

Unit 4 | Disease & Disruption of Homeostasis

Living Environment

20-25 days



The incidence of disease at different point in history, and in different communities, is affected by lifestyle, access to healthy infrastructure, emerging pathogens, and new treatments. In this unit students will explore both the disappearance of certain diseases thanks to antibiotics and vaccines, and the emergence or growth of other diseases. Accessing data from maps, graphs, and other non-print texts -- and using that data to draw conclusions and ask further questions -- is a key component to this unit.

Why are certain diseases prevalent in our community, while others have completely disappeared? Why do some diseases only affect old people or young people?

UNIT STORYLINE SNAPSHOT



Anchor Phenomenon: Prevalence of Diseases

Why are certain diseases prevalent in our community, while others have completely disappeared?

Performance Task: Community Health PSA



Non-specific Immune Response

3E Instructional Model Plan

How does the immune system fight nonspecific threats?



Polio: Viruses

5E Instructional Model Plan

How does the immune system respond to known pathogens, such as viruses?



Tuberculosis: Bacterial Infection

5E Instructional Model Plan

Why have some antibiotics become less effective?



Diabetes

5E Instructional Model Plan

Why are some diseases, such as diabetes, challenging to prevent and treat?

PLANNING RESOURCES

[Knowledge and Enduring Understandings](#)

[Storyline and Pacing Guide](#)

[Common Core Standards](#)

[NY State Regents Exam Readiness](#)

[NY State Science Standards](#)

[Unit Vocabulary](#)

KNOWLEDGE AND ENDURING UNDERSTANDINGS

Knowledge: (Students will know. . .)

Enduring Understandings



<p>High priority content - required</p> <ul style="list-style-type: none"> Causes of disease: pathogenic genetic, exposure to toxins, lifestyle Treatment/prevention : vaccines, antibiotics, healthy choices <p>(Std. 4, Key Idea 5 - PI 5.2)</p> <ul style="list-style-type: none"> Dynamic equilibrium feedback <p>(Std. 4, Key Idea 5 - PI 5.3)</p>	<p>Mid-priority content - recommended</p> <ul style="list-style-type: none"> Mitosis and cell division/ replication <p>(Std. 4, Key Idea 4 - PI 4.1)</p> <ul style="list-style-type: none"> Antibiotic resistance and disease <p>(Key Idea 3 - PI 3.1)</p>	<p>Low-priority content - not required</p> <ul style="list-style-type: none"> Interaction of all human body systems <p>(Std. 4, Key Idea 1 - PI 1.2)</p>	<ul style="list-style-type: none"> Two major causes of the disruption of homeostasis in human beings are: <ul style="list-style-type: none"> toxins: substances which, in excess, interfere with human body systems pathogens: living things that cause disease in the human body. The immune system fights disease Disease may be prevented through vaccination, medical interventions, and lifestyle choices
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◆ Storyline and Pacing Guide

	Time	Teacher Resource	Driving Questions	What students figure out <i>Ideas that contribute to student thinking about the anchor phenomenon and performance task</i>
 <p>Launch Anchor Phenomenon</p>	1 -2 Days	Link	<p><i>How has disease prevalence changed over time?</i></p> <p><i>Why are some diseases rates increasing, and others declining?</i></p>	<ul style="list-style-type: none"> In the US, mortality from some diseases, such as gastrointestinal infections, have drastically declined since 1900. In the US, mortality from some diseases, such as heart disease and cancer, have drastically increased since 1900.



**Introduce
Performance
Task**

1 Day

[Link](#)

How can we determine which disease is the greatest threat to our community?

What actions can we take to educate our community about this disease?

- Some diseases may have a greater impact on our community than others, this may be determined in a variety of ways including researching the prevalence, impact, and infectiousness of different diseases
- Public Service Announcements (PSAs) can be used to educate the community on preventing or treating a disease



**Nonspecific
Immune
Response**

2-3 Days

[3E Plan](#)

Why are we not sick all of the time?

How does the body protect itself from the majority of pathogens it encounters?

