Students participating in the 1818 ACC Program through enrollment in BIOL 104 and 106 are held to at least the same standards of achievement as those expected of students taking the same course on the Saint Louis University campus. Because of the high value Saint Louis University and the College of Arts & Sciences place on individual departmental and faculty autonomy, rarely are any two syllabi identical, even among campus professors or instructors. While the paired syllabi attached may not appear to articulate identical course objectives and expectations, close scrutiny will prove them to be comparable in content and rigor. Course objectives are determined collaboratively within departments.

In the Biology Department, campus faculty delivering sections of the course collaborate on objectives which are then communicated to adjuncts and graduate students also delivering the course both on and off campus.

Members of the campus teaching faculty of BIOL 104 and 106 have collaborated to develop the general description and course objectives for the two entry level Biology courses. It is within the authority of the individual instructors to design the actual section which he/she will deliver, based on the instructor’s interests and academic research areas. Most high school sections deliver only BIOL 104.

Instructors delivering sections on campus are instructed to submit copies of their syllabi to the department chair each semester, who forwards them to the Associate Dean of the College of Arts & Sciences, in whose office they are housed. High school adjunct instructors are instructed to send copies annually to the 1818 ACC Program office where they are housed, and from which copies are forwarded to the Biology faculty liaison.
1818 BIOL 104 Learning Objectives

Question numbers that map to each learning objective are indicated in brackets.

1. Scientific Inquiry and the Properties of Life
   a. Describe the characteristics & organization of living organisms (heredity, homeostasis, cells, energy, carbon-based, responds to environment, metabolism, evolution). [134, 135]
   b. Explain the scientific method and its application in biology.
   c. Read and interpret data in graphs and tables. [1, 2, 4, 5, 6, 7, 21, 120]
   d. Represent data appropriately in graphs and tables. [1, 2, 3]
   e. Summarize data and report the mean of a data set.
   f. Analyze data with statistics.
2. Chemistry and Macromolecules
   a. Apply basic concepts regarding ions, isotopes, solutions, pH, and chemical reactions (including redox). [10]
   b. Compare chemical bonds (ionic, polar covalent, nonpolar covalent, hydrogen).
   c. Describe how carbon is suited as the basis of life.
   d. Describe properties of water and explain how they are essential for life. [12]
   e. Compare different types of macromolecules (carbohydrates, proteins, nucleic acids, lipids). [11, 13, 43]
   f. Relate monomers to polymers. [9]
   g. Identify functional groups that are commonly found in biological macromolecules.
   h. Contrast anabolic and catabolic reactions.
   i. Recognize polar, nonpolar, and charged groups and relate these properties to the hydrophilic and hydrophobic properties of molecules. [8]
3. Membranes and Cellular Structure
   a. Differentiate between prokaryotes and eukaryotes. [93, 94, 95, 97, 98, 99, 101, 102]
   b. Contrast plant & animal cells. [96, 100, 101]
   c. Identify organelles and their functions. [38, 103, 104]
   d. Recognize the parts of a microscope. [105]
   e. Describe the structure of the plasma membrane. [32, 106, 107, 113]
   f. Describe endosymbiosis and its significance in the evolution of eukaryotic cells. [38, 108]
   g. Contrast different mechanisms of membrane transport (simple diffusion, facilitated diffusion, active transport, and osmosis). [33, 34, 109, 110, 111]
   h. Outline the endomembrane system and the path of a protein in the endomembrane system. [35, 112]
   i. Contrast mechanisms of cell-cell communication. [14, 36, 37]
4. Cellular Metabolism (Energy, Respiration, and Photosynthesis)
   a. Describe the laws of thermodynamics.
   b. Describe how free energy changes influence chemical reactions (e.g., whether a reaction will occur spontaneously and whether it requires energy). [6]
c. Explain how enzymes work. [7]
d. Outline the major steps in cellular respiration. [129, 131]
e. Contrast aerobic & anaerobic respiration.
f. Explain how chemiosmosis works. [131]
g. Contrast respiration & photosynthesis.
h. Outline the major stages of photosynthesis. [5, 130, 133]
i. Explain the role of electron carriers in cellular resp. & photosynthesis.
j. Explain how oxygen is produced in photosynthesis.
k. Describe the evolutionary impacts of biochemical pathways.
l. Keep track of the matter and energy in photosynthesis and cellular respiration.
m. Explain how energy transformations occur in cellular resp. & photosynthesis.
n. Explain the importance of phosphate groups to free energy.
o. Identify steps that are regulated in metabolic pathways.

