



**COWLEY COLLEGE  
& Area Vocational Technical School**

**COURSE PROCEDURE FOR**

<p><b>MICROBIOLOGY</b> <b>BIO4160      5 Credit Hours</b></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:**

**BIO4160 – MICROBIOLOGY (N) (5 hrs)**

An introduction to microorganism and their morphology, physiology, genetics and distribution. Emphasis is placed on the relationship of microorganisms to disease and the human immune responses. Techniques involving staining, culturing, identifying, and biochemistry are considered.

**Prerequisite:**

The student must complete one of the following: BIO4110 Biology Review, BIO4111 Principles of Biology, or successful completion of a life science lab class within the past five years. Suggested Prerequisite: CHM4211 General Chemistry.

**Controlling Purpose:** This course is designed to provide students with a basic knowledge of microorganisms and their relationship to human disease.

**Learner Outcomes:** Upon completion of the course, students will have an understanding of the varieties of microorganisms, their morphology and physiology, their relationship to disease, and of the human immune response. Those students entering professional training in the health sciences will be at a level of competency required in that training.

The learning outcomes and competencies detailed in this course meet, or exceed the learning outcomes and competencies specified by the Kansas Core Outcomes Project for this course, as sanctioned 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.

<b>UNIT 1: MICROBIAL CELL BIOLOGY</b>						<b>25%</b>
<b>SECTION A: Structure and Function of Prokaryotic and Eukaryotic Organisms</b>						
Outcomes: The student will gain familiarity with basic characteristics of cellular microbes.						
A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Compare and contrast prokaryotic and eukaryotic cellular organization.
						Categorize the major shapes and arrangements of bacterial cells.
						Describe the function of major organelles and structures associated with eukaryotic and prokaryotic cells, including cell membrane, cell wall, ribosomes, nucleus, nucleoid, endoplasmic reticulum, Golgi complex, lysosomes, pili flagella glycocalxy, nucleolus, vacuoles, vesicles, inclusion bodies, photosynthetic organelles, mitochondria and cytoskeleton.
						Compare and contrast the organization of cell walls in gram positive, gram negative and acid-fast bacteria.
						List the diverse functions of the cell membrane in bacteria.

**UNIT 1: MICROBIAL CELL BIOLOGY****SECTION B: Structure and function of acellular infectious agents**

Outcomes: The student will gain familiarity with basic characteristics of acellular microbes.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						List the major structural components of viruses and bacteriophages and their functions including genome, capsid, envelope, attachment proteins and enzymes.
						Discuss the origins of a viral envelope.
						Discuss the chemical nature of viroids and prions, the types of organisms they infect and various diseases associated with each.

**UNIT 1: MICROBIAL CELL BIOLOGY****SECTION C: Growth and Division**

Outcomes: The student will gain familiarity with environmental factors affecting microbial growth and nutrition.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Outline the physical factors necessary for bacterial growth.
						Outline the process of binary fission.
						Compare the effects of tonicity on bacterial cells.
						Compare autotrophs to heterotrophs with respect to carbon and energy sources.
						Predict the appearance of a growth curve in an open system.
						Calculate the total bacteria in a system when given the formula $N_t = (N_i)2^n$
						Describe environmental influences that govern the growth of bacteria.

**UNIT 1: MICROBIAL CELL BIOLOGY****SECTION D: Energy Metabolism**

Outcomes: The student will gain an understanding of photosynthesis, fermentation, respiration and other metabolic activities of microbes.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Describe the function of enzymes and the physical factors that influence their activity.
						Distinguish among the enzyme categories: hydrolases, ligases, lysases and oxidoreductases.
						Summarize the sequence of events taking place during glycolysis, transition reactions, Kreb's Cycle and electron transport.
						Compare the major catabolic reactions in microbes including aerobic and anaerobic cellular respiration, fermentation, phototrophy, and chemolithotrophy including information about overall reactions, key intermediates, final products and energy produced at each stage.
						Summarize the chemiosmotic theory of ATP production.
						Explain the following in terms of nutrient transport: active transport and facilitated diffusion.

