, vesicle, vacuole, plastid, chloroplast and cell wall.

Define the three classes of transport vesicles.

Describe the structure and function of the following parts of the cytoskeleton: microtubules, microvilli, cilia, flagella, and centriole.

SESSION 10 - CELL RESPIRATION Chapter 9

Define the terms respiration, aerobic, anaerobic and fermentation.

Define the term coenzyme, list four and explain the function of each.

Diagram and describe the overall reaction for the oxidation of glucose stating the number of ATP's produced, and why oxygen is needed.

List the starting materials, the end products, and key chemicals in glycolysis and the formation of Acetyl-CoA.

SESSION 11 - CELL RESPIRATION (Cont.) Chapter 9

Describe the Chemiosmostic Theory of ATP synthesis, including the role of the electron transport system, the mitochondrial membrane, the electrochemical gradient, and ATP synthetase.

Summarize the number of ATP molecules produced from each step in fermentation.

Contrast aerobic respiration with yeast alcoholic fermentation and muscle lactate fermentation.

Explain how and why muscles go into oxygen debt.

Explain how other nutrients, such as lipids, proteins and polysaccharides enter into the glucose oxidative pathway.

SESSION 12 - PHOTOSYNTHESIS Chapter 10

Describe the relationship between cellular respiration and photosynthesis, autotroph and heterotroph, oxidation and reduction.

Name the three main groups of photosynthetic pigments and state the function of each.

Describe the structure of the plant leaf and chloroplast. Define cuticle, epidermis, mesophyll, stomata, vascular bundle, grana, thylakoid, and stroma.

State the colors of light most effective in promoting photosynthesis, and explain why.

Write the overall reaction summary for photosynthesis.

SESSION 13 - PHOTOSYNTHESIS (cont.) Chapter 10

Summarize the input and output for the four steps of photosynthesis: photochemical reactions, electron transport, chemiosmosis, carbon fixation (dark reaction), and light reaction.

Describe the two photosystems, including chlorophyll a, P700, P680, antenna pigment, light trap, and reaction center.

Draw the two photosystems and show the energy flow relationships between them.

Explain the C3 cycle of carbon fixation, stating the importance of ribulose bisphosphate, RuBP carboxylase, and the number of turns of the cycle needed to produce a molecule of glucose.

Discuss how various environmental factors control the rate of photosynthesis.

Compare and contrast the C4 and C3 cycles and the relative benefits of each.

SESSION 14 – CELL CYCLE AND MITOSIS Chapter 12

Define mitosis, meiosis, haploid, diploid, somatic cell, germ cell, fertilization, zygote, chromatids, homologous chromosomes, gametes, autosomes, karyokinesis, and cytokinesis.

Describe the parts of the cell cycle and the three periods of interphase.

SESSION 15 - MITOSIS (cont.) Chapter 12

Describe the events in each of the stages of mitosis: prophase, metaphase, anaphase, and telophase.

Define poles, centrioles, mitotic spindle, colchicine, cleavage furrow, and cell plate.

Describe how the kinetochore controls chromosome partitioning.

List the regulatory factors of the cell cycle and the function of each.

SESSION 16 - MEIOSIS Chapter 13

Describe the events in meiosis; include tetrad, synapsis, and separation of homologous chromosomes.

Distinguish between spermatogenesis and oogenesis.

Describe the significance of 'crossing over' in heredity.

Describe how the process of meiosis influences genetic variation.

SESSION 17 - PRINCIPLES OF MENDELISM Chapter 14

Describe Mendel's experiments and give reasons why he was successful in discovering the laws governing the inheritance of genetic traits. State his three laws.

Define the terms genotype and phenotype, and their relationship to dominant and recessive.

Define parental (P1), first filial (F1), and second filial (F2) generations; homozygous, heterozygous, allele, monohybrid cross, dihybrid cross, homologous chromosomes, segregation, independent assortment, and linked genes.

SESSION 18 - PRINCIPLES OF MENDELISM (cont.) Chapter 14

Use the Punnett square to predict the results of monohybrid and dihybrid crosses, giving both genotype and phenotype ratios.

Describe the test cross and discuss its use as a genetic tool to distinguish between homozygous and heterozygous genotypes.

Describe how the discovery of linkage and the chromosome theory altered Mendel's original theory.

List and describe the mechanism of some non-Mendelian patterns of inheritance including incomplete dominance, multiple allelism and environmentally-influenced genes.

SESSION 19 - DNA SYNTHESIS Chapter 15

Describe the experiments of Griffith, Avery, and Hershey and Chase and how their results were able to relate DNA to heredity.

Review the structure of DNA. Define purine, pyrimidine, complementary bases, double helix, antiparallel strands, 3' and 5' ends.

Describe the semiconservative model of DNA replication with reference to the Meselson and Stahl experiment.

Describe the process of DNA replication, including replication bubbles, helicase, DNA polymerase, direction of replication, Okazaki fragments, DNA ligase, leading strand and lagging strand.

Compare DNA replication in prokaryotes vs. eukaryotes.

Describe the significance of telomeres and the enzyme telomerase

SESSION 20 - MIDTERM EXAMINATION on Chapters 1-10, 12-15

SESSION 21 - HOW GENES WORK Chapter 16

Review the differences between DNA and RNA.

State the "one-gene, one-enzyme" hypothesis.

Define what is meant by the genetic code.

Describe how the genetic code differs between DNA and RNA.

Describe the underlying principal of the Central Dogma and how it relates genotype to phenotype.

SESSION 22 - TRANSCRIPTION Chapter 17

Describe what is meant by transcription.

Describe the role of the promoter in transcription.

Describe the structure and origin of mRNA, tRNA and rRNA.

