

# Infectious Disease - Unit 2 - The Agent

## Unit Focus

Students will explore the world of microbiology as they investigate microbes to better understand how pathogens are able to cause disease, become resistant, and spread through vectors. Students will be able to classify and differentiate various types of pathogens with an emphasis on treatment and prevention of different pathogenic illness. Students will utilize standard laboratory procedures, such as gram-staining and bacterial culturing, including interpretation of the zone of inhibition and microscopic analysis, as they analyze a case study of a person suffering from a mysterious illness. Students will grapple with global issues with regard to the factors that influence the susceptibility of different countries to the spread of disease as well as how globalization has increased exposure to pathogens. Additionally, students will engage in discourse about the various societal issues impacting disease transmissions such as the availability of medicines for treatment and prevention as well as the ongoing concerns about vaccines and overuse of antibiotics and the associated consequences. Ultimately, students will synthesize their understanding of infectious disease, treatment, and transmission as they analyze and diagnose a patient and propose a scientifically-supported prevention plan.

## Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p><b>Next Generation Science Standards (DCI)</b> <i>Science: 10</i></p> <ul style="list-style-type: none"> <li>All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. <i>LS1.9.A2</i></li> <li>In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. <i>LS1.9.B1</i></li> <li>Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. <i>LS3.9.A1</i></li> </ul>	<p><b>T1</b> Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions. <b>T2</b> Communicate effectively based on purpose, task, and audience to promote collective understanding and/or recommend actions.</p>	
	Meaning	
	Understanding(s)	Essential Question(s)
	<p><b>U1</b> There are several mechanisms and factors that allow pathogens to spread through populations, some of which are easily controlled and others that are difficult to prevent and treat. <b>U2</b> The spread of infectious diseases can be prevented by vaccinations and sanitary and hygienic practices. <b>U3</b> Vaccines have been developed for both viral and bacterial infections. <b>U4</b> Due to the structure and processes of a virus, they cannot be treated with antibiotics. <b>U5</b> Antibiotic resistance is a growing threat that is spurred on by the overuse of antibiotics for treatment and prevention of infections. <b>U6</b> Antibiotics and antivirals are treatment options</p>	<p><b>Q1</b> How do bacteria and viruses cause infection and spread through populations? <b>Q2</b> How do vaccines work to prevent individuals and populations from becoming ill? <b>Q3</b> How does mutation lead to antibiotic resistance and how does this resistance spread in the bacterial population?</p>

## Stage 1: Desired Results - Key Understandings

<ul style="list-style-type: none"> <li>Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. <i>LS3.9.B2</i></li> <li>The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. <i>LS4.9.B2</i></li> <li>Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. <i>LS4.9.C1</i></li> <li>Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. <i>LS4.9.C2</i></li> </ul>	<p>for some diseases, but there is much work to do to maintain the efficacy, delivery, and evolution of these treatments.</p>	
<b>Acquisition of Knowledge and Skill</b>		
<p><b>Student Growth and Development 21st Century Capacities Matrix</b> <i>Critical Thinking</i></p> <ul style="list-style-type: none"> <li>Analyzing: Students will be able to examine information/data/evidence to make inferences and identify possible underlying assumptions, patterns, and relationships. <i>MM.1.2</i></li> <li>Synthesizing: Students will be able to thoughtfully combine information/data/evidence, concepts, texts, and disciplines to draw conclusions, create solutions, and/or verify generalizations for a given purpose. <i>MM.1.3</i></li> </ul>	<p><b>K1</b> Pathogens can avoid immune detection through a variety of methods. Often it is due to mutation or evolution of resistance to treatments.  <b>K2</b> Bacteria and viruses can reproduce inside a host causing symptoms that can enable the pathogen to spread.  <b>K3</b> Antibiotics and antivirals work against the pathogens and their processes to decrease their population in a body.  <b>K4</b> Vaccines work with a person's immune system to prevent or lessen the onset of a disease.  <b>K5</b> Vocabulary: Lysogenic, lytic, antibody, antigen, gram-positive, gram-negative, antibiotic, antiviral, vaccine, conjugation, transformation, retrovirus, ELISA assay, bacterial culture</p>	<p><b>S1</b> Employ the techniques used in infectious disease laboratories.  <b>S2</b> Analyze patient profiles and apply understanding of microbiology and medical treatments to diagnose and create a prevention plan.</p>