**UNIT 1: MICROBIAL CELL BIOLOGY****SECTION E: Regulation of Cellular Activities**

Outcomes: The student will gain an understanding of how microbes control the expression of genes.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Describe the various mechanisms of regulating enzyme activity including feedback inhibition and covalent modification.
						Describe the various mechanisms of regulation transcription an translation including positive and negative controls.

**UNIT 2: MICROBIAL GENETICS****SECTION A: Inheritance and Flow of Information**

Outcomes: The student will gain an understanding of how DNA functions in controlling cellular activity.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Compare and contrast the structure and function of DNA and RNA.
						Describe the arrangement of the genome in prokaryotes and eukaryotes.
						Describe the components of the central dogma of molecular genetics including the processes of replication, transcription and translation. Be familiar with differences between prokaryotes and eukaryotes in these processes.

**UNIT 2: MICROBIAL GENETICS****SECTION B: Causes, Consequences, and Significance of Mutations**

Outcomes: The student will gain an overview of the necessity of mutations in microbial populations.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Describe several mutagens including chemical agents and radiation.
						Describe several consequences of a mutation in DNA, relating it to the protein or proteins being produced.
						Discuss why mutations are essential to microbial populations.

**UNIT 2: MICROBIAL GENETICS****SECTION C: Exchange and acquisition of Genetic information**

Outcomes: The student will gain familiarity with the diversity of reproductive processes on microbial populations.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Describe various sexual and asexual processes used by microbes.
						Outline the processes of transformation, transduction and conjugations in relation to genetic variability.

**UNIT 2: MICROBIAL GENETICS****SECTION D: Genetic Engineering/Biotechnology**

Outcomes: The student will gain familiarity with the role of microbes in biotechnology and genetic engineering.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Discuss monoclonal & polyclonal antibodies.
						Describe the role of microorganisms in genetic engineering and biotechnology.
						Discuss several useful products and processes that have been developed using biotechnology.

**UNIT 3: INTERACTIONS OF MICROORGANISMS AND HUMANS****50%****SECTION A: Host Defense Mechanisms and Immune Systems**

Outcomes: The student will gain a basic understanding of the immune response, immune system components, and their action.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Explain and describe the 3 line of defense against pathogens.
						Describe the anatomy and physiology of the primary and secondary lymphatic organs including: bone marrow, thymus, lymph nodes, spleen, peyers patch and tonsils.
						Outline the sequence of events that occurs in phagocytosis.
						Differentiate between the populations of granulocytes and agranulocytes in terms of morphology and physiological effect.
						Describe the general complement reactions and list their 5 benefits.
						Outline and describe the events occurring in the inflammation response to an invading bacterium.
						Explain the relationship between hapten and antigen.
						Outline the major components of the innate immune system.
						List the origins and actions of several cytokines including interleukins, prostaglandins, tumor necrosis factor and colony stimulating factor.
						Explain the clonal selection theory of antibody specificity and diversity.
						Diagram the origin and development of B and T-lymphocytes.
						Diagram the steps leading from an undifferentiated T cell to a sensitized cytotoxic T cell and an undifferentiated B cell to an antibody producing plasma cell.
						Compare and contrast the primary and secondary response to antigens.
						Differentiate between endogenous and exogenous infections.

### UNIT 3: INTERACTIONS OF MICROORGANISMS AND HUMANS

#### SECTION B: Pathogenicity Mechanisms of Cellular and Acellular Infectious Agents

Outcomes: The student will gain an understanding of microbial roles in a variety of disease processes.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Compare atopic allergy to anaphylaxis.
						Outline the major characteristics of the 4 types of hypersensitivities and provide examples of each.
						Describe the causative agent, life cycle and symptoms of bacteria including but not limited to staphylococcal infections, toxicoses, Group A streptococcal infections, gonorrhoeal infection, pulmonary tuberculosis, meningitis, diphtheria, legionellosis, dental carries, T. pallidum, Rickettsia and chlamydia.
						Describe the causative agent, life cycle and symptoms of fungal diseases including but not limited to superficial mycoses, Candida, Histoplasma, Cryptococcus and Coccidioides.
						Describe the causative agent, life cycle and symptoms of viral disease including but not limited to HIV, smallpox, various types of herpes, various types of hepatitis, chicken pox, adenoviruses, polio, RSV, parvovirus, paramyxoviruses and retroviruses.
						Describe the causative agent, life cycle and symptoms of eukaryotic pathogens including but not limited to Giardia, Amoebas, Plasmodium, Toxoplasma, Trichomonas, Trypanosoma and members of helminthes.
						Compare the four major groups of protozoa according to cell structure, locomotion, infectious state and mode of transmission.
						Compare the function of the trophozoite and cyst stages in protozoa.
						Differentiate between contamination, infection and disease.
						Compare true pathogens to opportunistic pathogens.
						Distinguish between virulence and pathogenicity.

