



**GRADE 11**

Interdisciplinary  
Global Health Curriculum

# global health

WASHINGTON GLOBAL HEALTH ALLIANCE  
AMBASSADORS PROGRAM

Washington  
**Global Health**  
ALLIANCE









## ABOUT THE WASHINGTON GLOBAL HEALTH ALLIANCE

The mission of the Washington Global Health Alliance (WGHA) is to facilitate creative collaboration and initiatives with our partners. We also seek to expand research and development and educational opportunities, to improve health worldwide, and to inform the stakeholders and the public about global health.

Washington State is a premier center for work to discover and develop solutions to world health challenges. The state's global health leaders recognize that combining efforts to create life-saving technologies and train compassionate global health leaders is essential to make significant progress to save lives.

WGHA was formed in 2007 to foster new partnerships within the extraordinary concentration of global health nonprofits, research organizations, and educational institutions in Washington State. We focus on four areas: research, technologies, and programming; education, training, and mentoring; advocacy and outreach; and public-private partnerships.

WGHA's partner organizations have been collaborating for over 30 years to creatively address global health challenges. Hope for even more efficient and effective innovation stems from the combined efforts of our executive partners:

- Fred Hutchinson Cancer Research Center
- Global Alliance for the Prevention of Prematurity and Stillbirth, an initiative of Seattle Children's
- Infectious Disease Research Institute
- Institute for Systems Biology
- Pacific Northwest National Laboratory
- PATH
- Public Health—Seattle & King County
- Seattle Biomedical Research Institute
- University of Washington Department of Global Health
- Washington State University School for Global Animal Health
- Bill & Melinda Gates Foundation

Washington Global Health Alliance web site: <http://www.wghalliance.org/>

## ABOUT THE WASHINGTON GLOBAL HEALTH ALLIANCE AMBASSADOR PROGRAM

The WGHA Ambassador Program is a pilot project designed to introduce global health into Washington State high schools. The program brought together a team of teachers and administration officials from four high-needs high schools to develop and pilot an innovative, problem-solving, interdisciplinary global health learning community. The Ambassador curriculum is designed for eleventh grade students and provides learning opportunities for the following three courses: U.S. History, Advanced Algebra and Chemistry. With support from the Bill & Melinda Gates Foundation, the Ambassador schools receive on-site mentoring opportunities, global health resources and student internships at participating WGHA organizations.

WGHA Ambassador Program Website:  
<http://www.wghaa.org/>

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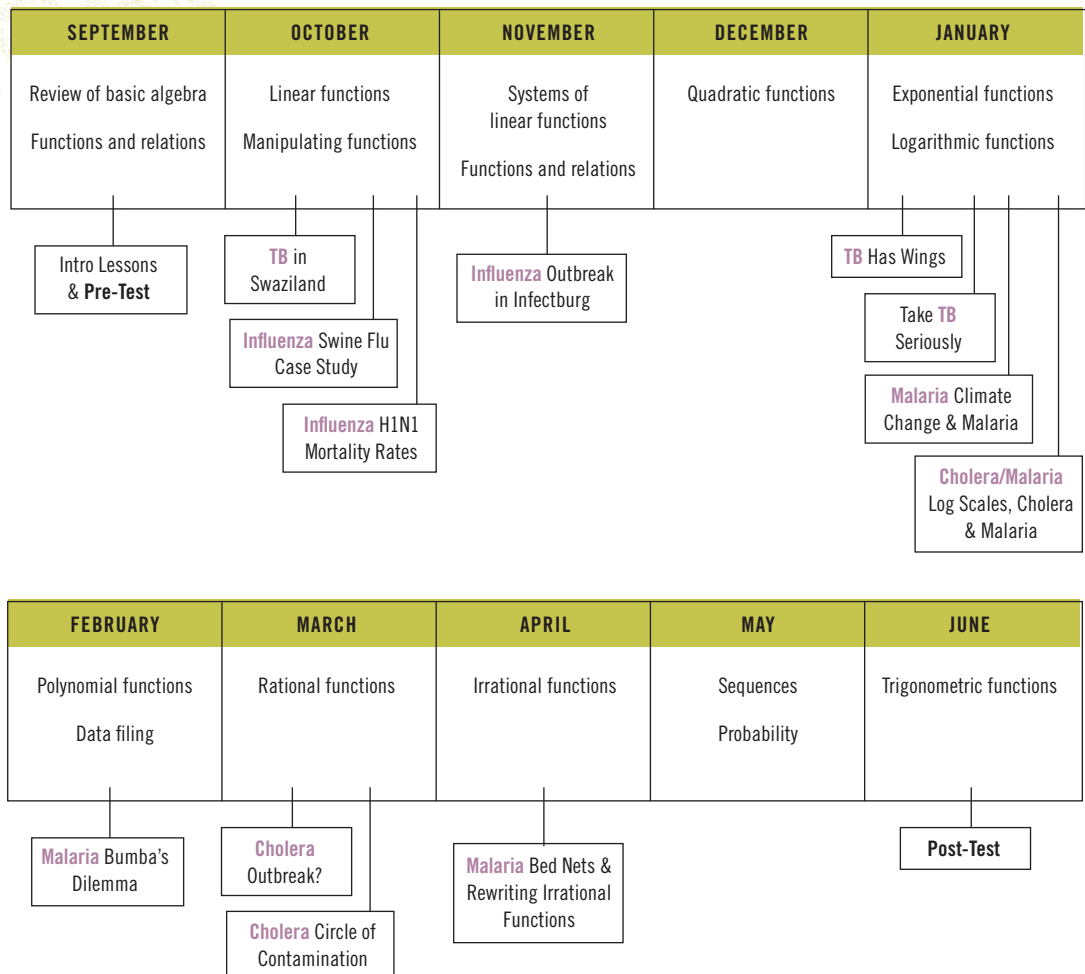


