

OUTCOMES BASED LEARNING MATRIX

Course: **BIOL231 MICROBIOLOGY**

Department: **BIOLOGY**

Course Description:

This is a course in general microbiology with emphasis placed on the practical applications for medical, food, dairy, water, and environmental microbiology. Part of the laboratory experience includes an introduction to techniques in molecular biology and the identification of one or more bacterial “unknowns” to demonstrate adequate knowledge of the proper laboratory technique. Organisms of discussion include bacteria, viruses, fungi, and some of the primitive algae and protozoa. Topics covered include classification, prokaryotic cell structure, microbial genetics, biotechnology, microbial metabolism, microbial growth and control of microbial growth. Lecture: 2 hours Laboratory: 4 hours

Prerequisite: Grade of “C-“ or better in Biological Principles (BIOL121) or successful performance on departmental challenge exam, and Preparing for College Reading II (ENGL092), Introductory Writing (ENGL099), and Fundamentals of Mathematics (MATH010), or waiver by placement testing results, or Departmental Approval. Chemistry is recommended but not required.

The individual outcomes listed in the first column answer the question: **What must the learner know and be able to do at the end of the course?** Items in the third column should answer the question: **How do we know?** The second column is where teachers can be most creative; it's for pedagogy. Each rectangle in column one contains just one outcome; the corresponding rectangles in columns two and three, however, may contain more than one item.

The code indicates the core competencies being strengthened by the outcomes activities and the assessment tools. Critical Thinking (CT); technology skills (TS); oral communications (OC); quantitative skills (QS); reading (R); writing (W).

COURSE OUTCOMES	OUTCOMES ACTIVITIES	ASSESSMENT TOOLS
Discuss selected historic figures in microbiology and important milestones accomplished to appreciate the history of the field.	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures (W,R,CT) • Class Discussions (CT, OC) • Study Questions (R,W,CT) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Essays (CT,R,W)
Classify microorganisms, focusing on their diversity in form and function; include methods of classification in order to distinguish among microorganisms in the laboratory and in the natural environment.	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures (W,R,CT) • Class Discussions (CT, OC) • Laboratory Activities (CT,TS,R,W,QS) • CD-ROM; Website (R,W,CT,TS) 	<ul style="list-style-type: none"> • Exams (CT,R,W,TS) • Essays (CT,R,W,TS) • Lab Reports (CT,R,W,QS) • Keep daily lab journal (R,W)
Discuss beneficial uses of microorganisms	<ul style="list-style-type: none"> • Read Text (CT,R) 	<ul style="list-style-type: none"> • Exams (CT,R,W,)

<p>and the implication of microorganisms in disease in order to counter common misconceptions about microorganisms. Describe the role of microorganisms in the environment.</p>	<ul style="list-style-type: none"> • Attend Lectures (W,R,CT) • Class discussions (CT, OC) • Study Questions (R,W,CT) • Construct Winogradsky columns (R,W,CT) 	<ul style="list-style-type: none"> • Essays (CT,R,W) • Case Studies (CT,R,W)
<p>Demonstrate knowledge of basic chemistry including the properties of atoms, ions, chemical bonding and chemical reactions to understand biologically important molecules and processes. Describe the role of biologically important molecules in order to understand the correlation between cell structure and function.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussions (CT,W,R,OC) • Study Guide (R,W,CT) • Laboratory Activities: Impact of acids, bases • and water on bacterial growth • (CT,QS,TS,R,W) 	<ul style="list-style-type: none"> • Exams (CT,W,R) • Essays (CT,W,R) • Lab Reports (CT,R,W,TS,QS)
<p>Explain the role of enzymes, glycolysis, the Krebs cycle, and the electron transport chain in microbial metabolism, and discuss the metabolic diversity of microorganisms, in order to understand how microorganisms extract nutrients and utilize energy.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Study Guide (R,W,CT) • Attend Lectures/Discussions (CT,W,R,OC) • Do labs on microbial utilizations of varying substrates (CT,R,TS,QS) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Lab Reports (CT,R,W,TS,QS) • Unknown Organism Identification (CT,R,W,TS,QS)
<p>Discuss and demonstrate requirements for bacterial division, and measure microbial growth in order to construct a growth curve and relate microbial growth to available nutrients and other conditions.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Study Guide (R,W,CT) • Attend Lectures/Discussions (CT,W,R,OC) • Culture, describe and quantitate bacteria • (CT,R,W,TS,QS) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Lab Reports (CT,R,W,TS,QS) • Unknown Organism Identification (CT,R,W,TS,QS)

