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/

WGHA Ambassador Program Contact Information
For information on the WGHA Ambassador Program, please contact Nona Beth Clifton at Seattle Biomedical Research Institute.

Nona Beth Clifton, WGHA Ambassador Officer
Seattle Biomedical Research Institute
307 Westlake Ave N Suite 500,
Seattle WA 98109
T 206.256.7423
F 206.256.7229
E nona.clifton@sbri.org

CREDITS

WGHAA Staff & Consultants
- Lisa Cohen, WGHA Director
- Kristen Eddings, WGHA Assistant
- Theresa Britschgi, BioQuest Director, Seattle Biomedical Research Institute
- Nona Beth Clifton, WGHA Ambassador Officer, Seattle Biomedical Research Institute
- Kristen Clapper Bergsman, Laughing Crow Curriculum LLC
- Judi Backman, Instructional Specialist
- Laura J. Collins, PhD, Center for Research and Learning

Curriculum Development & Pilot Testing Team
- Blaine High School (Blaine School District)
  David Fakkema, Social Studies; Mike Couto, Science; Mike Dahl, Math
- Cleveland High School (Seattle School District)
  Jeff Taylor, Social Studies; Steve Pratt, Science
- Health Sciences and Human Services High School (Highline School District)
  Jan Munger, Social Studies; Steve Miguelez, Science; Chris Hill, Math
- Toppenish High School (Yakima Valley School District)
  Leslie Brown, Social Studies; Mike Ayling, Science; Brad Baker, Math
- Washington Global Health Alliance Ambassador Program
  Nona Clifton, Program Officer; Theresa Britschgi, BioQuest Director
- Colleen F. Craig, PhD
- Kristen Clapper Bergsman, Laughing Crow Curriculum LLC
School District Administrators

- Blaine High School (Blaine School District)
  Scott Ellis, Principal;
  George Kaas, Vice Principal;
  Deb Cummings, District Director of Curriculum
- Cleveland High School (Seattle School District)
  Princess Shareef, Principal
- Health Sciences and Human Services High School (Highline School District)
  Paula Montgomery, Principal
- Toppenish High School (Toppenish School District)
  Steve Myers, Superintendent;
  John Cerna, Assistant District Superintendent;
  Trevor Greene, Principal; Frank Harris, Vice Principal

WGHAA Educational Advisory Committee

- Bookda Gheisar, Global Washington
- Emmanuela Gakidou, PhD, University of Washington School of Public Health
- Jennifer Earle, University of Washington Department of Global Health
- Joan Griswold, Northwest Association for Biomedical Research
- Katherine Barr, Global Washington
- Meena Selvakumar, PhD, Pacific Science Center
- Laura Tyler, University of Washington MESA
- Nancy Hutchison, PhD, Fred Hutchinson Cancer Research Center
- Tese Neighbor, World Affairs Council
- Wendy Church, PhD, Facing the Future
- Wendy Law, PhD, Marsha Rivkin Center for Ovarian Cancer Research

WGHAA Leadership and Curriculum Review Committee

- Trevor Greene, Principal, Toppenish High School
- John Cerna, Assistant District Superintendent, Toppenish High School
- Paula Montgomery, Principal, Health Sciences and Human Services High School
- Princess Shareef, Principal, Cleveland High School
- Scott Ellis, Principal, Blaine High School
- Alice Grasset, DVM, Infectious Disease Research Institute
- Theresa Britschgi, Seattle Biomedical Research Institute
- Steve Gloyd, MD, University of Washington
- John Gardner, PhD, Washington State University
- Jackie Sherris, PhD, PATH
- Dara Lehman, PhD, Fred Hutchinson Cancer Research Center
- Dana Riley-Black, PhD, Institute for Systems Biology
- Amanda Jones, PhD, Global Alliance for the Prevention of Prematurity and Stillbirth, an initiative of Seattle Children's
- Sara Curran, PhD, University of Washington
- Jay Mclean-Riggs, MD, Seattle Central Community College
- Randy Hassler, Seattle Biomedical Research Institute
- Robyn Buck, Office of the Superintendent of Public Instruction
Content Experts and Workshop Speakers

- Infectious Disease Research Institute
  Julie A. Bowman; Alice Grasset, DVM; Ed Kesicki; Narek Shaverdian; Ines Tucakov

- Seattle Biomedical Research Institute
  Theresa Britschgi; Ken Stuart; Ashley Vaughan; Marissa Vignali

- Washington State University
  Oumar Badini, PhD; Tim Baszler, PhD; Don Knowles, PhD; Lynn Nelson, PhD; Chris Pannkuk, PhD; John L. “Skip” Paznokas, PhD; Marsha Quinlan, PhD; Mary Sanchez-Lanier, PhD; Debra Sellon, PhD; William Sischo, PhD; Patricia Ann Sturko, PhD; Trish Talcott, PhD

- UW Institute for Health Metrics
  Krycia P. Cowling; Kyle J. Foreman; Nancy Fullman; Emmanuela Gakidou; Sean Lassiter; Alison K. Levin-Rector; Susanna Makela; Jake Markus; Rebecca M. Myerson

- University of Washington
  Greg Crowther

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Graphic Design

Clayton DeFrate Design

Research

Judi Backman

Editing

Kristen Clapper Bergsman,
Laughing Crow Curriculum LLC

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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.

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.

<table>
<thead>
<tr>
<th>CURRICULUM MAP</th>
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<tbody>
<tr>
<td>SEPTEMBER</td>
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<tr>
<td>Review of basic algebra Functions and relations</td>
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<tr>
<td>Intro Lessons &amp; Pre-Test</td>
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<tr>
<td>FEBRUARY</td>
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<tr>
<td>Polynomial functions Data filing</td>
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<tr>
<td>Malaria Bumba’s Dilemma</td>
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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 antimalarial 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.

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.

<table>
<thead>
<tr>
<th>SEPTEMBER</th>
<th>OCTOBER</th>
<th>NOVEMBER</th>
<th>DECEMBER</th>
<th>JANUARY</th>
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<tbody>
<tr>
<td>Measurement</td>
<td>Nomenclature</td>
<td>Periodic properties of matter</td>
<td>Chemical bonding</td>
<td>The mole</td>
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<tr>
<td>Structure of matter</td>
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<tr>
<td>Intro Lessons &amp; Pre-Test</td>
<td>TB Colony Measurement</td>
<td>TB Article Review can be taught throughout the year</td>
<td>Cholera Oral Rehydration Therapy Challenge</td>
<td>TB Colony Measurement</td>
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</tbody>
</table>

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<tr>
<th>FEBRUARY</th>
<th>MARCH</th>
<th>APRIL</th>
<th>MAY</th>
<th>JUNE</th>
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<tbody>
<tr>
<td>Chemical reactions</td>
<td>States of matter</td>
<td>Gas chemistry</td>
<td>Solutions</td>
<td>Organic chemistry</td>
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<tr>
<td>Stoichiometry</td>
<td>Intermolecular forces</td>
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<td>Acids and bases</td>
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</tr>
<tr>
<td>Malaria Stopping the Runs with Folk Medicine</td>
<td>Malaria Column Chromatography Lab</td>
<td>Cholera Soap Lab</td>
<td>TB Mg’s Per Kg’s</td>
<td>Malaria Structure of DDT–Part I</td>
</tr>
<tr>
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<td>TB Article Review</td>
<td>Influenza Vaccine Chemistry Lab</td>
<td>Malaria Structure of DDT–Part II</td>
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<td>Cholera Soap Lab</td>
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<td>Cholera Soap Lab</td>
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</table>

Post-Test
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 undertook 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).

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.
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 an 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?”