# Overview for Advanced Algebra Teachers

This Global Health Curriculum provides advanced algebra teachers with 12 lesson plans, as well as two introductory lessons and four background readings. Each lesson plan provides an opportunity to bring real-world issues and problems into the math classroom. These activities will help your students understand the connections between advanced algebra content, and how mathematics can be used to analyze societal problems and develop viable solutions.

## CURRICULUM MAP

A sample year-long curriculum map for a typical 11th grade Advanced Algebra course is provided below. The curriculum map shows connections between each of the global health lesson plans and math content.



## LESSONS AT A GLANCE ADVANCED ALGEBRA

The 14 advanced algebra lesson plans in this curriculum provide students with the opportunity to study math content within the context of cholera, influenza, malaria, and tuberculosis. A brief description of each of the lesson plans is provided below.

### INTRODUCTION TO GLOBAL HEALTH

#### Student Background Readings

Four background readings are provided in this section: cholera, influenza, malaria, and tuberculosis. Each reading should be assigned prior to delivering a lesson related to that disease.

#### Lesson #1: Global Health Careers & Challenges

*Activity Time:* 50 minutes  
(plus additional homework)

In this lesson, students will take a brief pre-test, read career case studies, and view a short video about the variety of global health careers.

#### Lesson #2: Global Health Facts

*Activity Time:* 50 minutes

In this lesson, students will view a video segment from *Rx for Survival*, participate in a team question and answer exchange, and explore career options using the BioQuest career website.

### CHOLERA

#### Lesson #1: Log Scales, Cholera & Malaria

*Activity Time:* 50 - 100 minutes

In this lesson, students will become familiar with a Cholera Model Diagram that shows the path of the cholera bacterium, *V. cholerae*. Students will explore the mathematical model of  $\lambda(B)$ , which models the probability of a person catching cholera. Students will also find an association between poverty and the prevalence of malaria. In addition, students will change linear axes to logarithmic axes to better view data.

#### Lesson #2: Outbreak?

*Activity Time:* 100-150 minutes

In this lesson, students will take on the role of a consultant for the World Health Organization and will be challenged to recommend how Zimbabwe's Minister of Health should spend his money in order to protect a community from a cholera outbreak. Students will explore direct and indirect functions and their applications to a possible cholera outbreak.

#### Lesson #3: Circle of Contamination

*Activity Time:* 50 minutes

In this lesson, students will graph and interpret a graph of an inverse square variation function. Using the scenario of a water source contaminated with *V. cholerae*, students will calculate the spread of the bacteria in a circular pattern over time and calculate a person's probability of cholera infection.