5. Cell Division, Genetics, and the Central Dogma
   a. Outline the cell cycle. [49, 50, 51]
   b. Explain how cyclins regulate the cell cycle. [52, 126]
   c. Outline the stages of mitosis. [53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 127, 137]
   d. Distinguish homologous chromosomes from sister chromatids. [64]
   e. Contrast mitosis & meiosis. [66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 83, 122, 124]
   f. Outline the steps of meiosis. [76, 123, 128]
   g. Explain how nondisjunction produces aberrant chromosome numbers. [77, 115]
   h. Distinguish among chromosomes, genes, alleles, and genomes.
   i. Use Mendel’s laws of segregation and independent assortment to predict the results of genetic crosses involving one or two genes. [39, 78, 79, 80, 81, 125]
   j. Relate Mendel’s laws to chromosome behavior during meiosis. [114, 141]
   k. Analyze a pedigree. [40, 82]
   l. Identify sources of genetic variation.
   m. Contrast replication, transcription, and translation. [121]
   n. Describe the steps in DNA replication. [118]
   o. Describe the structure of DNA. [42, 44, 65, 116, 119]
   p. Describe the steps in transcription. [43, 84, 117]
   q. Describe the steps in translation, and identify the roles of mRNA, tRNA, and rRNA in translation.
   r. Use the genetic code to convert a nucleotide sequence to an amino acid sequence. [41, 85, 86]

6. Animal Structure and Organization
   a. Describe how cells are organized into tissues, organs, and organ systems. [18]
   b. Contrast the different tissue types found in animals. [15, 16, 18]
   c. For each organ system, identify the primary organs and their functions.

7. Homeostasis and the Endocrine and Nervous Systems
   a. Explain how animals maintain homeostasis (i.e., conforming vs. regulating).
   b. Explain the roles of positive and negative feedback in maintaining homeostasis. [14, 17]
c. Explain how antagonistic hormones can maintain homeostasis for a physiological variable.
d. Describe the roles of the hypothalamus and the pituitary gland in regulating homeostasis.
e. Explain how the opening and closing of ion channels generate graded and action potentials. [22]
f. Describe how an electrical signal is converted to a chemical signal at an axon terminal. [23, 24, 25]
g. Describe the structure of a neuron, and relate the structure to the direction in which information travels. [22]
h. Explain why different cell types may have different responses (or no response) to the same hormone.
i. Contrast hormones in vertebrates and invertebrates.

8. Reproduction and Animal Development
   a. Identify embryonic tissues and germ layers. [132, 139]
   b. Outline the stages of embryonic development in animals. [140, 142]
   c. Explain how differential gene expression results in cellular specialization.
   d. Describe stem cells and their developmental potential. [143]
   e. Contrast sexual and asexual reproduction.
   f. Relate mitosis and meiosis to reproduction. [138]
   g. Explain how hormones influence the function of the human reproductive system. [136]
   h. Describe the structures of human gametes. [144]

9. Digestive, Respiratory, Circulatory, and Excretory Systems
   a. Identify exchange surfaces for gases, nutrients, and wastes. [48, 87, 88]
   b. Describe the roles of transporters in the exchange of gases, nutrients, and wastes. [89]
   c. Identify countercurrent exchange systems used in the respiratory and urinary systems. [90]
   d. Identify the roles of filtration, secretion, and reabsorption in kidney function. [91, 92]
   e. Explain how the kidney adjusts the composition of urine. [46]
   f. Outline the flow of blood through the circulatory system in vertebrates. [47]
   g. Identify places in the circulation that have oxygenated and deoxygenated blood.
   h. Explain why organisms need to take in oxygen and nutrients.
   i. Outline how different types of food are broken down into smaller molecules in the digestive system. [19, 45]
   j. Explain how nutrients are absorbed from the digestive tract into the blood.
   k. Contrast the respiratory organs used by different species (e.g., gills, lungs).

10. The Immune System
    a. Distinguish between innate and acquired immunity.
    b. Explain how the immune system recognizes foreign antigens. [28, 31]
    c. Describe the cells that are involved in the innate and acquired immune response. [31]
    d. Explain how immune cells can produce T cell receptors and antibodies that are specific for different antigen.
e. Explain how memory cells allow the immune system to respond rapidly to an antigen it has encountered before. [27, 29]

f. Outline the inflammatory response. [26]