

Department: Science

Course Title: Honors Microbiology & Biotechnology

Course #: 50553H

Grades: 11, 12

DESCRIPTION OF COURSE:

The spectacular advances in microbial genetics have made understanding microbiology desirable for all students. Students will learn the fundamentals of microbiology and biotechnology using bacteria and viruses. They will demonstrate their understanding of the scientific inquiry process by identifying unknown organisms and by designing a creative experiment using common procedures performed in biotechnology research laboratories. Students will grasp the importance of molecular biology, understand the role of microbes relative to disease and discuss ways to control and manipulate such organisms. Assessments will include cooperative learning activities, laboratory investigations, research projects, tests, reflection papers etc.

REQUIRED TOPICS OF STUDY	SUGGESTED INSTRUCTIONAL TIME	Disciplinary Core Ideas
<i>Intro to microbiology</i> <ul style="list-style-type: none"><i>History of microbiology</i><i>Aseptic technique</i><i>Kingdoms of life and prokaryotes</i>	~20 days	LS4.D: Biodiversity and Humans LS1.B: Growth and Development of Organisms ETS1.B: Developing Possible Solutions
<i>Chemical Principles</i> <ul style="list-style-type: none"><i>Atomic structure</i><i>Atoms form molecules</i><i>Chemical reactions</i><i>Important Biological molecules: water</i><i>Organic Macromolecules</i>	~14 days	PS1.A: Structure and Properties of Matter PS1.B: Chemical Reactions PS2.B: Types of Interactions
<i>Microscopy and laboratory procedures</i> <ul style="list-style-type: none"><i>Microscopy</i><i>Using the Microscope and slide preparation</i><i>Staining procedures</i>	~13 days	LS1.A: Structure and Function LS1.B: Growth and Development of Organisms
<i>Functional Anatomy of Prokaryotes & Eukaryotes</i> <ul style="list-style-type: none"><i>Basic structure of a prokaryote</i><i>Bacterial shapes and arrangements</i><i>Bacterial Motility</i><i>Eukaryotes & Endosymbiosis</i>	~12 days	LS1.A: Structure and Function LS1.B: Growth and Development of Organisms ETS1.B: Developing Possible Solutions

<p><i>Bacterial Metabolism & Growth</i></p> <ul style="list-style-type: none"> • <i>Energy Production</i> • <i>Catabolic and Biosynthetic pathways</i> • <i>Bacterial nutrition, culture media</i> • <i>Control of microbial growth</i> 	<p>~20 days</p>	<p>LS1.A: Structure and Function LS1.B: Growth and Development of Organisms PS3.D: Energy in Chemical Processes LS1.C: Organization for Matter and Energy Flow in Organisms ETS1.B: Developing Possible Solutions</p>
<p><i>Microbial Genetics</i></p> <ul style="list-style-type: none"> • <i>Prokaryotic vs. Eukaryotic genomes</i> • <i>Bacterial genomic expression</i> • <i>Regulation of gene expression and bacterial operon</i> • <i>Mutations</i> • <i>Methods of DNA transfer in bacteria</i> • <i>Transposable elements</i> • <i>Restriction enzymes</i> • <i>Recombinant DNA technology</i> 	<p>~23 days</p>	<p>LS1.A: Structure and Function LS1.B: Growth and Development of Organisms LS1.C: Organization for Matter and Energy Flow in Organisms PS3.D: Energy in Chemical Processes</p> <p>LS4.A: Evidence of Common Ancestry and Diversity LS4.B: Natural Selection LS4.C: Adaptation ETS1.B: Developing Possible Solutions</p>
<p><i>Topics in Biotechnology</i></p> <ul style="list-style-type: none"> • <i>Intro to Biotechnology</i> • <i>Transgenic organisms (GMO)</i> • <i>Applications of GMOs</i> 	<p>~15 days</p>	<p>LS4.D: Biodiversity and Humans LS1.A: Structure and Function LS1.B: Growth and Development of Organisms LS1.C: Organization for Matter and Energy Flow in Organisms PS3.D: Energy in Chemical Processes</p> <p>LS4.A: Evidence of Common Ancestry and Diversity LS4.B: Natural Selection LS4.C: Adaptation ETS1.B: Developing Possible Solutions</p>
<p><i>Immunology</i></p> <ul style="list-style-type: none"> • <i>Principles of disease and epidemiology</i> • <i>Mechanisms of pathogenicity</i> • <i>Specific / Nonspecific host resistance</i> <p><i>Cellular immunity</i></p>	<p>~20 days</p>	<p>LS1.A: Structure and Function LS1.B: Growth and Development of Organisms LS1.C: Organization for Matter and Energy Flow in Organisms PS3.D: Energy in Chemical Processes LS4.A: Evidence of Common Ancestry and Diversity LS4.B: Natural Selection LS4.C: Adaptation ETS1.B: Developing Possible Solutions</p>

INSTRUCTIONAL RESOURCES:

- *Microbiology: An Introduction, 11th edition by Tortora, Funke & Case.*
- *Independent Reading Book selections:*
 - Biography of a Germ, by Arno Karlen*
 - OR*
 - The Hot Zone, by Richard Preston*
 - OR*
 - The Demon in the Freezer, by Richard Preston*
 - OR*
 - The Andromeda Strain, by Michael Crichton*
- *Assorted Laboratory References*
- *Online References*
- *Additional Resources as determined by the instructor*