

## NORTHWESTERN CONNECTICUT COMMUNITY COLLEGE

**Course Title:** Cell Biology with Organ System      **Course #:** BIO\* 127

**Course Description:** This one semester laboratory science course covers principles of cell biology, including basic biological chemistry, cell structure and function, human genetics, cell division, cellular respiration, and protein synthesis. These concepts are applied to a study of the structure and function of the major organ systems human body. Aspects of health and disease are presented including basic elements of nutrition, exercise, cancer, and chemical addictions. The course can be used as a prerequisite for BIO 211 or BIO 235.  
(3 hours of lecture, 2 hours of laboratory)

**Pre-requisite:** Recent college preparatory biology recommended or COL 100 – Health Careers

**Goals:** To provide the student with an understanding of the biological principles of animal cell physiology as it applies to the structure and function of the human body. To provide students with a basic understanding of the structure and function of the human body and how the systems work together to promote life. To develop a basic understanding of the conditions necessary for good health and examples of major causes of human disease.

### **Outcomes:**

#### **Cell Biological and Physiological Principles**

##### **Identify and describe specific chemical and cellular biological principles**

###### Scientific Method

- Recognize the process of scientific method
  - Identification of control group and experimental group
  - Identification of an appropriate hypothesis
- Identification of characteristics of living organisms
- Identification and classification of living organisms into domains and kingdoms

###### Basic chemistry and biochemistry

- Recognize the basic structure of atoms, isotopes, ions, and molecules
  - Predict ion charge for specific atoms
  - Calculate atomic number, mass number, number of protons, neutrons and electrons for specific elements and isotopes
  - Predict chemical formula for specific ionic compounds
  - Define pH and relate pH to concentration of hydrogen and hydroxide ions
  - identify the importance of pH in living organisms
  - Describe the role of buffers
  - Recognize basic functional groups such as amino, carboxyl, hydroxyl and phosphorylation and identify the type of functional group(s) associated with carbohydrates, lipids, proteins and nucleic acids
  - Identify the building blocks of carbohydrates, lipids, protein, and nucleic acids and roles of each in the body and major reaction categories important in physiology such as hydrolysis, dehydration synthesis, decarboxylation, and deamination

###### Cell structure and physiology

- Identify the difference between prokaryotic and eukaryotic cells

- Identify the basic structure and function of the plasma membranes, nucleus, organelles and cytosol of an animal cell

### Cellular physiology

- Describe the sequence of events involved in protein synthesis
  - Using a specific DNA nucleotide sequence identify the steps in transcription and translation to identify the correct mRNA and amino acid sequence and all of the steps necessary to produce the peptide strand
  - During translation explain the significance of initiation, elongation and termination
  - Explain the difference between a point mutation and a frame shift mutation
- Identify the steps in DNA replication and recognize the significance of mutations and recognize the difference between DNA replication and protein synthesis
- Identify the steps in cellular respiration and the significance of specific steps in each process (glycolysis, oxidation of pyruvate, Krebs cycle, ETC and chemiosmosis)
  - Identify specific enzymes in glycolysis
  - Identify specific types of reactions (isomerization and phosphorylation)
  - Identify the locations in the process where ATP is synthesized
- Recognize components of cellular signal transduction in animal cells using the adenylate cyclase pathway

### Cell reproduction

- Identify the phases of mitosis and meiosis
- Recognize the difference between mitosis and meiosis and determine their role in the organism

### Genetics

- Describe terms used in Mendelian genetics including allele, homozygous dominant, homozygous recessive, heterozygous, incomplete dominance, complete dominance, polygenic inheritance, genotype and phenotype
  - Predict genotype and phenotype when given parental genotypes
- Identify the differences between inheritance patterns including autosomal recessive, autosomal dominant and X-linked recessive
- Use molecular genetics principles to identify outcomes and significance of specific genetic disorders including sickle cell anemia, hemophilia, cystic fibrosis and Huntington's disease

