



Bioterrorism & Bioterror Agents

Learning Outcomes & Goals

After this lesson, students should be able to describe different infectious diseases used for bioterror and discuss the various ways that these infectious diseases attack the human body and impact the body's immune system.

Lesson Overview

The students will investigate infectious diseases that transmit these agents through a study on the use of biological agents as weapons and bioterrorism.

Initial Discussion

Begin by asking students to share what they know about biological or chemical terrorism and what they feel the threat is to the average citizen.

The 5 Phases

The five phases of activities in dealing with a bioterror attack are the preparedness phase, early warning phase, notification phase, response phase, and recovery phase. The most crucial step in the event of a bioterrorist attack is the identification of the event itself.

Bioterror Agents & Categories Activity

A reference handout (Pg 6) and activity sheet (Pg 2) follow. Have students fill in the chart below using GIDEON. Provide guidance with the GIDEON walkthrough sheets (Pg 3) as needed. Once students have finished the task, provide the reference sheet for students to keep with their notes.

Category A	Category B	Category C
<p>High priority agents include organisms that pose a risk to national security because they are:</p> <ul style="list-style-type: none"> Easily disseminated Cause high mortality Cause public panic and social disruption Require particular action for public health preparedness 	<p>The second highest priority agents include those that are:</p> <ul style="list-style-type: none"> Moderately easy to disseminate Cause moderate morbidity Require enhanced disease surveillance and public health diagnostic capacity 	<p>The third highest priority agents include emerging pathogens:</p> <ul style="list-style-type: none"> That could be engineered for mass dissemination in the future Have potential for high morbidity, mortality, and significant health impact



Bioterror Agent Chart

Use GIDEON (app.gideononline.com) to fill in the table below.

Bioterror Agent	Disease Caused	Bioterror Category	Reservoirs	Incubation Period	Notes
<i>Bacillus anthracis</i>					
<i>Yersinia pestis</i>					
Nipah virus					
<i>Clostridium botulinum</i> toxin					
<i>Coxiella burnetii</i>					
Ebola virus					



GIDEON Walkthrough

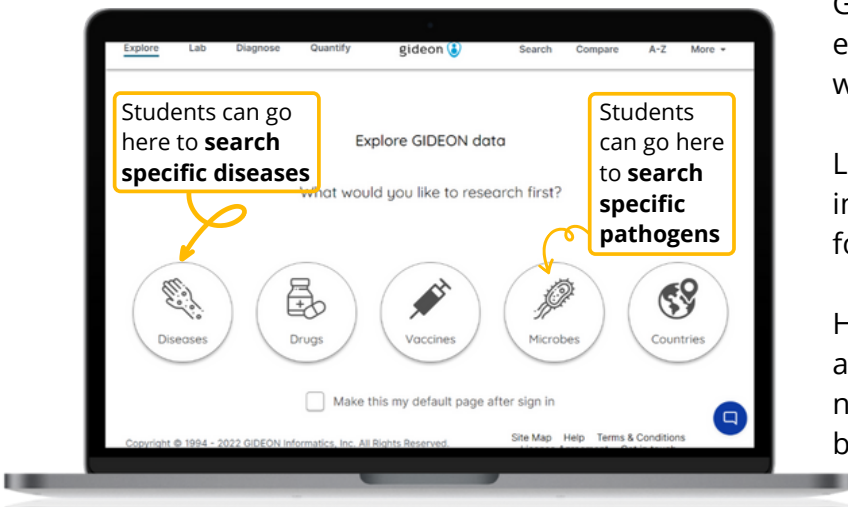
Use this sheet to provide support to students and answer questions on where to find the needed information to complete the Bioterror Agent Chart.

1 - GIDEON App Explore Module

Students should begin by navigating to GIDEON's Explore Module. Here they can explore the GIDEON database in a variety of ways.

Let's walkthrough gathering the required information for the Bioterror Agent Chart for *Bacillus anthracis*.