**UNIT 3: INTERACTIONS OF MICROORGANISMS AND HUMANS****SECTION C: Disease Transmission**

Outcomes: The student will become familiar with the mechanisms of microbe dispersal.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Describe the various mechanism of disease transmission for common bacterial, fungal, viral and protozoal pathogens.
						List several fomites and rank them as to their ability to spread disease.

**UNIT 3: INTERACTIONS OF MICROORGANISMS AND HUMANS****SECTION D: Control of Microorganism**

Outcomes: The student will gain familiarity with common methods of microbial control.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Compare sterilization, disinfection, and sanitation.
						Describe the relationship between sepsis, asepsis, and antisepsis.
						Summarize the mechanism and effectiveness of moist and dry heat.
						Compare pasteurization and sterilization.
						Evaluate as means of sterilization: tyndallization, boiling water, incineration, ultrasonics and ionizing radiation including advantages and disadvantages of each.
						Evaluate the use of heavy metals in sterilization such as formaldehyde and ethylene oxide.

**UNIT 3: INTERACTIONS OF MICROORGANISMS AND HUMANS****SECTION E: Antimicrobial Agents**

Outcomes: The student will become familiar with the types and mode of actions for antimicrobial products.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Differentiate between antibiotics and synthetic drugs.
						Evaluate and antibiotic as broad of narrow spectrum.
						List 5 criteria that chemosynthetic drugs must meet in order to be useful against an infectious agent.
						Discuss the various mechanisms of action antimicrobial agents have on their respective microbes.
						Explain how one microbe can acquire resistance to several drugs.

**UNIT 3: INTERACTIONS OF MICROORGANISMS AND HUMANS****SECTION F: Epidemiology and Public Health**

Outcomes: The student will gain familiarity with the science of epidemiology and its significance to public health.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Describe the strategies for developing vaccines.
						Outline the science of epidemiology and the work of an epidemiologist.
						Differentiate between communicable and non-communicable.
						Given sample statistical data on the number of reported cases of disease determine which show: sporadic frequency, endemic, epidemic and pandemic.
						List the main features of Koch's postulates and why they do not apply to some diseases.

**UNIT 4: INTERACTIONS AND IMPACT OF MICROORGAISMS IN THE ENVIRONMENT 5%**

Outcomes: The student will gain familiarity with the impacts and relationships of microbes in various ecosystems.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Describe the importance of adaptation and natural selection to microbial populations.
						Explain a variety of symbiotic relationships formed by microbial populations.
						Explain the role of microbes in recycling resources in an ecosystem.
						Describe the various ways microbes transform the environment.

**UNIT V: DISPLINE SPECIFIC LABORATORY TECHNIQUES**

Outcomes: The student will gain familiarity with basic laboratory techniques in microbiology.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Practice laboratory safety.
						Collect and handle specimens.
						Isolate and identify microorganisms (differentiation).
						Use a microscope.
						Pipette and micropipette.
						Use aseptic technique.
						Grow and control microorganisms.
						Utilize basic antigen-antibody interactions.
						Make dilutions.

**Projects Required:**

One project will be required with topics and project to be developed jointly by the class and instructor.

**Textbook:**

Contact Bookstore for current textbook.

**Materials/Equipment Required:**

Compound microscopes  
Prepared microscope slides of microorganisms  
Incubators  
Various VHS tapes, 35 mm slides, charts  
CCD VHS video camera and microscope  
Television and VCR  
Media  
Stains/regents  
Autoclave

**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

**Course Timeframe:**

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.