### Histology

- Recognize and identify specific examples of the four basic types of body tissues
- Recognize specific subtypes in each category, and identify the function of each type
- Identify location where each type and subtype of tissue are located in a mammal

### Organismal System Principles

- Identify components of a negative and positive feedback system and explain the role in maintaining homeostasis in an organism
- Identify and recognize and describe the anatomy and physiology on an organ and cellular level for the:
  1. **Integumentary system** including: layers of the skin, structural and functional elements such as hair and hair follicles, sebaceous glands, sweat glands, and arrector pili
  2. **Skeletal system** including comparison and contrast of compact bone versus spongy bone, structure of a long bone, endochondral ossification and growth of a long bone, significant of bone remodeling and the role of osteoclasts and osteoblasts in remodeling and the importance of diet in maintaining health bones

3. **Muscular system** including the organization of an entire muscle beginning with an individual fiber and its cellular components, to fascicles, and to the entire muscle including role of connective tissue in holding the muscle together. Students should be able to explain the structure and functional role of contractile elements of myofibers including myofibrils, sarcomeres and myofilaments. Students should be able to discuss the sliding filament model of muscle contraction and explain how this leads to movement of a bone.
  4. **Nervous system** including division of the nervous system, types of neurons, anatomy of a neuron and events that occur at a synapse. Students should be able to explain the difference between an excitatory postsynaptic potential and an inhibitory post-synaptic potential and how graded potentials relate to an action potential. They should be able to give examples of excitatory and inhibitory neurotransmitters and Students should be able to recognize the regions of the brain and spinal cord and identify their functions. They should be able to recognize the components of a withdrawal reflex.
  5. **Digestive system** including the role of the accessory organs and where each of the major category of nutrients is digested. Students can identify the order in which the food passes through the digestive system and the contribution of each specific organ in digestion and should be able to recognize specific digestive enzymes and where they are produced.
  6. **Cardiovascular system**, including the composition and role of each of the blood cells, the composition of plasma and the role of hemostasis. Students should be able to recognize the final common pathway in hemostasis. Students should be able to identify the structure and function of the heart, veins, arteries, capillaries and explain the movement of blood through the heart and circulation through blood vessels back to the heart. Students should be able to recognize the major components of an EKG and understand basic pathology including an MI.
  7. **Respiratory system** including flow of air into the lungs and the structure and function of each component, the dynamics of breathing, and the process of internal and external respiration and the forces that drive gas exchange during each. Students should be able identify how both CO<sub>2</sub> and O<sub>2</sub> are carried in the blood.
  8. **Urinary system** including the kidneys, ureters, urinary bladder and urethra. Students should be able to identify the role of each component of the nephron and how it contributes to the formation of urine and maintenance of homeostasis. Students should be able to explain how the kidneys maintain the volume, composition and oxygen carrying capacity of blood.
  9. **Endocrine system** including the major endocrine glands such as the hypothalamus and its role in regulating the pituitary and producing oxytocin and antidiuretic hormone. Students should be able to discuss the anatomy, histology and function of the anterior and posterior pituitary, thyroid gland, pancreas, parathyroid, adrenal gland, ovaries, and testes
  10. **Reproductive system** including the structure and function of female and male reproductive systems including recognizing and identifying the ovarian and uterine cycles, the, the pathway that sperm travel in the male, how erection occurs and where fertilization of the oocyte occurs.
- Discuss basic principles in nutrition
  - Identify examples of pathologies for each of the above systems including but not limited to:  
Decubitus ulcers, fractures, sprains, carcinoma, basic principles of chemical addiction, depression, gastroesophageal reflux, , myocardial infarction, anemia, asthma, pneumonia, emphysema, kidney damage, diabetes type I and type II

- Recognize basic diagnostic tests including x-ray, MRI and CT Scans
- Write an essay that integrates the structure and function of the major body systems to demonstrate how the body systems work together to support an activity and maintain homeostasis

Transfer and Articulation Outcomes:

*Scientific Reasoning:* Upon the completion of this course, students should be able to:

