

Course: Human Biology Unit #:3 Pathology: Disease & Response	Year of Implementation: 2025-2026
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Stage One - Desired Results	
Link(s) to New Jersey Student Learning Standards for this course: https://www.nj.gov/education/standards/	
<ul style="list-style-type: none"> ● Unit Standards: <p>Content Standards</p> <p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> ● Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) 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, which carry out most of the work of cells. (HS-LS1-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.) ● Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) ● Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. <p>LS4.C: Adaptation</p> <ul style="list-style-type: none"> ● 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. (HS-LS4-2) <p>HS-LS1-1</p> <ul style="list-style-type: none"> ● Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. 	

HS-LS1-2

- Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3

- Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-4

- Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS2-7

- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS4-2

- Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-3

- Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

Science and Engineering Practices

The content of this unit will strengthen student skills in the following SEPs.

- Practice 1 Ask Questions
- Practice 2 Developing and Using Models
- Practice 3 Planning and Carrying Out Investigations
- Practice 4 Analyzing and Interpreting Data
- Practice 5 Using Mathematics and Computational Thinking
- Practice 6 Constructing Explanations and Designing Solutions
- Practice 7 Engaging in Argument from Evidence
- Practice 8 Obtain, Evaluate and Communicate Information

21st Century Life & Career Standards

- 9.4.12.CI.1 - Demonstrate the ability to reflect, analyze and use creative skills and ideas
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
- 9.4.12.IML.3 - Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).

English Companion Standards

- **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1- 1),(HS-LS1-6) (SEP 3, 4, 6)
- **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS4-6) (SEP 1, 4, 6,7,8)
- **WHST.11-12.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-LS1-3) (SEP 4, 6, 8)
- **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS1-1),(HS-LS1-6) (SEP 4)

Interdisciplinary Content Standards

- **Health - [Standard: 2.1.12.PP.1, 2.1.12.PP.2]**

NJ Statutes: NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction

shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A. 18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: <https://www.nj.gov/education/amistad/about/>

Diversity and Inclusion: <https://www.nj.gov/education/standards/dei/index.shtml>

- (Sample Activities/ Lessons): <https://www.nj.gov/education/standards/dei/samples/index.shtml>

Asian American and Pacific Islanders:

- [Asian American and Pacific Islander Heritage and History in the U.S.](#)

A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goals:

Students will be able to independently use their learning to make informed decisions that promote lifelong wellness, while also communicating effectively and evaluating ethical issues in medical practice and research.

As aligned with LRHSD Long Term Learning Goal(s): <https://www.lrhdsd.org/academics/program-of-studies/curriculum>

- design, critique, and carry out experiments in order to investigate scientific questions and/or propose solutions
- collect, interpret, and analyze data in order to solve a defined problem
- apply mathematics to express relationships efficiently and accurately
- draw evidence-based conclusions from data in order to make informed decisions;
- construct, interpret, and refine models (scientific and mathematical) to explain the physical and natural world
- effectively communicate scientific ideas and evidence-based arguments to an appropriate audience through written and oral means
- evaluate for their validity arguments that rely on scientific reasoning presented in the popular press and informational sources

Enduring Understandings

Students will understand that. . .

EU1

the proper functioning of the lymphatic and immune system is the body's defense against infection and disease.

EU2

the major cell and tissue alterations associated with diseases contribute to organ dysfunction or clinical signs and symptoms.

EU3

there are a variety of pathogens that cause disease and are transmittable and the prevention and control of diseases and health conditions are affected by many factors.

Essential Questions

- How do the immune and lymphatic systems use the three lines of defense to protect against pathogens, interact with vaccines, and function in coordination with other body systems, and how can disruptions in these systems lead to or worsen diseases?
- How do cellular dysfunctions, pathogen behavior, and medical interventions like antibiotics and vaccines affect the development, transmission, and treatment of diseases?

Knowledge

Students will know . . .

