BioEd℠ Teacher's Guide

the science of HIV/AIDS

Mapping the Spread of HIV/AIDS

Trailing the Pandemic

by

Gregory L. Vogt, Ed.D.

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RESOURCES

Free, online presentations, downloadable activities in PDF format, and annotated slide sets for classroom use are available at www.bioedonline.org or www.k8science.org.

CONTENT ADVISORY

See the following resources for additional information about HIV/AIDS and advice for discussing HIV/AIDS with students.

- National Institute of Allergy and Infectious Diseases, National Institutes of Health (NIH), offers resources on understanding HIV/AIDS: niaid.nih.gov/topics/hivaids/and aidsinfo.nih.gov.
- National Institute on Drug Abuse, NIH, offers facts about drug abuse and the link between it and HIV/AIDS: hiv.drugabuse.gov.
- The Centers for Disease Control and Prevention provides up-to-date information on HIV/AIDS prevention: cdc.gov/hiv/topics.

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SOURCE URLs

AMERICAN DENTAL EDUCATION ASSOCIATION
explorehealthcareers.org

BAYLOR COLLEGE OF MEDICINE
BIOED ONLINE TEACHER RESOURCES
bioedonline.org | k8science.org
BAYLOR-UT CENTER FOR AIDS RESEARCH
bcm.edu/cfar
MOLECULAR VIROLOGY AND MICROBIOLOGY
bcm.edu/molvir

DARTMOUTH COLLEGE
ELECTRON MICROSCOPE FACILITY
dartmouth.edu/~emlab/

THE HENRY J. KAISER FAMILY FOUNDATION
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JOURNAL OF NANOBIOTECHNOLOGY
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NATIONAL INSTITUTES OF HEALTH
LIFEWORKS
science.education.nih.gov/lifeworks

NATIONAL CENTER FOR RESEARCH RESOURCES
ncrr.nih.gov
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES
www.niaid.nih.gov
aidsinfo.nih.gov
NATIONAL INSTITUTE ON DRUG ABUSE
hiv.drugabuse.gov
NATIONAL LIBRARY OF MEDICINE
nlm.nih.gov/hmd
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SUMANIS, INC.
ANIMATED TUTORIALS: MICROBIOLOGY
http://sumanasinc.com/webcontent/animation.html

U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)
HIV/AIDS PREVENTION
cdc.gov/hiv/topics
PUBLIC HEALTH IMAGE LIBRARY
phil.cdc.gov

U.S. CENTRAL INTELLIGENCE AGENCY
THE WORLD FACTBOOK
https://www.cia.gov/library/publications/the-world-factbook/geos/us.html

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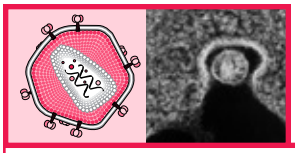


HIV virus particle. Charles P. Daghlian, Ph.D., Louisa Howard, Dartmouth College.

INTRODUCTION

Microbial Challenges

Infectious diseases have plagued humans throughout history. Sometimes, they even have shaped history. Ancient plagues, the Black Death of the Middle Ages, and the "Spanish flu" pandemic of 1918 are but a few examples.

Epidemics and pandemics always have had major social and economic impacts on affected populations, but in our current interconnected world, the outcomes can be truly global. Consider the SARS outbreak of early 2003. This epidemic demonstrated that new infectious diseases are just a plane trip away, as the disease was spread rapidly to Canada, the U.S. and Europe by air travelers. Even though the SARS outbreak was relatively short-lived and geographically contained, fear inspired by the epidemic led to travel restrictions and the closing of schools, stores, factories and airports. The economic loss to Asian countries was estimated at $18 billion.

The HIV/AIDS viral epidemic, particularly in Africa, illustrates the economic and social effects of a prolonged and widespread infection. The disproportionate loss of the most economically productive individuals within the population has reduced workforces and economic growth in many countries, especially those with high infection rates. This affects the health care, education, and political stability of these nations. In the southern regions of Africa, where the infection rate is highest, life expectancy has plummeted in a single decade, from 62 years in 1990–95 to 48 years in 2000–05. By 2003, 12 million children under the age of 18 were orphaned by HIV/AIDS in this region.

For an emerging disease to become established, at least two events must occur: 1) the infectious agent has to be introduced into a vulnerable population, and 2) the agent has to have the ability to spread readily from person to person and cause disease. The infection also must be able to sustain itself within the population and continue to infect more people.

Despite significant advances in infectious disease research and treatment, control and eradication of diseases are slowed by the following challenges.