### INFLUENZA

#### Lesson #1: Swine Flu Case Study

*Activity Time:* 100 minutes

In this lesson, students will practice their skills in moving between the four representations of a linear set of data. Students will analyze rates of infections as one of the factors that determines if an influenza virus is considered as endemic, epidemic, or pandemic.

#### Lesson #2: H1N1 Mortality Rates

*Activity Time:* 100 minutes

In this lesson, students use CDC data to predict the severity of a H1N1 outbreak both in terms of infection rates and mortality rates.

#### Lesson #3: Outbreak in Infectburg

*Activity Time:* 100 minutes

In this lesson, students will solve systems of equations using graphing, equations, charts or pictures. They will use these solutions to guide their logistical planning to respond to an influenza outbreak in a rural town called Infectburg.

## MALARIA

### **Lesson #1: Climate Change & Malaria (or Why Mosquitoes Don't Want You to Know about Climate Change)**

*Activity Time:* 50 minutes

In this lesson, students will use an exponential graph and equation to determine the relationship between temperature and incubation time of the malaria-causing parasite, *Plasmodium falciparum*, in mosquitoes.

### **Lesson #2: Bumba's Dilemma—Malaria and Drug Resistance**

*Activity Time:* 100 minutes

In this lesson, students consider a case study involving a district health officer from the Democratic Republic of the Congo who is considering whether to purchase new anti-malarial drugs, since the drugs he has been using are losing their effectiveness as the parasite develops drug resistance. Students use matrices and graphing calculators to find the coefficients of a polynomial that fits all of the data points given.

### **Lesson #3: Bed Nets and Rewriting Irrational Expressions**

*Activity Time:* 55 minutes

In this lesson, students investigate the long-term effectiveness of bed nets treated with two different types of insecticide. Students evaluate an expression, and in doing so, they must simplify radical expressions.

## TUBERCULOSIS

### **Lesson #1: TB in Swaziland**

*Activity Time:* 60-90 minutes

In this lesson, students will learn about the high HIV and TB rates in Swaziland and determine the amount of aid that can be provided with a very strict health care budget. Students will set up and graph the solution to a system of inequalities.

### **Lesson #2: Tuberculosis Has Wings**

*Activity Time:* 90 minutes

In this lesson, students will take on the role of WHO officials dealing with an airline passenger who is infected with Extensive Drug Resistant TB (XDR TB). Students will evaluate growth and/or decay data stemming from factors contributing to the growth and/or decay of tuberculosis.

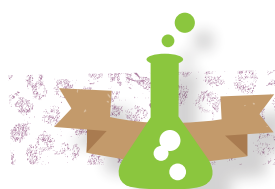
### **Lesson #3: Take TB Seriously**

*Activity Time:* 150 minutes

In this lesson, students will analyze TB data from different countries and then determine the mathematical model that the data fits. Students will analyze graphs of TB death rates and mathematically derive data/patterns within that can be used to inform and persuade a country to increase their TB prevention measures.