<p>Discuss and demonstrate methods of microbial control including antibiotics and physical and chemical methods of control in order to make informed decisions about the use of antibiotics and other control methods.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussion (CT,W,R,OC) • Study Guide (R,W,CT) • Kirby Bauer Lab (CT,W,R,TS,QS) • Germicidal Lab (CT,W,R,TS,QS) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Lab Reports (CT,R,W,TS,QS)
<p>Describe the structure and replication of DNA and its role in protein synthesis in order to understand the chemical basis of genetics and the use of DNA in genetic engineering and biotechnology; include gene regulation, mutation, recombination, transformation and transduction.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussions (CT,W,R,OC) • Study Guide (R,W,CT) • Transformation Lab (CT,W,R,TS,QS) • Make DNA origami model 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Lab Reports (CT,R,W,TS,QS) • DNA origami model (CT)
<p>Discuss viral structure, cultivation and identification methodologies, reproduction and disease implications in order to distinguish between viruses and bacteria, and dispel common misconceptions about viruses.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussions (CT,W,R,OC) • Study Guide (R,W,CT) • Research paper (CT,R,W) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Research paper(CT,R,W)
<p>Discuss principles of infectious disease and microbiological causes of select diseases in order to better understand and communicate information about sources of infection.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Study Guide (R,W,CT) • Attend Lectures/Discussions (CT,W,R,OC) • Case studies (CT,R,W) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Case studies (CT,R,W)
<p>Follow safety procedures in microbiology lab in order to work safely in the laboratory environment.</p>	<ul style="list-style-type: none"> • Attend Lectures/Discussions (CT,W,R,OC) • Observe criteria on lab safety checklists (CT,R,TS) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Observe Student Behavior (CT)
<p>Properly utilize a bright field light microscope including correct set-up, focusing, care and storage in order to use the microscope correctly to view microorganisms.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussion (CT,W,R,OC) • Study Guide (CT,R,W) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Observe Student Behavior (CT)

<p>Prepare specimen for microscopic examination and utilize proper staining technique including gram stains, spore stains and acid fast stains; demonstrate understanding of each step of the stains; clean and dispose of slides, in order to distinguish among microorganisms and work in a safe environment.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussions (CT,W,R,OC) • Study Guide (CT,R,W) • Laboratory Procedures (CT,W,R,TS,QS) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Observe Student Behavior (CT) • Lab Reports (CT,W,R,TS,QS)
<p>Use standard microbiology equipment correctly including Meker burner, loops, picks, measurement equipment; utilize aseptic technique, in order to work safely in the laboratory.</p>	<ul style="list-style-type: none"> • Read and follow directions in lab Handouts (CT,R) • Observe Demonstrations (CT,W,TS) • Study Guide (CT,R,W) 	<ul style="list-style-type: none"> • Observe Student Behavior (CT) • Lab Report Outcomes (CT,W,R,TS,QS)
<p>Prepare media to be utilized in the microbiology lab in order to have media upon which to grow cultures.</p>	<ul style="list-style-type: none"> • Attend Lectures/Discussions (CT,W,R,OC) • Study Guide (CT,R,W) • Read Text (CT,R) • Prepare media 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Product Quality (CT,TS,QS)
<p>Recognize microbial growth patterns in liquid and on solid media, and quantitate microbe numbers in serial dilutions in order to identify microorganisms and quantitate the size of the culture.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussions (CT,W,R,OC) • Study Guide (CT,R,W) • Lab Exercise (CT,R,W,TS,QS) 	<ul style="list-style-type: none"> • Exams (CT,R,W) • Lab Report (CT,R,W,TS,QS)
<p>Perform and understand biochemical testing to identify microbiological organisms; integrate knowledge of the purpose of the test, procedure, basic biochemistry, reagents precautions and positive and negative results in order to correctly distinguish among microorganisms.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussions (CT,W,R,OC) • Perform biochemical testing on bacterial cultures • Create a dichotomous key 	<ul style="list-style-type: none"> • Exam (CT,R,W) • Observe Student Behavior (CT) • Lab Reports (CT,R,W,TS,QS) • Unknown Identification Project (CT,W,R,TS,QS) • Key for microorganism identification

<p>Identify microorganisms using microscopic, macroscopic and biochemical information, design a flow chart using the dichotomous key technique, and use reference material including Bergey's Manual in order to correctly distinguish among microorganisms.</p>	<ul style="list-style-type: none"> • Read Text (CT,R) • Attend Lectures/Discussions (CT,W,R,OC) • Study Guide (CT,W,R) • Lab Exercises (CT,W,R,TS,QS) 	<ul style="list-style-type: none"> • Exam (CT,R,W) • Flow Chart (CT,R,W,TS,QS) • Lab Reports (CT,R,W,TS,QS) • Unknown Project (CT,R,W,TS,QS)
<p>Strengthen Core Competencies in order to increase success in college courses and other courses in the workplace.</p>	<p>Referenced above</p>	<p>Referenced above</p>