



**COWLEY COLLEGE
& Area Vocational Technical School**

COURSE PROCEDURE FOR

<p>PRINCIPLES OF BIOLOGY BIO 4111 5 Credit Hours</p>
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Student Level:

This course is open to students on the college level in either the freshman or sophomore year.

Catalog Description of the Course:

BIO 4111 - PRINCIPLES OF BIOLOGY (N) (5 hrs)

KRSN BIO 1010/1011/1012

An introduction to biological concepts included in the General Education Biology Core Competencies. This includes understanding the nature of science, levels of organization, bioenergetics, reproduction, and inheritance, and the mechanisms of change. Laboratory stresses the process of scientific investigation and observation of biological processes.

Prerequisite:

None

Controlling Purpose:

This course is designed for non-science majors desirous of a laboratory course in biology as a part of their general education requirements. Students majoring in science will find this course helpful in the overall course content.

Learner Outcomes:

Upon completion of this course students will have an understanding of the fundamental principles of biology in the areas of molecular biology, cellular structure and function, and ecology. Aspects of human biology and heredity are included.

Core Outcomes:

The learning outcomes and competencies detailed in this course outline or syllabus meet or exceed the learning outcomes and competencies specified by the Kansas Core Outcomes Groups project for this course as approved by the Kansas Board of Regents.

Units Outcomes and Criterion Based evaluation Key for Core Content:

The following defines the minimum core content not including the final examination period. Instructors may add other content as time allows.

Evaluation Key:

A = All major and minor goals have been achieved and the achievement level is considerably above the minimum required for doing more advanced work in the same

field

- B = All major goals have been achieved, but the student has failed to achieve some of the less important goals. However, the student has progressed to the point where the goals of work at the next level can be easily achieved.
- C = All major goals have been achieved, but many of the minor goals have not been achieved. In this grade range, the minimum level of proficiency represents a person who has achieved the major goals to the minimum amount of preparation necessary for taking more advanced work in the same field, but without any major handicap of inadequacy in his background.
- D = A few of the major goals have been achieved, but the student's achievement is so limited that he is not well prepared to work at a more advanced level in the same field.
- F = Failing, will be computed in GPA and hours attempted. N
- = No instruction or training in this area.

UNIT I: INTRODUCTION TO BIOLOGY						
Outcomes: The student will gain an overview of what constitutes a living organism and how science is conducted.						
A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						List six characteristics of living things and explain what is meant by each of the characteristics.
						Distinguish between levels of scientific certainty: hypothesis, conclusion, theory, and law.
						Identify various levels of organization from atomic to organismal.
						Describe the steps and utilization of the scientific method.
						Identify key parts of a scientific experiment.
						Identify and demonstrate proper lab safety procedures.

UNIT II: THE CHEMISTRY AND ORIGIN OF LIFE

Outcomes: The student will study the relationship between living organisms and our chemical world.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Describe how protons, electrons, and neutrons are arranged in an atom.
						Explain how the distribution of electrons in an atom or ion determines the numbers and kinds of bonds that can be found.
						Compare the types of bonding.
						Distinguish between organic and inorganic compounds.
						Describe the essential chemistry of water and its properties.
						Interpret, on the pH scale, which numbers indicate a basic solution and which indicate an acidic solution.
						Define buffers and explain their importance to life.
						Explain, giving examples, condensation and hydrolytic reactions.
						Describe the structure and function of the four major groups of organic compounds.

UNIT III: CELL BIOLOGY

Outcomes: Upon completion of this unit the student will be able to describe cell structure and how the parts of the cell function to perform jobs for the organism.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Compare viruses to cells.
						Compare prokaryotic cells and eukaryotic cells.
						List and describe the organelles of secretion, waste removal, inheritance, and energy production in the cell.
						List and describe the structures comprising the cellular architecture.
						Assess the cells surface molecules and their arrangement in regard to the biological functions of these molecules.
						Diagram a cell membrane, showing and describing the components.
						Compare the various mechanisms of cell membrane transport.
						Compare microtubules and microfibrils in structure and function.

