DEPARTMENT OF NATURAL AND APPLIED SCIENCES
LAGUARDIA COMMUNITY COLLEGE
CITY UNIVERSITY OF NEW YORK
STUDENT SYLLABUS

Course Title: Principles of Biology
Course Number: SCB115
Course Hours/Credits: 6 hours (3 lecture; 3 laboratory) - 4 credits
Prerequisites: CSE099, ENG099, MAT096 or Waivers

Course Description:
This is a one-semester laboratory-based biology course designed for students not intending to major in the life sciences. Topics covered include biological chemistry, cell structure and function, classical and molecular genetics, evolution, and ecology, while homeostasis is explored in the context of human biology. Laboratory exercises include chemical analyses of nutrients, use of the microscope, examination of cells and cellular processes, a survey of mammalian organ systems through dissection of the fetal pig and an introduction to organismic diversity.

Instructional Objectives:
The goals of this course are to help you
1. Develop a specific biological vocabulary.
2. Acquire a comprehensive knowledge of chemistry as it applies to biology.
3. Develop basic laboratory skills.
4. Understand the importance of cells in living organisms.
5. Appreciate the role of cellular processes such as cell division, respiration and protein synthesis in the maintenance of life.
6. Appreciate how genetic characteristics are inherited and understand the molecular basis of heredity.
7. Understand how the body functions to maintain homeostasis.
8. Become familiar with the structure and function of mammalian organ systems.
9. Understand evolution as a process and as a scientific explanation for organismic diversity.
10. Examine the relationships between living organisms and their environment.
11. Appreciate the characteristics and diversity of living things;

Required Textbook: Starr, Evers, and Starr (2013). "Biology: Today and Tomorrow".4th edition. ISBN: 978-1-133-36445-0. Brooks/Cole Cengage Learning
Software: Mindtap

Laboratory Manual: Maria Entezari (2015). Principles of Biology, SCB115 Laboratory Manual. 2nd edition. Blue door Inc.

Office Hours: The instructor will announce his/her office hours at the course orientation.
Attendance: Students are required to attend all lecture and laboratory sessions. Lateness or absence of greater than 10% is considered excessive and could result in a lowering of your course grade.

Grade Determination:

The final course grade will be based on performance in the following:

4 Lecture Quizzes @ 6% each	24%
(The lowest grade Quiz will be dropped)	
Lecture Midterm Exam	15%
Lecture Final Exam	15%
2 Laboratory Exams @ 8% each	16%
Laboratory Final Exam	15%
5 Laboratory Reports	**5%**
***Research Project**	**10%**

***The lab instructor will discuss the nature of the Research Project with the class.**

Make-ups on quizzes, midterms and finals will be permitted only with documented absence (e.g. doctor‟s note). However, make-up examinations will tend to be considerably more difficult than the scheduled examinations and the format of the make- up exam might be different from the scheduled ones. .

Dates of Examinations:
The dates and times of quizzes and examinations will be announced well in advance.

Laboratory Exam 1 and 2 are written and the format of the questions are as follows: Labeling, matching,fill in the blanks and short answers. THERE WILL BE NO MULTIPLE CHOICE QUESTIONS FOR THE LAB EXAMS.

Laboratory Final exam included both written and practical portions. 7.5% of the grade of the lab final exam belongs to the written part and 7.5% belongs to the written part.

Academic Integrity Policy:

The instructors of this course are required to implement the College Policy regarding cheating on examinations and quizzes. A complete statement of the policy is available at the student counseling services.