1. Explain the methods of scientific inquiry that lead to the acquisition of knowledge. Such methods include observations, testable hypotheses, logical inferences, experimental design, data acquisition, interpretation, and reproducible outcomes.
2. Apply scientific methods to investigate real-world phenomena, and routine and novel problems. This includes data acquisition and evaluation, and prediction.
3. Represent scientific data symbolically, graphically, numerically, and verbally.
4. Interpret scientific information and draw logical references from representations such as formulas, equations, graphs, tables, and schematics.
5. Evaluate the results obtained from scientific methods for accuracy and/or reasonableness

*Scientific Knowledge:* Upon the completion of this course, students should be able to:

1. Communicate using appropriate scientific terminology.
2. Use representations and models to communicate scientific knowledge and solve scientific problems.
3. Plan and implement data collection strategies appropriate to a particular scientific question.
4. Articulate the reasons that scientific explanations and theories are refined or replaced.
5. Evaluate the quality of scientific information on the basis of its source and the methods used to generate it.

### **College Policies**

**Plagiarism:** Plagiarism and Academic Dishonesty are not tolerated at Northwestern Connecticut Community College. Violators of this policy will be subject to sanctions ranging from failure of the assignment (receiving a zero), failing the course, being removed/expelled from the program and/or the College. Please refer to your “Student Handbook” under “Policy on Student Rights,” the Section entitled “Student Discipline,” or the College catalog for additional information.

**Americans with Disabilities Act (ADA):** The College will make reasonable accommodations for persons with documented learning, physical, or psychiatric disabilities. Students should notify Dr. Christine Woodcock, the Counselor for Students with Disabilities. She is located at

Green Woods Hall, in the Center for Student Development. Her phone number is 860-738-6318 and her email is [cwoodcock@nwcc.edu](mailto:cwoodcock@nwcc.edu).

**School Cancellations:** If snowy or icy driving conditions cause the postponement or cancellation of classes, announcements will be made on local radio and television stations and posted on the College's website at [www.nwcc.edu](http://www.nwcc.edu). Students may also call the College directly at **(860) 738-6464** to hear a recorded message concerning any inclement weather closings. Students are urged to exercise their own judgment if road conditions in their localities are hazardous.

**Use of Electronic Devices:** Some course content as presented in Blackboard Learn is not fully supported on mobile devices at this time. While mobile devices provide convenient access to check in and read information about your courses, they should not be used to perform work such as taking tests, quizzes, completing assignments, or submitting substantive discussion posts.

**Sexual Assault and Intimate Partner Violence Resource Team:** NCCC is committed to creating a community that is safe and supportive of people of all gender and sexual identities. This pertains to the entire campus community, whether on ground or virtual, students, faculty, or staff.

Sexual assault and intimate partner violence is an affront to our national conscience, and one we cannot ignore. It is our hope that no one within our campus community will become a victim of these crimes. However, if it occurs, NCCC has created the SART Team - Sexual Assault and Intimate Partner Violence Resource Team - to meet the victim's needs.

SART is a campus and community based team that is fully trained to provide trauma-informed compassionate service and referrals for comprehensive care. The team works in partnership with The Susan B. Anthony Project to extend services 24 hours a day, 7 days a week throughout the year.

The NCCC team members are:

Ruth Gonzalez, Ph.D.	860-738-6315	Green Woods Hall Room 207
Susan Berg	860-738-6342	Green Woods Hall Room 223
Kathleen Chapman	860-738-6344	Green Woods Hall Room 110
Michael Emanuel	860-738-6389	Founders Hall Annex Room 308
Seth Kershner	860-738-6481	Library
Jane O'Grady	860-738-6393	Founders Hall Annex Room 212
Robin Orloski	860-738-6416	Business Office Room 201
Patricia Bouffard, Ex-Officio	860-738-6319	Founders Hall Room 103
Savannah Schmitt		Student Representative

At NCCC we care about our students, staff and faculty and their well-being. It is our intention to facilitate the resources needed to help achieve both physical and emotional health.