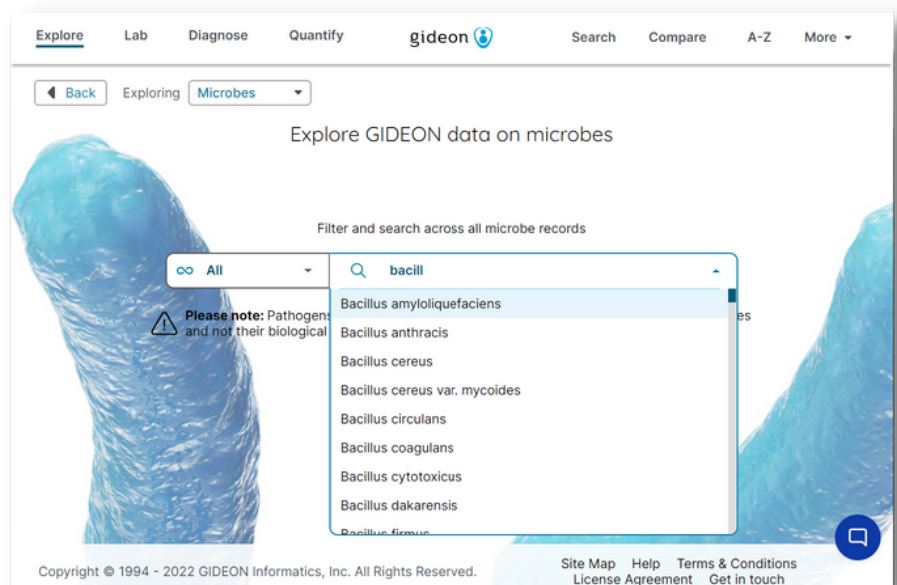
Have the student navigate to the microbes area* from the Explore Module if they do not know the disease associated with the bacterial agent from the chart.



***Note:** the Microbe Module is only for bacterial and yeast agents. For viral agents students should navigate directly to the diseases area (skip to page 3 of the walkthrough)

Once in the Microbes area, students can type in the bacterial bioterror agent from the chart. In this case, we will begin typing "*Bacillus anthracis*".

GIDEON will begin to populate options as the student types. Once they see their desired pathogen they can select it from the list or finish typing it out manually.



Walkthrough

2 - Pathogen Page

Once on the pathogen note page, students can learn about the bioterror agent. They can look at images and phenotype information in this area as well.

Students may wish to use some of this information to fill in their notes space on their Bioterror Agent Chart. Some students may notice that this does not contain the bioterror information that they need. **This area will be most useful for the bioterror agents students do not recognize as the "Ecology" area will tell them for which disease the pathogen is an agent.**

Conveniently, from here, students can also navigate directly to the Anthrax disease note as they now know that the bioterror agent Bacillus anthracis is the agent of anthrax.

If students do not notice the link to the anthrax page, then they can also travel back to the Explore Module page and navigate to the diseases subarea which will allow them to search the disease specifically. This is the same as searching a microbe from before.

Let's take a look at what students will see when visiting the Anthrax disease note.

Bacillus anthracis +

- [1. Summary](#)
- [2. Images](#)
- [3. Phenotype](#)
- [4. Downloads and references](#)

Summary

Notes
Does not grow at 50°C
Elliptical central or terminal spores which do not swell the cell body
Gray-white to white colonies on blood agar
Encapsulated (ie, India ink prep.).

Ecology
Found in mammals
Agent of [Anthrax](#) - recovered from human skin lesions, pus, cerebrospinal fluid, sputum, etc. ⁽¹⁾

Drug Susceptibility
Bacillus anthracis

Synonyms (2)

- Bacillus cereus var. anthracis
- Davaine's bacillus

Images

Source: CDC Image Library
Title: Bacillus anthracis
Description: Bacillus anthracis - Gram stain

Phenotype

Always	> 90%	10 - 90%
Gram positive	Gelatin hydrolysis	Oxidase
Bacillus or coccobacillus		Methyl red
Spore formation		Voges Proskauer
Facultative		Citrate
Growth on ordinary blood agar		Esculin hydrolysis
Catalase		Lecithinase
Glucose fermenter		Tyrosine hydrolysis
Nitrate to nitrite		
Casein hydrolysis		
Starch hydrolysis		
Growth in 6.5% NaCl		
Maltose		
Sucrose		
Trehalose		
< 10%	Never	
No phenotypic tests found	Gram negative	
	Coccus	

Explore Lab Diagnose Quantify **gideon** Search Compare A-Z More ▾

◀ Back Exploring Diseases ▾ Anthrax ▾

Anthrax +

Endemic or potentially endemic to 151 of 233 countries

1. [Summary](#)
2. [Images](#)
3. [Clinical findings](#)
4. [Downloads and references](#)

Students can easily navigate through the sections of the disease entry with these hyperlinks.