- The emergence of new infectious diseases
- An increase in the incidence or geographical distribution of old infectious diseases
- The re-emergence of old infectious diseases
- The potential for intentional introduction of infectious agents by bioterrorists
- The increasing resistance of pathogens to current antimicrobial drugs
- Breakdowns in public health systems.

Baylor College of Medicine, Department of Molecular Virology and Microbiology, bcm.edu/molvir.

Using Cooperative Groups In The Classroom

Cooperative learning is a systematic way for students to work together in groups of two to four. It provides organized group interaction and enables students to share ideas and to learn from one another. Students in such an environment are more likely to take responsibility for their own learning. Cooperative groups enable the teacher to conduct hands-on investigations with fewer materials.

Organization is essential for cooperative learning to occur in a hands-on science classroom. Materials must be managed, investigations conducted, results recorded, and clean-up directed and carried out. Each student must have a specific role, or chaos may result.

The Teaming Up! model* provides an efficient system for cooperative learning. Four "jobs" entail specific duties. Students wear job badges that describe their duties. Tasks are rotated within each group for different activities so that each student has a chance to experience all roles. For groups with fewer than four students, job assignments can be combined.

Once a model for learning is established in the classroom, students are able to conduct science activities in an organized and effective manner. Suggested job titles and duties follow.

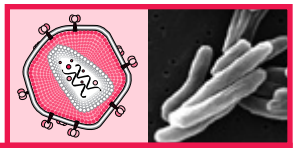
Principal Investigator
- Reads the directions
- Asks the questions
- Checks the work

Maintenance Director
- Follows the safety rules
- Directs the cleanup
- Asks others to help

Reporter
- Records observations and results
- Explains the results
- Tells the teacher when the group is finished

Materials Manager
- Picks up the materials
- Uses the equipment
- Returns the materials

* Jones, R.M. 1990. *Teaming Up!* LaPorte, Texas: ITGROUP.



Mycobacterium tuberculosis bacteria. CDC\ 9997 Ray Butler, Ph.D., Janice H. Carr.

Trailing the Pandemic

Each week on television, police investigators race to the latest crime scene and dazzle viewers by solving the "who done-it" using sophisticated laboratory tests and computer wizardry. While some of the techniques shown are scientific nonsense, occasionally real crime scene investigation techniques, such as "mapping the evidence," are shown. Brightly colored markers are placed next to evidence or clues, photographed and logged on a scene map. Like following footprints in snow or mud, the sequence of events in a crime sometimes can be deduced from this "map."

In the 1980s, when AIDS cases first began to appear, the affliction was thought to be restricted to homosexual men. But as more cases emerged among different populations, the relationship of the disease to the community became unclear. No longer limited only to gay men, HIV was infecting heterosexual men and women, as well as children, of all races and many countries.

The origins of AIDS were very difficult to trace, because most people infected with HIV show no symptoms for many years. During this time, infected individuals can unknowingly pass HIV particles to others through bodily fluids. While many scientists sought to find cures or treatments for AIDS, others sought to determine the origin of the HIV virus. Knowing where it came from and how it spread could help explain how the virus infects people—and how to combat it. Research agencies, including the World Health Organization and the U.S. Centers for Disease Control and Prevention began tracking the prevalence of infection, country by country.

As hoped, mapping HIV/AIDS populations around the world provided important clues. Epidemiologists (scientists who study factors that affect the health of populations) found that countries with the highest incidence rates were among the earliest to report HIV/AIDS infections. Mapping also confirmed that HIV/AIDS had become a pandemic (Greek: *pan* = "all" + *demos* = "people"), an infectious disease epidemic that has spread through human populations across continents, or even the entire world.

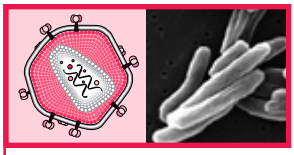
By tracking back to the earliest reported HIV outbreaks, researchers determined the virus originated in Africa. The first known case of HIV infection was detected in a blood sample collected in 1959 from a man in Kinshasa, Democratic Republic of Congo. However, investigators believe HIV may have existed since the 1930s. And still today, there is an astoundingly high percentage of adults living with HIV/AIDS in central and southern Africa.

It has been established that HIV arose from a related virus found in chimpanzees once common in west-central Africa. A subgroup of chimpanzees still living there was found to have simian immunodeficiency virus (SIV). Researchers confirmed the presence of SIV and its close relationship to HIV by collecting and studying chimpanzee feces from ten forest sites in southern Cameroon. SIV was found in five of the sites. Genetic analysis then enabled scientists to trace the virus to individual chimpanzees.