LECTURE COURSE CALENDAR

WEEK	TOPIC	ASSIGNMENT: TEXTBOOK
1	Properties of Life, Levels of organization, Homeostasis, Basic Chemistry: Atoms, Elements, Compounds, Chemical Bonds	Ch. 1 (p. 4-9) Ch.19 (p.388-389) Ch. 2 (p. 24-29)
2	Water, pH, Acids and Bases, Buffers, Introduction to Organic Molecules, Polymers and Monomers, Carbohydrates, Lipids, and Proteins	Ch. 2 (p. 30-40)
3	**Quiz 1 (based on Weeks 1-2);** Nucleic Acids, DNA, RNA. Chemical reactions, Enzymes, ATP	Ch. 2 (p. 41); Ch. 4 (p. 64-71 and p.77)
4	Cell Theory, Prokaryotic and Eukaryotic Cells, Eukaryotic Cell Structure and Function, Animal and Plant Cells, Membranes, Membrane Transport	Ch.3 (p. 46-59); Ch. 4 (p. 71-76)
5	**Quiz 2 (based on Weeks 3-4);** Energy and ATP, Cellular Respiration	Ch. 5 (p.82, 85-87, 89-95)
6	DNA, DNA replication and the Genetic Code, Protein Synthesis	Ch.6 (p. 100-109); Ch.7 (p. 114-123)
7	**Midterm Exam (based on Weeks 1-6** Evolution and Natural Selection,	Ch. 11 (p. 190-195, p. 204-207); Ch. 12(p. 212-231)
8	Community Ecology, Population Ecology, Human Demography	Ch.16 (p. 316-329); Ch. 17 (p. 334-340, p. 344-346, and p. 350-351)
9	**Quiz 3 (based on Weeks 7-8);** Organ systems, Digestion, Excretion	Ch.19 (p. 379-380, and p. 386); Ch. 23 (pp. 450-465)
10	Circulation, Respiration	Ch. 21 (p. 408-423)
11	Neural Control, Endocrine control	Ch. 24 (p.470-482); Ch.25 (p. 494-507)
12	**Quiz 4 (based on Weeks 9-11);** Reproduction, Development	Ch. 26 (pp. 512-527)
13	**Final Exam (based on Weeks 7-12)**	

LECTURE OUTLINES

Week 1:

Invitation to Biology. Ch. 1 (p. 4-8) Ch.19 (p. 388-389)

• Define biology and its importance in our daily lives.
• Define the levels of organization and describe each level from the smallest to the most inclusive by giving examples.
• Define the common characteristics of living things:cellular organization, metabolism, homeostasis, growth & reproduction, heredity (by DNA) and describe each category by giving examples.
• Explain the difference between growth and development.
• Describe organisms sense and respond to change and explain homeostasis
• Explain how some organ systems interact to provide homeostasis in the human body.
• Explain the roles of sensory receptors, integration centers, and effectors in homeostasis.
• Define the term negative feedback.
• Explain the steps in homeostasis of body temperature.

Molecules of Life Ch. 2 (p. 24-29)

- Define matter, states of matter (solid, liquid, gas); energy
- Define and describe atomic structure: stable nucleus (protons, neutrons), shells (electrons), mass & electrical charge of subatomic particles, arrangement of electrons in shells (2, 8, 8 rule).
- Define atomic number, atomic mass.
- Describe the differences between atoms, isotopes, and ions.
- Describe how isotopes and ions form.
- Draw an atom in the form of a shell diagram.
- Describe the difference between an atom, molecule, and compound.
- Define, compare, and contrast the formation and strength of ionic, covalent, and hydrogen bonds.
- Describe how covalent bonds lead to the formation of nonpolar and polar compounds.
- Describe how polar interactions contribute to the formation of hydrogen bonds.

Week 2:

Water & pH Ch. 2 (p. 30-32)

- Define Solvents, solutes, solutions
- Describe properties of water explained by hydrogen bonding between water molecules
- Describe the characteristics of acids and bases in terms of concentration of [H+] and [OH-] ions.
- Describe a buffer and how it keeps the pH stable by donating or absorbing H+ ions

Organic Molecules Ch. 2 (p. 33-40)

- Describe what makes a molecule organic.
- Describe Organic vs. inorganic compounds: main differences
- Describe the difference between monomers and polymers.
- Describe the structure and function of Carbohydrates
- Describe monosaccharides, disaccharides, polysaccharides and give examples for each of them.
- Describe the structure and function of Lipids.
- Describe triglycerides.
- Describe saturated , unsaturated, and trans fats.
- Describe phospholipids and their importance in the cell wall.
- Describe Steroids and their functions.
- Describe the structure and function of Proteins.
- Explain different functions of proteins related to their structure: enzymes, hormones, transport (e.g. hemoglobin), contractions (e.g. muscle), structural (hair, nails, fibers in bone, ligaments), antibodies, etc
- Describe the importance of maintaining the protein structure (the effect of changing pH and temperature on the structure of proteins=dnaturation).

Week 3:

Quiz 1 (based on Weeks 1-2)

Organic Molecules Ch. 2 (p. 41)

- Describe Nucleic acids: DNA & RNA; polymers of nucleotides, carry genetic information, the importance in protein synthesis
- Describe the structure of DNA: double-stranded helix,backbone, A-T & G-C complement
- Describe the differences between the DNA and RNA

Chemical Reactions & Enzymes: Ch. 4 (p. 64-71 and p.77)

- Understand the function of alcohol dehydrogenase.
- Explain how alcoholic hepatitis occurs.
- State the statistics on binge drinking among college undergraduates.
- State the first and second laws of thermodynamics.
- Know that some energy disperses as heat in every energy transfer.
- Know that chemical reactions in cells either require or release energy.
- Understand that energy is stored in chemical bonds in cells.
- Describe activation energy.
- Define ATP.
- Know the definition and function of enzymes.
- Know the factors that affect enzyme functioning.