EU1

- immune and lymphatic systems use three lines of defense used by the body to deal with pathogens. (HS-LS1-2, HS-LS1-3)
- disruptions in the immune system elicit or exacerbate disease. (HS-LS1-3)
- immune responses work in relation to vaccines. (HS-LS1-3)
- the structure of the lymphatic system and determine how it plays a role in protecting the human body. (HS-LS1-3)
- the lymphatic system functions in coordination with other systems of the body. (HS-LS1-1)
- feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1.A)

EU2

- a disease related to cellular dysfunction affects the body. (HS-LS1-3)
- systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1, HS-LS1-2)
- diseases are transmitted. (HS-LS1-3)

EU3

- pathogens reproduce, spread, mutate and cause disease. (HS-LS4-2, HS-LS4-3)
- some bacteria are harmful, in that they cause disease, while others are beneficial (in preventing disease,

Skills

Students will be able to . . .

EU1

- analyze how the immune and lymphatic systems use the three lines of defense used by the body to deal with pathogens. (HS-LS1-2, HS-LS1-3) (SEP 1, 4, 6)
- examine how disruptions in the immune system can elicit or exacerbate disease. (HS-LS1-3)(SEP 1, 3, 4)
- investigate how immune responses work in relation to vaccines. (HS-LS1-3) (WHST.9-12.7, WHST.11-12.8) (SEP 3)
- model the role the lymphatic system plays in protecting the human body. (HS-LS1-3) (SEP 2) (CCC: System & System Models HS-LS1-2 HS-LS1-4)
- diagram how the lymphatic system functions in coordination with other systems of the body and is regulated through feedback mechanisms.(HS-LS1-3) (WHST.9-12.2) (SEP 2, 6, 8) (CCC: Structure & Function HS-LS1-1)

EU2

- analyze how a disease related to cellular dysfunction affects the body. (HS-LS1-3) (SEP 1, 4)
- critically analyze how knowing the parts of a cell help us in understanding illnesses of the body.(HS-LS1-1, HS-LS1-2) (SEP 1, 4)
- formulate an experiment to demonstrate how diseases are transmitted. (HS-LS1-3) (WHST.9-12.2, WHST.9-12.7) (SEP 2, 3, 6) (CCC: System & System Models HS-LS1-2 HS-LS1-4)(SEP 1,2,3,4,5,7,8)

EU3

- demonstrate how pathogens reproduce, spread, mutate and cause disease. (HS-LS4-2, HS-LS4-3) (SEP 6, 7,

consumer production, etc) based on the structure and function of the cell to cell interactions. (HS-LS1-1)

- the role of antibody-antigen complexes is necessary in combating microorganisms. (HS-LS1-3)
- antibiotics fight infections while antibiotic resistance can occur due to the misuse/overuse of antibiotics. (HS-LS4.C)
- vaccines are made of live or attenuated viruses that trigger an immune response to prevent disease. (HS-LS1-2, HS-LS1-4)
- the origin and development of disease and its manifestations in the form of molecular, chemical, physiological and morphological changes can be used to understand disease. (HS-LS1-2, HS-LS1-4)
- individuals can make informed decisions by investigating data, generating alternatives, exploring options, selecting “best” solution, evaluating a plan, communicating decisions and taking action about prevention and treatment of communicable diseases. (HS-LS2-7)

8) (CCC: System & System Models HS-LS1-2 HS-LS1-4)