Students will find further bioterror related information by selecting the bioterror note button



Worldwide note



Outbreaks map



Bioterror note

Summary**Agent** ⓘ

BACTERIUM.

[Bacillus anthracis](#)

An aerobic gram positive bacillus

Reservoir ⓘ

Soil, Goat, Cattle, Sheep, Water, Horse, Zoonotic

Vector ⓘ

Fly (rare)

Vehicle ⓘ

Hair, Wool, Hides, Bone products, Air, Meat, Contact, Respiratory or pharyngeal acquisition

For further details and references related to agents, vectors, vehicles, and reservoirs, see the [Worldwide note](#)

Incubation Period ⓘ

1d-7d; 1-12 cutaneous, 1-7 GI; 1-43 pulmonary

Diagnostic Tests ⓘ

Bacteriological culture.

Alert laboratory that organism may be present.

Serology and rapid tests by Ref. Centers.

Typical adult therapy ⓘ

Isolation (secrections).

[Ciprofloxacin](#) (or Penicillin if susceptible).If systemic infection, add [Meropenem](#) (or [Imipenem](#)) + [Linezolid](#) (or [Rifampin](#) or [Clindamycin](#))

Dosage/route/duration as per severity

If inhalational anthrax, add Raxibacumab^[1]**Typical pediatric therapy** ⓘ

As for adult

Vaccines ⓘ[Anthrax immune globulin](#)[Anthrax vaccine](#)**Clinical hints** ⓘ

Acquired from contact with large mammals or their products (meat, wool, hides, bone).

Anthrax may present as dermal, pulmonary, gastrointestinal or other forms depending of site of inoculation.

- Edematous skin ulcer covered by black eschar - satellite vesicles may be present
- Fulminant gastroenteritis or pneumonia
- Necrotizing stomatitis
- Hemorrhagic meningitis

Synonyms (20)

1. Antrace
2. Antrax
3. Antraz

Walkthrough



3 - Disease Page

Once on the disease note page, students can access a large amount of information about the specific disease related to their chosen bioterror agent.

By exploring this note they will find some of the needed information for their chart as well as more information that they may feel worth noting in their notes area.

From here, students can get a better look at the disease in relation to bioterror by selecting the bioterror note area.

4 - Bioterror Note

The bioterror note in GIDEON features unique information in relation to the specific disease as an agent of bioterror. It includes the disease category as well as information on its bioterror potential and more. Students should thoroughly explore this area.

Agents of Bioterrorism By Category

Category A	Category B	Category C
<ul style="list-style-type: none"> • <i>Bacillus anthracis</i> (anthrax) • <i>Clostridium botulinum</i> toxin (botulism) • <i>Francisella tularensis</i> (tularemia) • Variola major (smallpox) • <i>Yersinia pestis</i> (plague) • Filoviruses • Ebola virus (Ebola hemorrhagic fever) • Marburg virus (Marburg hemorrhagic fever) • Arenaviruses • Junin virus (Argentine hemorrhagic fever) • Lassa virus (Lassa fever) 	<ul style="list-style-type: none"> • Alphaviruses • Eastern and western equine encephalomyelitis viruses (EEE, WEE) • Venezuelan equine encephalomyelitis virus (VEE) • <i>Brucella species</i> (brucellosis) • <i>Burkholderia mallei</i> (glanders) • <i>Coxiella burnetii</i> (Q fever) • Epsilon toxin of <i>Clostridium perfringens</i> • Ricin toxin from <i>Ricinus communis</i> • <i>Staphylococcal enterotoxin B</i> • <i>Cryptosporidium parvum</i> • <i>Escherichia coli</i> O157: H7 • <i>Salmonella species</i> • <i>Shigella dysenteriae</i> • <i>Vibrio cholerae</i> 	<ul style="list-style-type: none"> • Hantaviruses • Multidrug-resistant tuberculosis • Nipah virus • Tickborne encephalitis viruses • Tickborne hemorrhagic fever viruses • Yellow fever

Phases of Addressing a Bioterror Event



The 5 Phases

The five phases of activities in dealing with a bioterror attack are the preparedness phase, early warning phase, notification phase, response phase, and recovery phase. The most crucial step in the event of a bioterrorist attack is the identification of the event.