UNIT IV: BIOLOGICAL ENERGY

Outcomes: Upon completion of this unit the student will be able to explain the importance of photosynthesis and respiration to the energy pathways of organisms.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Discuss the 1 st and 2 nd Laws of Thermodynamics and how they apply to living systems.
						Explain the nature of enzymes and their importance to living systems.
						Outline the light and dark reactions of photosynthesis.
						Integrate in an outline the glycolytic pathway, Krebs cycle, and electron-transfer pathway.
						Compare fermentative and aerobic respiration.
						Describe the anabolism and catabolism of the major groups of organic compounds.
						Formulate how energy pathways in cells may have evolved.

UNIT IV: BIOLOGICAL ENERGY

Outcomes: Upon completion of this unit the student will be able to explain the importance of photosynthesis and respiration to the energy pathways of organisms.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Compile three similarities and three differences between photosynthesis and respiration.

UNIT V: MITOSIS

Outcomes: Upon completion of the unit the student will be able to identify and explain the parts of the cell cycle and its link to the continuity of life.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Summarize the factors that cause cells to undergo mitosis.
						Outline the phases of the cell cycle and explain the activity occurring in each phase.
						Assess the controls on mitotic division.
						Compare normal cells and cancer cells.
						Propose the effect of genes on causing cancer cells to develop.
						Identify the mitotic phases & structures in both plant & animal cells.

UNIT VI: HUMAN MEIOSIS, REPRODUCTION, AND EMBRYOLOGY

Outcomes: Upon completion of this unit the student will be able to explain how meiosis leads to the continuity of life.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Identify the meiotic phases & structures in animal cells.
						Compare spermatogenesis with oogenesis-outline the steps in each.
						Appraise the necessity for gametic cells to have half the number of chromosomes found in somatic cells.
						Arrange the developmental stages of the human in chronological order beginning with fertilization and ending at birth (zygote, morula, blastula, gastrula, germ layer development).
						List the body systems and the germ layer from which each is derived.
						Name and describe the functions of and fates of the four fetal membranes.

UNIT VII - PART A: GENETICS--MOLECULAR GENETICS

Outcomes: Upon completion of this unit the student will be able to determine the relationship between DNA, RNA, and protein synthesis.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Describe the various experiments and scientists involved, leading to the discovery of DNA and its structure.
						Compare the structures of DNA and RNA.
						Compare and contrast: transcription and translation; codons and anticodons; introns and exons; rRNA, mRNA, and tRNA.
						Compare the structure of a gene and a protein.
						Describe the relationship between inherited traits and proteins.
						Outline the steps in transcription through translation.
						Contrast a gene mutation to a chromosomal abnormality.
						Demonstrate how a base substitution and a frame shift will produce abnormal proteins.

UNIT VII - PART B: GENETICS-MENDEL'S LAWS AND HUMAN GENETICS

Outcomes: Upon completion of this unit the student will be able to relate the principles of heredity to various traits and disorders.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Relate Mendel's laws of segregation and independent assortment to specific events in meiosis.
						Describe dominant and recessive alleles and understand the concepts related to genotype and phenotype.
						Describe patterns of inheritance beyond simple dominance: codominance, incomplete dominance, and polygenic inheritance.
						Solve genetics problems involving one or two autosomal traits and sex-linkage traits.
						Define aneuploidy and give an example of how this condition can arise.
						Define polyploidy and explain why it is seen to occur more often in plants than in animals.
						Describe the chromosomal theory of inheritance.
						Indicate the underlying genetic defect and the gene product that is involved for various human disorders.
						Describe how pedigrees, chromosome charts, and biotechnology tools are used to detect or evaluate genetic diseases.

UNIT VIII: HUMAN BIOLOGY

Outcomes: Upon completion of this unit the student will be able to give the functions of the organ systems and how they work to maintain homeostasis.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Compare the mammalian organ systems as to their functions.
						Describe the organs involved in the various mammalian organ systems.
						Explain how these systems function together to maintain homeostasis.
						Describe how an error in one system can affect the other systems in the body.