Week 4

Cell Structure: Ch.3 (p. 46-59)

- Explain how normally useful bacteria can cause disease.
- Describe the structure of the plasma membrane and its role in regulating the movement of material into and out of the cell.

- Understand the characteristics of cells.
- Explain the cell theory.
- Explain the fluid mosaic model of the plasma membrane.
- Describe the various functions of membrane proteins.
- Distinguish between prokaryotes and eukaryotes.
- Understand the genetic material in the form of DNA that resides within the nucleus of eukaryotes.
- Compare the following components of the endomembrane system: rough endoplasmic reticulum, smooth endoplasmic reticulum, Golgi apparatus, lysosomes, peroxisomes, and vacuoles.
- Describe the structure and function of mitochondria and chloroplasts.
- Explain the theory of endosymbiosis.
- Compare the composition of microtubules and microfilaments.
- Explain the structure and function of cilia, flagella, and pseudopodia.
- Describe the various cell surface specializations that allow cells to transfer materials and information.

Membranes and Membrane Transport: Ch. 4 (p. 71-76)

- Define selective permeability, and state its importance in cell membranes.
- State what a concentration gradient is; give an example.
- Define diffusion and osmosis; compare and contrast the two.
- Explain tonicity and its role in concentration gradients.
- Know the terms isotonic, hypertonic, and hypotonic.
- Compare and contrast, active transport and passive transport.
- Know the two-step process by which alcohol is detoxified in the liver.

Week 5:

Quiz 2 (based on Weeks 3-4)

Capturing and Releasing Energy: Ch. 5 (p.82, 85-87, 89-95)

- Understand the similarities and differences between biofuels and fossil fuels.
- Know that photosynthesis is the process by which plants make their food.
- Describe the difference between autotrophs and heterotrophs.
- Describe chloroplasts and their component parts.
- Define the term photosystem.
- Understand that aerobic respiration is a pathway by which organisms access the energy stored in carbohydrates.
- State the three phases of aerobic respiration and the net ATP gain from each phase.
- State where glycolysis, Krebs cycle, and electron transfer phosphorylation occur in the cell.
- State the products of alcoholic fermentation and lactate fermentation.
- Know how anaerobic respiration differs from aerobic respiration.
- Explain the fate of excess glucose (what cannot be burned in the Krebs cycle).
- Show a simple pathway for fats and proteins to enter the Krebs cycle.

• Explain why current CO2 levels in the atmosphere are considered a result of the activities of humans.
• Describe the effects of global warming on some plants and animals.

Week 6:

DNA Structure and Function: Ch.6 (p. 100-109)
• Explain the laboratory process that created the clones of Trakr.
• Define the terms chromosome and sister chromatid and centromers.
• Define nucleosome.
• Draw a simple double-helix shape.
• Explain what the term diploid means.
• Compare and contrast autosomes and sex chromosomes.
• Explain how sex chromosomes differ in human males versus females.
• Understand what a karyotype is and how it is performed.
• Explain complementary bases in DNA.
• Summarize the contributions of Franklin, Wilkins, Watson, and Crick in elucidating the structure of DNA.
• Understand how the sequence of paired bases along a double helix can account for the diversity of life (Chargaff's second rule).
• Draw a simple representation of two parent DNA strands, two separated strands, and two strands that have replicated from the parents (according to base-pairing rules).
• Describ DNA replication.
• Explain why mistakes sometimes occur during DNA replication.
• Define mutation.
• Explain what the term reproductive cloning means.
• Explain the process of somatic cell nuclear transfer (SCNT).
• Discuss why reproductive cloning is used in agricultural settings.

Gene Expression and Control: Ch.7 (p. 114-123)
• Define gene, transcription, translation, and gene expression.
• Define the base-pairing rules during transcription.
• Summarize the process of transcription.
• Transcribe a given gene into RNA.
• Compare and contrast mRNA, tRNA, and rRNA.
• Describe the basic functions of the RNAs during translation.
• Describe the process of translation.
• Given an mRNA transcript and the genetic code, translate the mRNA into a polypeptide strand.

Week 7:

Midterm Exam (lectures on weeks 1-6)

Evidence of Evolution: Ch. 11 (p. 190-195, p. 204-207)
- Describe early beliefs about how species existed in the "great chain of being."