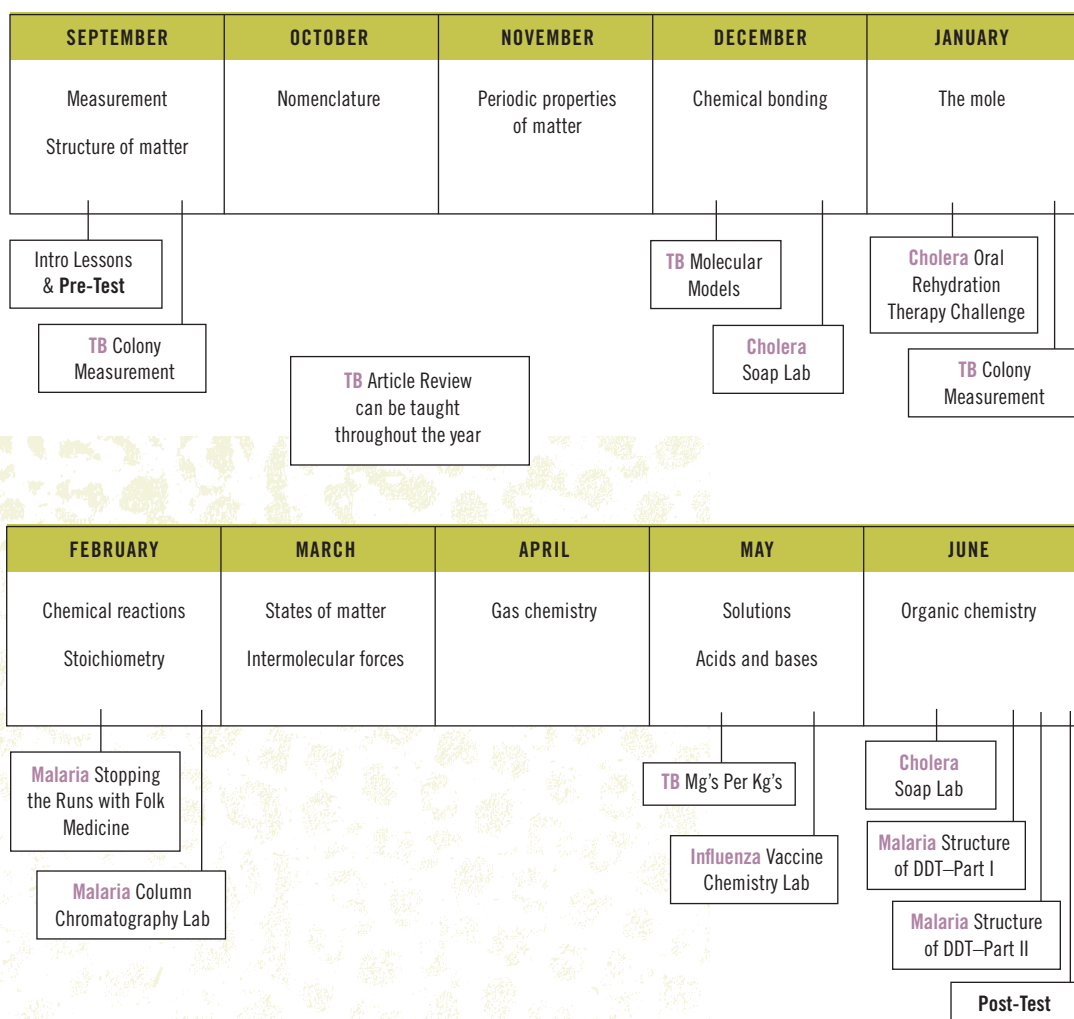


# Overview for Chemistry Teachers

This Global Health Curriculum provides chemistry teachers with 11 lesson plans (including three wet labs), as well as two introductory lessons and four background readings. Each lesson plan provides an opportunity to bring real-world issues and problems into the chemistry classroom and laboratory. These activities will help your students understand the connections between chemistry content, societal problems, and scientific solutions.

## CURRICULUM MAP

A sample year-long curriculum map for a typical 11th grade General Chemistry course is provided below. The curriculum map shows connections between each of the global health lesson plans and chemistry content.





## LESSONS AT A GLANCE CHEMISTRY

The 11 chemistry lesson plans in this curriculum provide students with the opportunity to study chemistry content within the context of cholera, influenza, malaria, and tuberculosis. A brief description of each of the lesson plans is provided below.

### INTRODUCTION TO GLOBAL HEALTH

#### Student Background Readings

Four background readings are provided in this section: cholera, influenza, malaria, and tuberculosis. Each reading should be assigned prior to delivering a lesson related to that disease.

#### Lesson #1: Global Health Careers & Challenges

*Activity Time:* 50 minutes  
(plus additional homework)

In this lesson, students will take a brief pre-test, read career case studies, and view a short video about the variety of global health careers.

#### Lesson #2: Global Health Facts

*Activity Time:* 50 minutes

In this lesson, students will view a video segment from *Rx for Survival*, participate in a team question and answer exchange, and explore career options using the BioQuest career website.

### CHOLERA

#### Lesson #1: Oral Rehydration Therapy Challenge

*Activity Time:* 100 minutes

In this problem-based activity, students will be challenged to offer solutions for a cholera outbreak in central Africa that requires the implementation of an oral rehydration program.

#### Lesson #2: Soap Lab

*Activity Time:* 100 minutes

In this hands-on lesson, students will learn about saponification, the chemistry involved in creating soap. Students will understand how soap is a simple, low-cost method of decreasing exposure to many communicable diseases, including diarrheal illnesses such as cholera. This lesson fits well within the study of organic chemistry and saponification.