UNIT IX: EVOLUTION

Outcomes: Demonstrate an understanding of discussing evolution as the mechanism of change in biology

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Identify the mechanisms of evolutionary change.
						Contrast the processes of artificial selection and natural selection.
						Discuss the mechanisms that are involved in speciation.
						Explain the anatomical, developmental, and genetic evidence for evolution.
						List the main taxa used in current classification systems.
						Distinguish between cladistics and taxonomy.

UNIT X: DIVERSITY OF LIFE

Outcomes: Upon completion of this unit, the student will be able to distinguish between the major groups of living organisms and their role in the ecosystem.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Compare the major characteristics of the classification system that currently exist.
						Compile a list of the main tissues and structures of the plant body and give their functions.
						Compare the monocots and dicots as to roots, stems, leaves, flowers and seeds.
						List the major phyla in the Animal Kingdom and the characteristics used in their classification.
						Describe the characteristics of the prokaryotes and their classification.
						Describe the characteristics of the fungi and their classification.
						Describe the characteristics of the protista and their classification.
						Identify and compare the anatomical structures associated with the organisms studied.

UNIT XI: PRINCIPLES OF ECOLOGY

Outcomes: Upon completion of this unit the student will be able to explain the homeostasis that exists in an ecosystem.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Compare the following: population, community, and ecosystem; producers and consumers; detritus feeder and decomposer; food chain and food pyramid.
						Diagram, illustrating the interdependency of producers, consumers, and decomposers, in food chains, food webs, and food pyramids.
						Describe the general pattern of energy flow through life forms and explain how Earth's resources are cycled and the impacts of the human population on those cycles.
						Distinguish between a habitat and a niche.
						Describe four types of positive interspecies interactions.
						Describe two types of negative interspecies interactions.
						Compare primary and secondary succession.

UNIT XI: PRINCIPLES OF ECOLOGY

Outcomes: Upon completion of this unit the student will be able to explain the homeostasis that exists in an ecosystem.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Formulate why there are usually no more than four or five trophic levels in a food chain.
						Describe the major features of biomes.
						Discuss several issues of environmental concern and the underlying causes and potential solutions (including habitat loss and destruction, deforestation, global climate change, and species extinction).

SPECIFIC LABORATORY SKILLS OR TOPICS

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Identify structures and organisms using the microscope.
						Use quantitative measurement skills incorporating the metric system.
						Interpret graphs and tables using analytical and statistical skills.
						Identify and describe organisms in the laboratory and/or field setting.
						Identify and correctly use major pieces of laboratory equipment.

Projects Required:

As assigned. A semester project may be required and will be explained by the instructor.

Text Book:

Contact Bookstore for current textbook.

Materials/Equipment Required:

None

Major Pieces of Equipment:

Compound microscopes (monocular and binocular)

Stereo dissecting microscopes

Attendance Policy:

Students should adhere to the attendance policy outlined by the instructor in the course syllabus.

Grading Policy:

The grading policy will be outlined by the instructor in the course syllabus.

Maximum class size:

Based on classroom occupancy (24)

Course Time Frame:

The U.S. Department of Education, Higher Learning Commission and the Kansas Board of Regents define credit hour and have specific regulations that the college must follow when developing, teaching and assessing the educational aspects of the college. A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work for approximately fifteen weeks for one semester hour of credit or an equivalent amount of work over a different amount of time, The number of semester hours of credit allowed for each distance education or blended hybrid courses shall be assigned by the college based on the amount of time needed to achieve the same course outcomes in a purely face-to-face format.

Refer to the following policies:

[402.00 Academic Code of Conduct](#)

[263.00 Student Appeal of Course Grades](#)

[403.00 Student Code of Conduct](#)

Disability Services Program:

Cowley College, in recognition of state and federal laws, will accommodate a student with a documented disability. If a student has a disability which may impact work in this class which requires accommodations, contact the Disability Services Coordinator.