- Describe how biogeography, comparative morphology, and the fossil record was key in the development of new evolutionary theory.
- Describe the competing theories about gradual change that emerged starting in the 1800s.
- Describe the basic elements of natural selection and how a trait ends up being adaptive.
- Compare and contrast morphological convergence and divergence.
- Describe how genomic and protein analysis is evidence for evolution.

Process of Evolution: Ch. 12 (p. 212-231)

- Explain how the use of poisons to combat pests has led to resistance in pest populations such as rats.
- Explain what is meant by a population gene pool.
- Define microevolution.
- Distinguish between dimorphic, polymorphic, and continuously variable traits.
- Describe the conditions under which a population would be at genetic equilibrium and therefore not evolve.
- Describe selection, and explain how it can produce sexual dimorphism in a species.
- Define balanced polymorphism, and explain under what conditions balanced polymorphisms persist.
- Describe genetic drift.
- Define speciation.
- Explain reproductive isolation, and distinguish between prezygotic and postzygotic isolating mechanisms.
- Define macroevolution.
- Describe coevolution, expatiation, extinction, and adaptive radiation.
- Define taxonomy, and describe cladistics and its role in clarifying evolutionary relationships.

Week 8:

Population Ecology: Ch.16 (p. 316-329)

- Understand that ecology is the study of interactions among organisms and between organisms and their environment.
- Define demographics, and explain the difference between population size and population density.
- Describe the conditions under which population distributions tend to be clumped, uniform, or random.
- Describe how immigration and emigration influence population growth.
- Understand that per capita growth is the number of offspring produced per reproductive individual in a population over some unit of time.
- Define biotic potential, and explain why it is rare for any population to actually achieve its biotic potential.
- Describe characteristics that define a species' life history pattern.
- Know that life history traits are subject to natural selection and can evolve.
- Describe the importance of modern agriculture and modern technology in fueling the rapid increase in human population size.

- Understand the demographic transition model and how this model may not apply to pre-industrial countries moving toward industrialization.

Communities and Ecosystems: Ch. 17 (p. 334-340, p. 344-346, and p. 350-351)

- Differentiate between a habitat, a community, and an ecosystem.
- Explain the conditions under which an exotic species can flourish.
- Explain the concept of a niche.
- Define symbiosis, and distinguish between commensalism and mutualism.
- Describe interspecific competition.
- Identify the similarities and differences among predation, parasitism, and herbivory.
- Define coevolution, and provide examples.
- Explain mimicry, warning coloration, and camouflage as adaptations to avoid predation.
- Describe the roles of producers, consumers, detritivores, and decomposers in energy flow within an ecosystem.
- Explain the hierarchical organization of trophic levels, food chains, and food webs.
- Explain why energy transfer through an ecosystem is inefficient and how this influences biomass and species diversity at all trophic levels.
- Explain the greenhouse effect, and describe how human activities are contributing to global climate change.
- Understand that global climate change can alter species distributions and range limits.

Week 9:

Quiz 3 (based on Weeks 7-8)

Animal Tissues and Organs: Ch.19 (p. 379-380, and p. 386)

- Define tissue.
- Name the four major tissue types and their functions.
- Define organ and organ system and provide an example of each.

Digestion and Excretion: Ch. 23 (pp. 450-465)

- Compare and contrast the structural and functional variations in the digestive systems of different animals.
- Outline how mechanical digestion, chemical digestion, and absorption occur along the human digestive system.
- Discuss how the quantity and types of molecules in food affects human health.
- Analyze how changes in energy balance contribute to human health.
- Describe the function of the urinary system in animals.
- Correlate the processes of filtration, absorption, and secretion with nephron anatomy and urine formation.
- Predict how fluid consumption alters antidiuretic hormone activity.
- Analyze consequences and treatments of impaired kidney function.

Week 10:

Circulation and Respiration: Ch. 21 (p. 408-423)

• Compare and contrast open and closed circulatory systems.
• Describe the circulatory system of fish and land-dwelling animals.
• Describe the pulmonary and systemic circuits of blood vessels in the human cardiovascular system.
• Correlate the structures of the human heart with their function in the cardiac cycle.
• Connect the components of blood with their functions.
• Compare and contrast the structure and functions of arteries, arterioles, capillaries, venules, and veins.
• Analyze the importance of respiration in living things.
• Compare and contrast the respiratory process in organisms with integumentary exchange, gills, or lungs.
• Analyze the causes of common cardiovascular and respiratory disorders.
• Discuss health issues linked to smoking.