Preparedness Phase

This phase includes actions by different agencies to ensure preparedness. These include evaluation of the laboratory facilities, evaluating the hospital preparedness in emergency response and case management, conducting training of health professionals, ensure that requirement of safe drinking water is met, ensure availability of adequate stocks of medicines and vaccines, prepare contact details so that communications are unhampered during an attack. Reviewing the situation based on current information on threat perception is essential.

Early Warning Phase

The early warning phase includes activities like case definitions, notification, compilation, and interpretation of epidemiological data. This is critical in determining the scope and magnitude.

Notification Phase

The activities in this phase include rapid epidemiological investigations, quick laboratory support for diagnosis, quarantine and isolation, and handling health care management tasks.

Response Phase

In this phase, the activities include further investigation, laboratory support, mass casualty management, and initiation of preventive, curative, and specific control measures for the further spread of the disease. This phase has its own step breakdown which is as follows:

1. Assess the Situation
2. Contact Key Health Personnel
3. Develop an Action Plan
4. Implement the Action Plan
5. Recovery Phase

Phases of Addressing a Bioterror Event



Bioterror Preparedness Plan Activity

Have students prepare their own epidemiologic preparedness and investigation checklist in small groups. Specify that students should focus on what they feel would be most helpful in the epidemiologic response process.

Sample List/Ideas:

- **Lab Setup** (confirmation samples sent, lab standards prepped and provided)
- **Notification** (alerting response partners and rapid response teams)
- **Coordination** (listing and contacting necessary experts for epidemiological investigation)
- **Communication** (creation of a clear communication line to response partners and general public)
- **Investigation** (hypothesis generation, case definitions, creating broad contact net, creating uniform questionnaires for data collection, collecting data via interviews, contact tracing if needed, analyzing data, etc.)
- **Further surveillance** (consider if animals are involved in the spread)
- **Announcement of Threat** (this is primarily done by authorities and government personnel)

Discussion Questions

- Which step do you/your group feel is most important when responding to a bioterror incident? Why?
- How can disease databases like GIDEON help in the event of a bioterror event?
- Why is it important to consider if animals are involved in the spread of a bioterror agent?

Supplemental Activity:

Consider having students receive FEMA certification* for:

- IS-100.c (*Introduction to the Incident Command System, ICS*)
- IS-230.e (*Fundamentals of Emergency Management*).

<https://training.fema.gov/is/>

***Note:** "You do not have to be a U.S. resident to access, download, and use the course materials on the FEMA website. However, EMI does not typically provide printed materials, certificates of completion, or process final examinations for non-U.S. residents."

Supplemental Activity:

Consider having students research and present on one of these specific events or another event they can find in GIDEON

Bioterror Timeline

6th Century B.C. - Water supply contamination with fungus (*Claviceps purpurea*) by the Assyrians. Solon uses hellebore during the seige of Krissa.

1155 - Emperor Barbarossa poisons wells with human bodies in Italy.

1495 - The Spanish mix wine with the blood from those with leprosy and then sell it to their French rivals in Italy.

1710 - Russian soldiers catapult the bodies of those who died of plague into Swedish cities.

1763 - British officials distribute the blankets of those with smallpox to Native Americans.

1797 - Napoleon floods the plains around Italy to encourage the spread of Malaria/swamp fever.

1863 - Confederate Troops sell contaminated clothing to Union soldiers during the US Civil War. Clothing was from yellow fever and smallpox patients.

1914 - German and French agents make use of both glanders and anthrax during the first World War.

1939 - Japan uses plague, anthrax and more during World War II. Several other countries begin experiments on biological weapons or create biological weapon programs.

1950 - The US starts testing effectiveness of bioterror attacks by releasing harmless, identifiable agents in San Francisco. They repeat this in New York via the subway system.

1979 - An anthrax outbreak occurs in Russia. Government officials claim it was due to meat. Later investigations reveal it was a leak at a weapons development facility.

1980 - Iraq begins using mustard gas, sarin, and tabun against Iran during the Persian Gulf War.

1984 - The Rajneeshee cult in Oregon contaminated salad bars with salmonella with a goal to disrupt the election in the US.

1995 - Aum Shinrikyo uses sarin on the Tokyo subway system.

2001 - Anthrax filled envelopes were sent out across the US in what became known as the Amerithrax case.