Describe the role of RNA polymerase and how it functions in transcription

Describe the structure of pre-mRNA

Describe the post-transcriptional processing of pre-mRNA

Define the terms start and termination signals, pre-mRNA, snRNAs, cap poly-A tail, introns, and exons.

Define mutation, list some kinds of mutations, and describe the importance of mutations.

SESSION 23 - TRANSLATION Chapter 17

Define what is meant by translation

Describe how the ribosome functions as the site for protein synthesis

Describe the basic structure of tRNA and its role in translation.

List the stages of translation and the processes that occur at each stage.

Define the terms, P site, A site and catalytic site

Describe what is meant by post-translational processing and its role in protein synthesis.

SESSION 24- CONTROL OF GENE EXPRESSION Chapter 18

Describe the experimental basis of the lac operon theory.

Define the terms operator, repressor, and functional genes.

Define negative control and positive control in the transcriptional regulation of lac operon.

Define the role of CAP in transcriptional regulation.

Describe the characteristics and significance of DNA-binding proteins.

SESSION 25 - EUKARYOTIC GENE EXPRESSION Chapter 19

Describe the structure of a typical eukaryotic gene and the DNA sequences involved in the regulation of that gene.

Describe how the altering of chromatin structure can be a regulatory mechanism.

Describe what is meant by 'flanking sequences' and what they do in gene regulation.

Describe how alternative splicing of mRNA enables one gene to direct the production of more than one protein.

Define RNA interference and describe how micro RNAs function in post-transcriptional regulation.

Identify some of the post-transcriptional and post-translational regulatory controls on gene expression.

Compare regulation of gene expression in bacteria and eukaryotes.

SESSION 26 – INTRODUCTION TO GENETIC ENGINEERING/BIOTECHNOLOGY Chapter 20

Define genetic engineering and recombinant DNA.

Describe the use of reverse transcriptase to produce complementary DNA (cDNA).

Describe the use of restriction endonucleases and DNA ligase in manipulating DNA.

Describe how plasmids are used in cloning and how DNA libraries are produced and screened.

Describe the use of the polymerase chain reaction (PCR) to amplify DNA.

Describe the basic principles of DNA sequencing

SESSION 27 - THE GENOME Chapter 20

Define the term 'genome'.

Describe the characteristics of prokaryotic and eukaryotic genomes.

Define the term transposable element and describe its function.

List some of the uses that may be made of genomics.

SESSION 28 – PRINCIPLES OF DEVELOPMENT Chapter 21

Describe the four major processes that lead to the development of a multicellular organism: cell proliferation (and death), cell movement (or expansion), cell differentiation, cell-cell interaction.

Differential gene expression as the key process in cell differentiation.

Distinguish between maternal effect genes, zygotic genes and homeotic genes

Define the process of induction and apoptosis.

SESSION 29 - PRINCIPLES OF DEVELOPMENT (CONT.)

Drosophila development: Describe the function of bicoid and maternal effect genes in development.

Describe how the gap, pair-rule and segment polarity genes organize the embryo.

Explain how the differential expression of homeotic genes results in the formation of different structures from different body segments.

Describe the conserved and homologous nature of the genetic mechanisms that regulate development in animals.

Describe how changes in developmental pathways underlie evolutionary change.

SESSION 30 – ANIMAL DEVELOPMENT (Topics from chapter 47)

Describe the major processes in animal development, including gametogenesis, fertilization, cleavage, gastrulation and organogenesis.

List the stages of fertilization with reference to the sea urchin and describe how each stage is regulated.

Describe fertilization in mammals. Compare and contrast fertilization in sea urchins and mammals.

Define cleavage and describe how this process differentially distributes cytoplasmic determinants in the embryo.

Describe gastrulation and the formation of the embryonic tissues.

Describe organogenesis with respect to vertebrates.

Describe the processes of determination and differentiation

SESSION 31 - PRINCIPLES OF EVOLUTION/NATURAL SELECTION Chapter 22

Define evolution, gene pool, and natural selection.

Describe the four postulates of evolution by natural selection: variation, heritability, overproduction, selection.

Compare and contrast natural selection (Darwin/Wallace) and the inheritance of acquired characteristics (Lamarck).

SESSION 32 - PRINCIPALS OF EVOLUTION (cont.) Chapter 22

Define homologous, analogous, and vestigial structures, adaptive radiation.

Explain the following evidence for the occurrence of evolution: artificial selection, fossil record, comparative anatomy, embryology, and biogeography. Give an example of each.

SESSION 33 - EVOLUTIONARY PROCESSES Chapter 23

Explain why genetic diversity is essential in a species.

State the Hardy-Weinberg Principle and use it to determine allele frequencies in a population.

State and explain the five situations in which the Hardy-Weinberg Principle is invalid.

SESSION 34 - EVOLUTIONARY PROCESSES (cont.) Chapter 23

Describe evolution as deviation from the Hardy-Weinberg equilibrium through mutation, gene flow, genetic drift, founder effect, and natural selection.

Define what is meant by directional, stabilizing and disruptive selection and compare and contrast their respective mechanisms.

SESSION 35 - SPECIATION Chapter 24

Contrast the morphological and biological concepts of "species."

Define speciation and distinguish between allopatric and sympatric speciation.

List the different types of premating and post mating isolating mechanisms.

Describe the mechanisms of polyploidy and hybridization.

SESSION 36 - HISTORY OF LIFE Chapter 25

Describe some of the techniques that are used to discover the evolutionary of history of life.

Describe phylogenetic trees and the cladistic approach to estimating phylogeny.

Define synapomorphy, monophyletic, homoplasy, convergent evolution.

Describe the fossil record, the Cambrian explosion, adaptive radiation and mass extinctions.

THE FINAL EXAM COVERING CHAPTERS WILL BE GIVEN

DURING THE FINAL EXAM WEEK