It is not known exactly how the virus transferred to humans, but cultural evidence indicates that it might have occurred in a single incident. Chimpanzees long have been hunted in Africa as a food source. It is probable that the virus was transferred to a human who was butchering an infected chimpanzee. Perhaps the butcher had an open sore or a cut that provided a pathway for the virus contained in the animal's blood. Regardless, somewhere in the viral transference process, SIV mutated into HIV, a virus that causes infection and disease in humans.

In 1981, Dr. Michael E. Gregg published a report about five cases of the then-rare disease, PCP, among young men in Los Angeles. It was a precursor of the AIDS epidemic. Photo: CDC\10760.

From the 1930s to 2009, HIV/AIDS grew from a single case to a global pandemic, with approximately 34 million people now infected by HIV. This number does not include the estimated 30 million people worldwide who have died from AIDS. Due to improved treatments, the infection rate is dropping in some countries. However, these gains are being offset by the rise of infections in other regions, where HIV/AIDS care is minimal. Worldwide, there are approximately 2.7 million new HIV infections (including 53,000 in the U.S.) and about two million HIV-related deaths each year.



Mycobacterium tuberculosis bacteria. CDC\1997 Ray Butler, Ph.D., Janice H. Carr.

TIME

Setup: 30 minutes
Activity: 2 class periods

SCIENCE EDUCATION CONTENT STANDARDS

Grades 5–8

Life Science

- Disease is a breakdown in structures or functions of an organism. Some diseases are the result of damage by infection by other organisms.
- A population consists of all individuals of a species that occur together at a given place and time.

Science and Technology

- Many different people in different cultures have made and continue to make contributions to science and technology.

Science in Personal and Social Perspectives

- Societal challenges often inspire questions for scientific research.

History and Nature of Science

- Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models.

Grades 9–12

Life Science

- Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology and consumption.

Science and Technology

- Scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations.

History and Nature of Science

- Individuals and teams have contributed and will continue to contribute to the scientific enterprise. Doing science can be as simple as an individual conducting field studies or as complex as hundreds of people working on a major scientific questions or technological problem.

Overview

Students will act as epidemiologists by mapping the prevalence of HIV/AIDS worldwide.

MAPPING THE

Spread of HIV/AIDS

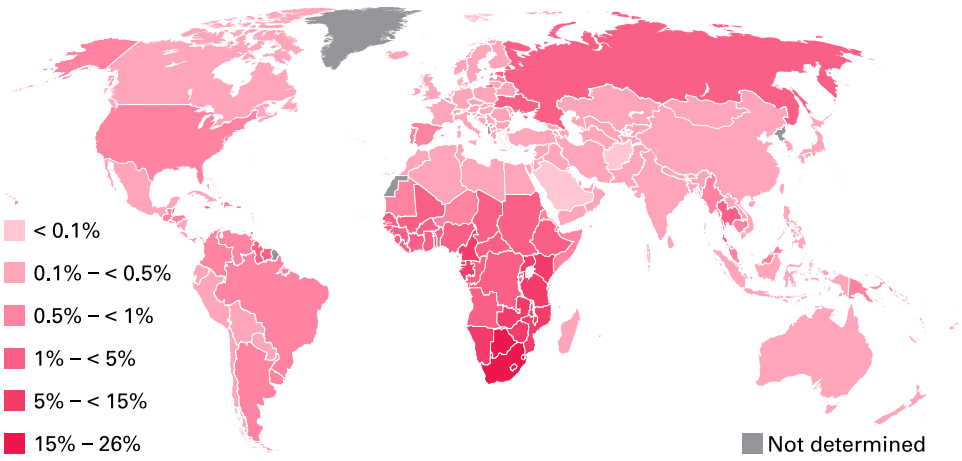
Diseases have haunted the human race throughout history. With the continued expansion of the world's population, international travel and global trade, diseases are able to spread more rapidly now than ever before. Since its origination in the 1930s, HIV has reached every country in the world and killed 30 million people. It is estimated that another 34 million people currently are living and struggling with HIV/AIDS.

This certainly is not the first disease calamity to strike humans. The Spanish Flu pandemic of 1918–19 resulted in the death of an estimated 50 million people, either directly from the disease or from its complications. Before that, yellow fever, small pox and the black plague ravaged populations around the world. Another old killer, malaria, still plays a deadly role in many nations.

Disease detectives, called epidemiologists, help us to understand and defeat these awful illnesses. Epidemiologists study factors that affect the health of populations. Their work is a colossal investigation being conducted in remote natural settings and high-tech laboratories around the world. Epidemiologists collect data to identify outbreaks of old and new diseases, analyze samples, make computer projections, and evaluate possible cures and strategies. Their goal is to identify the cause of disease and determine what to do about it.