- draw evidence to show why some bacteria are harmful, while others are beneficial. (HS-LS1-1) (WHST.9-12.7) (SEP 3, 4, 6, 8)
- model the role of antibody-antigen complexes in combating microorganisms. (HS-LS1-3) (SEP 2, 8) (CCC: System & System Models HS-LS1-2 HS-LS1-4)
- investigate how antibiotics work and how antibiotic resistance occurs due to the misuse/overuse of antibiotics. (HS-LS4.C) (WHST.9-12.7) (SEP 3, 4, 6, 8) (HS-LS4.C)
- model how vaccines prevent disease. (HS-LS1-2, HS-LS1-4) (SEP 2) (CCC: System & System Models HS-LS1-2 HS-LS1-4)
- predict how we could use the mechanisms of the origin and development of disease and its manifestations in the form of molecular, chemical, physiological and morphological changes. (HS-LS1-2, HS-LS1-4) (SEP 1, 6, 7, 8) (CCC: System & System Models HS-LS1-2 HS-LS1-4)
- evaluate how individuals can make informed decisions about prevention and treatment of communicable diseases. (HS-LS2-7) (WHST.9-12.2, WHST.11-12.8, RST.11-12.1) (SEP 6, 8)

Stage Two - Assessment

Performance Task:

Other Evidence:

- Laboratory activities
- Lab reports and notebooks
- Quizzes and tests
- Concept maps, graphic organizers, charts, tables, and graphs
- Presentations
- Class discussion

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.** {place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): **Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection**

PHENOMENON: Antibiotic Resistance and the effects of medical professionals overusing antibiotics.

Link: Hunting the Nightmare Bacteria (watch the first 13 minutes)
<https://www.pbs.org/wgbh/frontline/documentary/hunting-the-nightmare-bacteria/>

GOAL: Students will explore a real-world case study about a little girl named Addie.

Activity 1: What happened to Addie? (A/M/T) (EU1, EU2, EU3)

- Watch the first 12-13 minutes of The Frontline video "[Hunting the Nightmare Bacteria](#)"
 - [Transcripts for the video are available online for students that may need to view a transcript](#)
- During the video clip, students should make observations in chronological order of what happened to Addie and how she progressed in her sickness, create a timeline of events and share their timelines with the class

- c. As a class, compare and contrast timelines and then discuss and agree upon a timeline of events for Addie's progression
- d. Make predictions, how did Addie get sick - what was the cause?
- e. Research other similar case studies and present examples to the class

Activity 2: Read the article [antibiotic resistance in public transportation](#), and discuss the experimental findings. What observations can students make about public transportation and pathogens? (A/M/T) (EU1, EU2, EU3)

Activity 3: Why Don't antibiotics work like they used to? (A/M/T) (EU1, EU2, EU3)

- a. Students will investigate and model a simulation demonstrating how antibiotics interact with bacteria.
 - i. Website Link: <http://antibiotics.inquiry-hub.net/>
 - ii. Accompanying Handout:  Why dont antibiotics work like they used to activity.pdf
- b. Students will investigate and model a simulation demonstrating how changing a bacteria's environment affects their population
 - i. Website link: <http://contagion.inquiry-hub.net/>
 - ii. Accompanying Handout:  bacteria and antibiotic simulation activity.pdf

Activity 4: [Epidemic Simulation Lab](#) (A/M/T) (EU1, EU2, EU3)

- a. Students will model and simulate the transmission of an infectious disease through the class population and then assume the role of an epidemiologist to determine the source of the disease (patient zero) and make predictions about the number of people who might become infected
- b. Students will analyze their data and then graph their data of the classroom population number of exchanges and number of persons infected

Activity 5: [Viral Diagnostics Lab: Beating the Next Pandemic](#) (A/M/T) (EU1, EU2, EU3)

- a. Students will use gel electrophoresis to determine if patients complaining of viral symptoms have seasonal flu or are infected with a new emerging deadly virus. (if student have yet to learn micropipetting and gel electrophoresis an introductory micropipetting and gel electrophoresis lab is recommended prior to completing this lab experiment)

Activity 6: [Identification and Characterization of Bacteria Evotek Lab #160](#) (A/M/T) (EU1, EU2, EU3)

 Identification and Characterization of Bacteria Edvotek Lab.pdf (lab manual)

- a. Students will perform gram staining technique to examine the size, shape, arrangement, and gram status of 3 different strains of bacteria

Culminating Activity: Synthesis and Reflection (M/T) (EU1, EU2, EU3) - Suggested Activity: [miniPCR Agricultural Monitoring Lab, A Case Study in Antibiotic Resistance](#)  [Agricultural Monitoring Antibiotic Resistance Lab.pdf](#)

- a. Assign an individual or group project where students synthesize their learning from the previous activities.
- b. Incorporate reflective prompts to encourage students to analyze their own perspectives and insights gained throughout the learning process.