### INFLUENZA

#### Lesson #1: Vaccine Chemistry Lab

*Activity Time:* 60-120 minutes

In this lesson, students will learn how dilution calculations and titrations can play a role in the administering of the influenza vaccine. Students will also learn the process that is undertaken in developing the flu vaccine and learn of current research in making the flu vaccine go further with the use of an adjuvant. Students will also participate in an acid/base titration lab.



## MALARIA

### **Lesson #1: Stopping the Runs with Folk Medicine—An Exploration of Intermolecular Forces & Solubility**

*Activity Time:* 50 minutes

In this lesson, students will explore the connection between molecular structure, intermolecular forces, and solubility by examining how guava leaf is used in folk medicine to treat diarrhea, a symptom of malaria. This lesson may stand-alone, or may be used as background and preparation for the *Column Chromatography of Plant-Leaf Extract Wet Lab*.

### **Lesson #2: Column Chromatography of Plant-Leaf Extract Wet Lab**

*Activity Time:* 120 minutes

This experiment is intended to reinforce the lesson *Stopping the Runs with Folk Medicine*, in which the properties of intermolecular attraction are explored. In this experiment, an acetone extraction of plant leaves is performed, and the various components in the extract are separated using column chromatography. All of the required materials are relatively inexpensive, and can be purchased at grocery, drug, or hardware stores.

### **Lesson #3: Structure of DDT—Part I**

*Activity Time:* 100 minutes

In this lesson, students will discuss the big idea of “science and technology in society.” Students will learn about DDT as a way to prevent malaria. Students will categorize different molecules into polar/non-polar functional groups, including the DDT molecule.

### **Lesson #4: Structure of DDT—Part II**

*Activity Time:* 55 minutes

In this lesson, students will discover the polar/non-polar qualities of DDT that make it interact with cell membranes, using soap for comparison. By examining DDT’s functional group and structure, students will understand how it works as a pesticide.

## TUBERCULOSIS

### **Lesson #1: TB Colony Measurement**

*Activity Time:* 90 minutes

In this lesson, students will use black peas to model TB bacterium within colonies of various sizes and over different periods of time. Students will use the SI system and appropriate mathematical concepts to devise two methods for identifying how many bacterium are within their colony.

### **Lesson #2: TB Molecular Models**

*Activity Time:* 90 minutes

In this lesson, students will construct molecular models of various functional groups and compounds that make up the tuberculosis bacterium cell membrane. This activity will show students that molecules are three-dimensional and that their different geometries are responsible for how they react with other molecules. Students will further study how the shape of these functional groups and compounds are effective at protecting the bacterium from immunological agents and antibiotics.

### **Lesson #3: Article Review**

*Activity Time:* 60 Minutes

In this lesson, students will critically read articles about tuberculosis. The instructor will review technical reading skills including, but not limited to, interpreting graphics, using contextual clues, and building technical vocabulary. Students will select, read, and critically review one scientific article about tuberculosis.

### **Lesson #4: Mg’s Per Kg’s**

*Activity Time:* 90 minutes

In this lesson, students will determine the appropriate amount of antibiotic to give to various member of their family in order to maintain a consistent mg/Kg concentration. This activity will provide students with the understanding that dosage varies between individuals in order to maintain consistent concentrations.