Why do we get a fever when we are sick?

- Humans are surrounded by pathogens of all types, yet most people maintain homeostasis and remain relatively healthy most of the time
- There are many ways in which the body protects itself from **all** pathogens, such as fever and inflammation; this is called the nonspecific or innate immune response
- Increased body temperature impacts how pathogens function, but may also denature proteins in the body



Polio: Viral Infections

5-8 Days

[5E Plan](#)

Why are some diseases that historically impacted the United States, such as polio, much less of a problem now?

How does the body protect itself from specific pathogens?

How does vaccination work to protect against specific viral infections?

Why do you need only one polio vaccination, but a new flu shot every year?

- In the past, Polio killed and disabled many people in the US
- Pathogens, such as the Polio virus, have specific markers, called antigens
- Antigens stimulate the immune system
- The immune system has many mechanisms to protect the body against specific infections, such as the Polio virus, including: generating *matched* antibodies and memory cells capable of *remembering* how to fight a specific pathogen by producing antibodies
- Antibodies and antigens have specific shapes
- A vaccine developed against Polio, has virtually eliminated its' impact in the US
- Vaccines are weakened or dead pathogens that stimulate the immune system in order to develop immunity, through the development of antibodies
- Some influenza viruses mutate, changing the shape of their antigens; therefore a flu shot is needed every year
- In returning to the PSA task, students may conclude that most viral infections are not the greatest health threat to their community



Return to the performance task and engage students in revising their response based on the new evidence and ideas generated in the Nonspecific Immune Response and Polio instructional sequences.

Revisit the **Unit Driving Question Board** - are there questions that have been addressed in this 5E plan? -- have new questions been brought to the forefront?



Tuberculosis: 5-10 Days
Bacterial Infections

[5E Plan](#)

How can we determine which type of pathogen is causing an illness?

How does a bacterial infection disrupt homeostasis? How can we treat it?

Why are some bacterial diseases, such as TB, becoming more difficult to treat?

- There are many types of pathogens (bacteria, parasites, etc.); that all elicit an immune response
- Pathogens can be identified by using a patient's symptoms and through analyzing their characteristics
- Bacterial infections, such as TB, disrupt homeostasis by releasing toxins that harm cells and tissues
- Bacterial infections can be treated with antibiotics that kill or harm the bacteria
- Some bacterial strains are becoming resistant to antibiotics, making them harder to treat
- Antibiotic resistance is caused by the evolution of bacteria by natural selection
- The process of antibiotic resistance can be fostered by the overuse / misuse of antibiotics and crowded conditions
- In returning to the PSA task, students may argue that the emergence of *superbugs*, resistant to antibiotics, may be the greatest threat to their community



Return to the performance task and prompt students to revise their timeline based on the new evidence and ideas generated in the Tuberculosis instructional sequence.

Revisit the **Unit Driving Question Board** - are there questions that have been addressed in this 5E plan? -- have new questions been brought to the forefront?



Diabetes **5-6 Days**

[5E Plan](#)

How does Type 2 diabetes result in a disruption of glucose regulation?

Why are rates of Type 2 diabetes increasing globally?

Why do some people develop Type 2 diabetes and others do not?

How do multiple factors, such as diet and genetics, play a role in the development of diabetes and cancer?

- In type 2 diabetes, less insulin is produced or it becomes less effective. This results in excess blood glucose, which may damage tissues
- Type 2 diabetes rates are increasing across the globe
- Type 2 diabetes is complex, multifaceted disease that has many causes including diet and genetics.
- Type 2 diabetes may be preventable or treatable through lifestyle interventions, such as diet and exercise
- Cancer is also a complex disease; there are many types.
- Cancer is uncontrolled cell division
- Like diabetes, cancer has many causes and impacts people in different ways
- Factors such as diet, genetics, toxins, and exposure to pathogens may increase the chances of developing cancer
- In returning to the PSA task, students may argue that diabetes may be the greatest threat to their community due to its' high prevalence and impact on those suffering from the disease



**Complete
Culminating
Task**

2 Days

[Link](#)

How can we determine which disease is the greatest threat to our community?