Supporting Instructional Framework:

- Discuss the immune and Lymphatic systems - (A) (EU1)
- [HHMI - Cells of the Immune System Click and Learn](#) (EU1)
- Describe antigen-antibody complexes - (A) (EU1)
- [Operation Antibody](#) - (M,T) (EU1)
- Discuss microbiology - bacteria, fungus, protist, parasites - (A) (EU2)
- Describe bacteriology techniques- aseptic, streaking for isolation, gram staining - (A) (EU2)
- BioRAD pGLO Bacterial Transformation Kit - (M) (EU2)
- [HHMI bacterial Identification virtual Lab](#) - (M) (EU2)
- Microbiology Webquest - harmful vs helpful microorganisms - (A,M) (EU3)
- Investigate Microbiology/Bacteria via a Lab, i.e. BioRAD Microbes and Health Kit: "What Causes Yogurtiness?" - (M) (EU2)
- Streak plates for Isolation - (A,M) (EU3)
- Gram Stain Bacteria for Identification - (A,M) (EU3)
- Use Oil Immersion Microscope proficiently - (A,M) (EU1)
- Discuss pathogenic diseases - (A) (EU3)
- Discuss overuse of antibiotics and antibiotic resistance - (A) (EU3)
- Calculate and describe zones of inhibition - Antibiotic Resistance Activity - (A,M) (EU3)
- Discuss virus and vaccines - (A) (EU3)
- [HHMI Virus Explorer Click and Learn](#) - (M,T) (EU3)
- Create a 'wanted poster' of a virus - (A) (EU3)
- Create a Public Service Announcement about the importance of prevention or treatment of a communicable disease - (M,T) (EU3)
- Use data & charts from CDC to create timelines on disease transmission - (A,M) (EU3)
- Discuss the lymphatic system - (A) (EU3)
- Construct a model of a lymph node that shows how and why it works effectively; also explains why lymph nodes are removed from areas close to malignant tumors - (A,M,T) (EU3)
- [HHMI Stopping Mosquito-Borne Disease Click and Learn](#) - (M,T) (EU3)
- [HHMI From Birds to People: The West Nile Virus Story Click and Learn](#) - (M,T) (EU3)
- Investigate Regenerative Medicine / Alternative Medicine - (T) (EU3)

- [HHMI Immunology virtual lab](#) - (M,T) (EU1)
- BioRAD ELISA Immuno Explorer Kit: Real Antibodies, Real Learning, Real Fun (M,T) (EU1)
- [HHMI Drug Adherence and Resistance Click and Learn](#) - (M,T) (EU3)
- BIO-RAD Protein Expression and Purification Series: From Industrial Enzymes to Cancer Therapy - (M,T) (EU3)

Pacing Guide

Unit #	Title of Unit	Approximate # of teaching days
1	Advanced Cellular Processes	40
2	Anatomy and Physiology	65
3	Pathology	30

Instructional Materials

- *Graduated cylinders*
- *Microscopes*
- *Prepared slides*
- *Building Model Kits*
- *Various lab kits/perishables (*see learning plan for specific kit numbers/vendors)*
- *Large Post-It Note Presentation boards, notecards, and/or post-it notes*
- *Bacterial cultures*
- *Inoculating loops, gram stain kit*
- *agar/agar plates*
- *Micropipettors/tips*
- *Melt and pour agarose*

- *Microwave*
- *Gel electrophoresis buffer*
- *Gel electrophoresis equipment*
- *Modeling clay*

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.

Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.

English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.

Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.

Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.