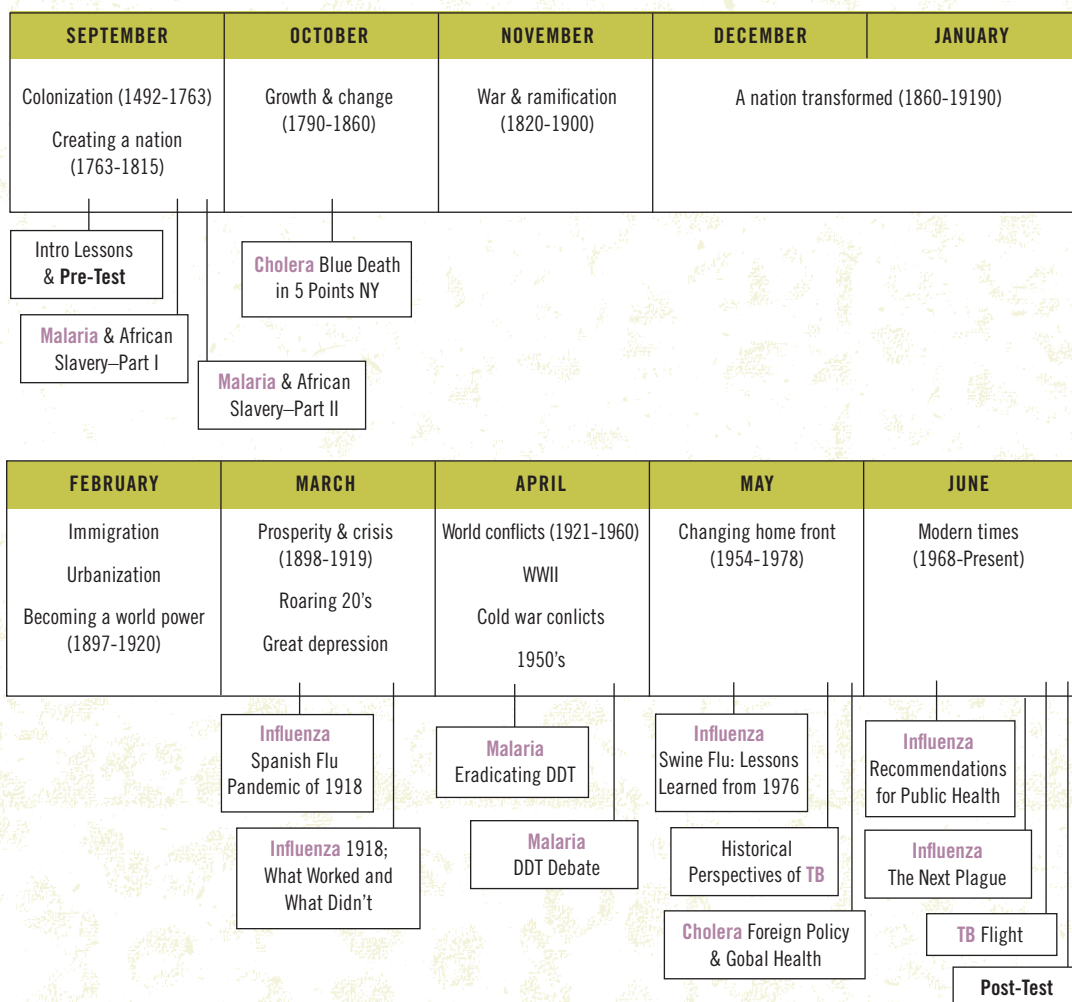


# Overview for U.S. History Teachers

This Global Health Curriculum provides U.S. history teachers with 13 lesson plans (including three Classroom-Based Assessments), as well as two introductory lessons and four background readings. Each lesson plan provides an opportunity to bring real-world issues and problems into the U.S. history classroom, and to examine the U.S.'s role in global health. These activities will help your students understand the connections between history content, historical problems, and how we can develop successful outcomes for contemporary problems based on our knowledge of the past. Three of the lesson plans can also be used to satisfy the requirements of three Classroom-Based Assessments (CBAs).

## CURRICULUM MAP

A sample year-long curriculum map for a typical 11th grade U.S. History course is provided below. The curriculum map shows connections between each of the global health lesson plans and history content.





## LESSONS AT A GLANCE U.S. HISTORY

The 13 U.S. history lesson plans in this curriculum provide students with the opportunity to study history content within the context of cholera, influenza, malaria, and tuberculosis. A brief description of each of the lesson plans is provided below.

### INTRODUCTION TO GLOBAL HEALTH

#### Student Background Readings

Four background readings are provided in this section: cholera, influenza, malaria, and tuberculosis. Each reading should be assigned prior to delivering a lesson related to that disease.

#### Lesson #1: Global Health Careers & Challenges

*Activity Time:* 50 minutes  
(plus additional homework)

In this lesson, students will take a brief pre-test, read career case studies, and view a short video about the variety of global health careers.

#### Lesson #2: Global Health Facts

*Activity Time:* 50 minutes

In this lesson, students will view a video segment from *Rx for Survival*, participate in a team question and answer exchange, and explore career options using the BioQuest career website.