What actions can we take to educate our community about this disease?

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- Public Service Announcements (PSAs) can be used to educate the community on preventing or treating a disease

◆ NY State Regents Exam Readiness

Regents Topics (from 1996 standards)	Historical Coverage (over the last 5 administrations of LE Regents) ¹	More Details <i>How is this addressed in the unit?</i>
Human body structure and function	4%	The immune system, and how the circulatory system facilitates immunity is discussed at length in this unit, specifically the Polio and Tuberculosis 5E Plans
Evolution	10%	Tuberculosis 5E Plan - introduces students to the idea of mutations, variation in a population, and natural selection in the discussion of antibiotic resistance.
Disease as a Failure of Homeostasis	6%	Every 5E plan in the unit focuses on the immune system and disease as a failure of homeostasis.

¹ [Regents Tool; Awesome table](#)



Unit 4 Regents Item Bank

◆ New York State Science Standards

NY State MST Standards (1996)

This unit was designed to address the following NY State 1996 Standards.

Key Idea 1: Living things are both similar to and different from each other and from nonliving things.

PI 1.2 Describe and explain the structures and functions of the human body at different organizational levels (e.g., systems, tissues, cells, organelles).

Key Idea 3: Individual organisms and species change over time.

PI 3.1 Explain the mechanisms and patterns of evolution

Key Idea 4: The continuity of life is sustained through reproduction and development

PI 4.1 Explain how organisms, including humans, reproduce their own kind

Key Idea 5: Organisms maintain a dynamic equilibrium that sustains life.

PI 5.2 - Explain disease as a failure of homeostasis.

PI 5.3 - Relate processes at the system level to the cellular level in order to explain dynamic equilibrium in multicellular organisms.

[New York State Core Curriculum Standards Crosswalk - Living Environment](#)

NYSSLS (2017)

As designed, this unit works towards the following NYSSLS Performance Expectations, with partial alignment.

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

[Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.]

[Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

[Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.]

[Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]



◆ Common Core Learning Standards

Reading	Writing
<p>9-10.R.ST.2 Reading: Key Ideas and Details</p> <p>Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>9-10.R.ST.3 Reading: Key Ideas and Details</p> <p>Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.</p> <p>9-10.R.ST.9 Reading: Integration of Knowledge and Ideas</p> <p>Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.</p>	<p>9-10.W.HST.10 Writing: Range of Writing</p> <p>Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.</p>
Listening	Speaking

◆ Unit Vocabulary

Consider using this list to guide the Explain or Elaborate portions of the 5E plans, and use it as reference for peer to peer vocabulary based discussions.

Unit Vocabulary	Domain Specific	Tier II
3E: NONSPECIFIC IMMUNITY	Phagocyte Engulf White blood cell* Pathogen* microbe Inflammation Enzymes Denature Mucus secrete	Fever Barrier Non-specific Non-discriminate disrupt

5E: POLIO : VIRUSES	Virus / viral Immune response White blood cells (T cells: helper T, Killer T, B cells: plasma, memory) pathogens Antigens Antibody mutation* Vaccine / vaccination	Infection / infectious Contagious Recognize Nonspecific / specific Trends Disrupt Stimulate Production
5E: TUBERCULOSIS: BACTERIA	Bacteria / bacterial Antibiotic Antibiotic resistance Mutation Variation	Infection / infectious Contagious Recognize Nonspecific / specific Develop Stimulate Production
5E: DIABETES	Diabetes / diabetic Glucose Regulation Urinalysis Insulin Glucagon Pancreas Liver Blood sugar Cancer	Increase / decrease Secrete Concentration Disruption Inactivity Obesity Factors uncontrolled
OVERALL UNIT	Disease prevalence Pathogen Virus / fungus / parasite / bacteria Immunodeficiency	Disease Sick / sickness / illness Immune Treatment / cure / chronic / condition Transplant Foreign toxin

*terms that may be encountered, but not fully defined or explored in this 5E Cycle