Week 11:

Neural Control and the Senses: Ch. 24 (p.470-482)

- Explain the nature of the synthetic drug ecstasy, its action, and typical and potential side effects.
- Describe the three types of neurons and their specific functions.
- Know the functional zones on a neuron.
- Explain the function of neuroglia.
- Compare and contrast resting potential, action potential, and threshold potential.
- Describe the role of chemical synapses and neurotransmitters in nerve transmission.
- List the major neurotransmitters and their effects.
- Compare and contrast the nerve net in a radially symmetric animal and neurons in a bilaterally symmetric animal.
- Define distinction between the central nervous system and the peripheral nervous system in vertebrates.
- Explain the importance of myelination of nerve axons.
- Compare and contrast the somatic, autonomic, sympathetic, and parasympathetic nervous systems.
- Define meninges, cerebrospinal fluid, and white and gray matter.
- Explain the importance of the blood-brain barrier.
- List the function of the spinal cord.
- List the main regions of the brain and a function for each region.
- List the major lobes of the cerebral cortex and their function.

Endocrine Control: Ch.25 (p. 494-507).

- Categorize hormones by type of molecule and mechanism of action.
- Correlate the role of the hypothalamus, anterior pituitary, and posterior pituitary with endocrine regulation in the human body.

- Describe the actions of the main endocrine glands and the hormones they produce.
- Predict consequences of decreased or increased hormone levels of growth hormone, thyroid hormone, parathyroid hormone, pancreatic hormones, and adrenal hormones.
- Discuss political and biological concerns for use of endocrine disrupters in various industries.

Week 12:

Quiz 4 (based on Weeks 9-11)

Reproduction and Development: Ch. 26 (pp. 512-527)

- Identify the developmental processes common to all animals.
- Recount the story of human reproduction from a single fertilized egg cell to a multicellular organism with trillions of specialized cells.
- Identify and discuss the six stages of reproduction and development that occur in animals that have tissues and organs.
- Describe the major components and functions of the male and female reproductive system.
- Describe the development of male and female sexual gametes (sperm and egg).
- Describe the ovarian cycle with its related hormonal changes.
- Recognize the most common menstruation-related disorders.
- Describe the various methods of contraception for both men and women.
- Describe the symptoms and consequences of the most common sexually transmitted diseases.

Week 13:

Final Exam (based on Weeks 7-12)

LAGUARDIA COMMUNITY COLLEGE OF THE CITY UNIVERSITY OF NEW YORK
SCB 115: Principles of Biology

Required Materials: Dissection Kit, Goggles and Nitrile disposable gloves

Laboratory manual: ISBN: 13:978-1-68135-017-2; SCB115-Principes of Biology by Maria Entezari; Blue door, 2nd edition 2015

LABO RATORY COURSE CALENDAR

WEEK	TOPICS	LAB MANUAL EXERCISES* AND LAB REPORTS DUE
1	Scientific Method; Metric system	1,2
2	Microscope, pH, Acids and Bases and Buffers	3,4 **Lab report#1Due (page 9-11)**
3	Biomolecules, Enzymes	5,6 **Lab report#2 Due (Page 45-47)**
4	Cladistics and Kingdom of life Cell Structure	7, 8
5	**Lab Exam 1 (based on Weeks 1-4)** Passive movement of molecules: Diffusion and osmosis	9 **Lab report#3 Due (Page 79-80)**
6	Cell Division: Mitosis and Meiosis	10 **Lab report#4 Due (Page 115-119)**
7	**Lab Exam 2 (based on Weeks 4-6);** Mendelian Genetics and Heredity	11
8	Evolution Community Ecology	12.13
9	Digestive and Urinary Systems, Fetal Pig Dissection	14.15,21 **Lab report#5 Due (Page 165-166, 172,179-180)**
10	Circulatory and Respiratory Systems, Fetal Pig Dissection	16,17,21
11	Nervous System, Special Senses, Sheep Brain Dissection	18,19
12	Reproductive System, Fetal Pig Dissection	20,21
13	**Lab Final Exam (based on Weeks 7-12)**	

PRACTICAL AND WRITTEN LABORATORY FINAL EXAMS ON LABS 7-12 IS GIVEN DURING FINALS WEEK

***** Note that there is a strict no food, no drink, no smoking and no open toed shoe policy in the laboratory. Students who fail to follow these simple rules may not participate in the laboratory and will have to make up the missed lab at another time.**

***** Make-up of missed labs and practical exams must be authorized in writing by the student's laboratory instructor with prior permission granted by the host laboratory instructor. Of course, students must provide a legitimate document for missing the lab.**

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