### CHOLERA

#### Lesson #1: Blue Death at 5 Points NY

*Activity Time:* 200 minutes

In this lesson, students will read an article about the 1832 cholera outbreak in NY. They will then generate questions based on the “big ideas” in the article. Students will then work in groups to research one of their own questions. Groups will write a brief regarding their question and present it to the class.

#### Lesson #2: Foreign Policy & Global Health

*Activity Time:* 300 minutes

In this lesson, students will complete the “U.S. Foreign Policy” Classroom-Based Assessment (CBA) while focusing on a global health issue. Students will examine the motivations that drive foreign aid.

### INFLUENZA

#### Lesson #1: Spanish Flu Pandemic of 1918

*Activity Time:* 90 minutes

In this lesson, students will become familiar with the Spanish Flu pandemic of 1918. Students will see how governments, communities, and individuals struggled to cope with the staggering losses and challenges of this pandemic.

#### Lesson #2: 1918—What Worked and What Didn't

*Activity Time:* Two 50 minute periods

In this lesson, students will read about government and community responses to influenza pandemics. Students will research different cities' and states' responses to the 1918 pandemic, including Boston, San Francisco, Philadelphia, Washington, and Georgia.

#### Lesson #3: Swine Flu—Learning from 1976

*Activity Time:* 30-45 minutes

In this lesson, students will read news stories to learn about an unsuccessful public response to a possible influenza pandemic.

#### Lesson #4: The Next Plague

*Activity Time:* 90 minutes

In this lesson, students will view the film *The Next Plague: Avian Influenza* and will describe how governments have responded to avian influenza outbreaks.

#### Lesson #5: Recommendations for Protecting Public Health

*Activity Time:* 90 minutes

In this lesson, students will identify and evaluate recommendations for safeguarding public health in the case of an influenza pandemic. Students will communicate their recommendations in the form of a letter to a newspaper editor, a public health official, or an elected official.

## MALARIA

### Lesson #1: Malaria & African Slavery—Part I

*Activity Time:* 50 minutes

In this lesson, students will investigate the pragmatic reasons that led to Africans being chosen as slaves. Students will read excerpts from *Medical Apartheid*, *Mosquito: The Story of Man's Deadliest Foe*, and *A People's History of the United States*. In addition, they will be asked to complete a question and inference chart. Students will then answer one of their own questions that has been selected by the teacher.

### Lesson #2: Malaria & African Slavery—Part II

*Activity Time:* 100 minutes

In this lesson, students will use a Socratic Seminar to examine the three readings that were introduced in the *Malaria & African Slavery—Part I* lesson. Students will gain a deeper understanding the issues, ideas, and principles contained in these documents, and how it conflicts with different perspectives and the students' own ideas.

### Lesson #3: Eradicating Malaria

*Activity Time:* 150 minutes

In this lesson, students will conduct research on one of the seven methods used to control or eradicate malaria. After obtaining some mastery over their subject, the new “experts” will then teach the class their method through a presentation with a focus on how these methods balance the common good with the rights of the individual.

### Lesson #4: DDT Debate

*Activity Time:* 200 minutes

In this lesson, students will engage in a debate over the use of DDT to control mosquitoes and malaria. Students will consider which treatment methods best balance the rights of the individual with what is best for society as a whole. This lesson can be used to fulfill the Classroom-Based Assessment (CBA) *Dig Deep*.

## TUBERCULOSIS

### Lesson #1: Historical Perspectives of TB

*Activity Time:* 250 minutes

In this lesson, students will explore the impact of sanatoriums on society through several different perspectives. Each student will be assigned a perspective (medical professional, political leader, or TB patient). Students will research how sanatoriums came to be, the conditions of the sanatoriums, and successes and failures of the sanatoriums in terms of curing TB. Once research is complete they will write a narrative for the Library of Congress to keep on file that tells their story from their perspective (similar to the slave narratives).

### Lesson #2: TB Flight

*Activity Time:* 270 minutes

In this lesson, students will fulfill the Classroom-Based Assessment (CBA) *Constitutional Issues* by answering the following question: “Should the United States government have the right to quarantine infected individuals in order to protect the common good?”

