

LS-HHMI Outreach Curriculum Project Information			
Title	HumanBodyIsanEcosystemTeacherNotes.docx, HumanBodyIsanEcosystemBacterialReproductionWarmup.docx, HumanBodyIsanEcosystemPowerpoint.pptx, HumanBodyIsanEcosystemProjectRubric.docx, HumanBodyIsanEcosystemStudentProjectHandout.docx, HumanBodyIsanEcosystemProjectRubric.docx		
Resource Type	Lesson Plan <input checked="" type="checkbox"/> Classroom Activity <input type="checkbox"/> Laboratory Activity <input type="checkbox"/> Homework Assignment <input type="checkbox"/> Bioinformatics <input type="checkbox"/> Other <input checked="" type="checkbox"/> Student Project		
Description	In this lesson, students will gain an appreciation for the sheer number and diversity of the microbiota of the human body. Students will conduct research on a beneficial microbe found in or on the body and create a multimedia presentation highlighting the microbe's close physiological relationship with humans.		
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Objective	<p>The purpose of this lesson is to:</p> <ul style="list-style-type: none"> • Introduce the idea that there are trillions of bacteria and other microbes of thousands of different species living on or in the human body • Help students to understand that not all bacteria cause disease, and many actually have positive effects on the body • Have students conduct research and create a creative, persuasive, multimedia presentation 		
Key Concepts	<p>At the end of this lesson, students will understand these BIG IDEAS:</p> <ol style="list-style-type: none"> 1. Prokaryotic cells (bacteria) perform many vital functions on Earth, even within the human body 2. Organisms are incredibly diverse, even those that are microscopic (including bacteria, fungi, and protists) 3. Organisms are interdependent (rely on each other) and no organism can live in isolation, including humans 4. Many organisms form close (symbiotic) relationships with other organisms that may be harmful or beneficial 		
Student Prep	Students should have basic skills in internet research, downloading images from websites, and Microsoft PowerPoint or Windows MovieMaker.		
Materials	Computer access Library access LCD Projector Additional materials depending on student's choice of product: flip chart, digital camera, microphone Handouts:		
Grade and Level(s)	Basic/Introductory Biology, Anatomy & Physiology		
Teacher Prep Time	1-2 hours to gather materials/handouts, schedule lab time	Class Time	5 Class Periods 1 for Introducing Project and Forming Student Groups, 3 for Research in Computer Lab or Library, 1 for Group Presentations
National Standards	<p>Science as Inquiry (12ASI)</p> <p>12ASI2.1 Scientists usually inquire about how physical, living, or designed systems function. Conceptual principles and knowledge guide scientific inquiries. Historical and current scientific knowledge influence the design and interpretation of investigations and the evaluation of proposed explanations made by other scientists.</p> <p>Life Science (12CLS)</p> <p>12CLS3.2 The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.</p> <p>12CLS4.3 Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.</p>		

	<p>12CLS4.4 Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.</p> <p>Science and Technology (12EST)</p> <p>12EST2.2 Science often advances with the introduction of new technologies. Solving technological problems often results in new scientific knowledge. New technologies often extend the current levels of scientific understanding and introduce new areas of research.</p> <p>Science in Personal and Social Perspectives (12FSPSP)</p> <p>12FSPSP1.2 The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease producing organism. Many diseases can be prevented, controlled, or cured. Some diseases, such as cancer, result from specific body dysfunctions and cannot be transmitted.</p> <p>12FSPSP2.1 Populations grow or decline through the combined effects of births and deaths, and through emigration and immigration. Populations can increase through linear or exponential growth, with effects on resource use and environmental pollution.</p> <p>12FSPSP2.3 Populations can reach limits to growth. Carrying capacity is the maximum number of individuals that can be supported in a given environment. The limitation is not the availability of space, but the number of people in relation to resources and the capacity of earth systems to support human beings. Changes in technology can cause significant changes, either positive or negative, in carrying capacity.</p> <p>12FSPSP6.5 Humans have a major effect on other species. For example, the influence of humans on other organisms occurs through land use - which decreases space available to other species - and pollution - which changes the chemical composition of air, soil, and water.</p>
<p>State Standards</p>	<p>5. Evolution and Biodiversity <i>Central Concepts:</i> Evolution is the result of genetic changes that occur in constantly changing environments. Over many generations, changes in the genetic make-up of populations may affect biodiversity through speciation and extinction.</p> <p>5.3 Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity within a population.</p> <p>6. Ecology <i>Central Concept:</i> Ecology is the interaction among organisms and between organisms and their environment.</p> <p>6.2 Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.</p> <p>6.3 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, mutualism) add to the complexity of biological communities.</p> <p>SIS4. Communicate and apply the results of scientific investigations.</p> <ul style="list-style-type: none"> • Develop descriptions of and explanations for scientific concepts that were a focus of one or more investigations. • Construct a reasoned argument and respond appropriately to critical comments and questions. • Use language and vocabulary appropriately, speak clearly and logically, and use appropriate technology (e.g., presentation software) and other tools to present findings.

Sources	http://www.scq.ubc.ca/microbes-and-you-normal-flora/ http://www.boston.com/news/science/articles/2008/02/25/of_microbes_and_men/ http://www.scientificamerican.com/article.cfm?id=human-microbiome-change&print=true http://www.textbookofbacteriology.net/normalflora.html http://www.pbs.org/wgbh/evolution/library/10/4/1_104_07.html http://nihroadmap.nih.gov/hmp/ http://www.colorado.edu/news/r/22ff22190dc1fb08aaae7396565bb0ca.html http://www.ajcn.org/cgi/content/full/73/2/437S http://bighugelabs.com/magazine.php http://mbio.asm.org/content/1/3/e00129-10.full http://www.ulb.ac.be/sciences/biodic/biodic/images/mone_proc/mproca_01_02.jpg http://upload.wikimedia.org/wikipedia/commons/2/20/Streptococcus_pneumoniae.jpg http://upload.wikimedia.org/wikipedia/commons/f/f4/Human_body_silhouette.svg http://www.openclipart.org/people/gmad/funny_bacilli.svg http://www.openclipart.org/people/J_Alves/bacteria.svg http://upload.wikimedia.org/wikipedia/commons/5/5c/Staphylococcus_epidermidis_lores.jpg http://farm1.static.flickr.com/212/512143802_42f4560468.jpg http://www.pdclipart.org/albums/People_Baby/Baby_baby_on_back.png http://phil.cdc.gov/PHIL/Images/10591/10591_lores.jpg http://roobrix.com/
References	None
Assessment	Students will be assessed using the included project rubric.