The following classroom activity places students in the role of disease detectives, as they investigate trends in HIV infection worldwide. Students will discover that many countries with high HIV infection rates have low levels of per capita income and education, two characteristics often linked with disease. For example, malnutrition and insufficient protection against parasites, often found in economically deprived nations and communities, can limit the immune system's ability to fight off infections. Under these circumstances, individuals are more susceptible to infection by HIV and other pathogens (disease causing organisms). HIV/AIDS treatments are expensive, and are less available in economically disadvantaged countries. Poor children have an increased likelihood of contracting HIV/AIDS from an infected mother during pregnancy or while nursing, because HIV treatments to reduce the chances of HIV transmission are expensive and may not be an option, or even available.

HIV/AIDS also depletes household resources and income. Medical care is expensive and family members who care for the sick may not be able to work. Children may be left to fend for themselves or even become orphaned. And poverty sometimes leads people to participate in risky activities that increase their chances of being exposed to disease. Sustainable economic development, improved standards of living, and



Estimated number of adults (ages 15–49) living with HIV in 2009.

Source: Map generated by M.S. Young, Baylor College of Medicine, using data from The World Factbook, and 2011 political map by the U.S. Central Intelligence Agency. Photo: National Library of Medicine, NIH.

better education are essential to combating the global HIV/AIDS pandemic.

MATERIALS

Per Class (see Setup)

- Set of Adult HIV/AIDS Prevalence Rate, by Country Tables sheets One set will accommodate 10 groups of students.
- Large political world map mounted in a central location or find and download a world map from the Internet using the search terms, "world," "map," and "countries." Enlarge the map to poster-size so that smaller countries, especially in Europe, can be identified.

Per Team of Students

- Map pins or push pins (or small, colored stick-on dots) in six colors
- Internet access to geography websites, or a current world atlas
- One (or more) Team Cards
- Copy of "Where in the World" and enlarged copy of a blank world map

SETUP

Pins of different colors will be used to identify HIV/AIDS rates in different countries. If using stick-on dots, it may be difficult to find six different colors. Dots in four colors are easy to obtain. Additional colors can be created by gently running colored markers over some of the yellow, green or white dots.

Mount the paper world map on a bulletin board. You and/or groups of students will create a map legend to match the colored pins or dots (see step 4 in Procedure).

Copy the Team Cards sheets onto cardstock and cut out the cards. (The number of cards per team of students will depend on the total number of student teams.) Make copies of the student sheet.

Divide your students into cooperative learning groups of 2 to 4. Place the mapping pins or colored dots in a central location.

Depending on the amount of time and resources available, you may want to conduct this activity as a student group project, with each group receiving its own map and plotting an entire set of dots.

PROCEDURE

1. Ask students, *Does anyone know what "CSI" stands for?* [crime scene investigation] *Have any of you watched one of the different CSI programs on television? How do the investigators on these programs gather information?* Mention that

Continued

MAKING HISTORY: EPIDEMIOLOGISTS

- **Edward Anthony Jenner** (1749–1823), was a doctor and surgeon who noticed that people who had a mild disease called cowpox were less likely to contract the much more deadly smallpox. His observations led to the smallpox vaccine and saving the lives of millions of people.
- **John Snow** (1813–1858) is considered one of the fathers of epidemiology. Dr. Snow first noticed the link between cholera and drinking water. By studying patterns of outbreak and talking to local residents, he traced cholera outbreaks in London to human sewage leaking into a public water pump. He also used a map to show clusters of cholera cases.

- **Beatrice Hahn, M.D.**, led a team of researchers that traced the origin of HIV-1 by collecting and analyzing chimpanzee feces from ten sites in central Africa, showing that a recombination of related viruses led to the origin of HIV.

CAREER FOCUS: EPIDEMIOLOGY

Epidemiologists study outbreaks of disease in human populations. Most people who choose this career have a keen interest in science, medicine and mathematics. They also like solving mysteries and puzzles, are creative and observant, and want to help improve people's lives. Visit these websites for more information on epidemiology careers.

- **American Dental Education Association**
  explorehealthcareers.org
- **Centers for Disease Control and Prevention: Careers in Public Health**
  cdc.gov/excite/careers
- **National Institutes of Health: LifeWorks**
  science.education.nih.gov/lifeworks
- **What is Public Health?**
  whatispublichealth.org

EXTENSION

Have each student "adopt" one country from his/her table and research that country's resources, people, politics, and other conditions that may contribute to the spread of HIV/AIDS and/or other health problems.

students will apply problem-solving strategies and scientific techniques like those used on CSI to collect clues and explain a mystery. Discuss the topic of mapping a crime scene and help students understand how the mapping process informs investigators. Ask, *What does a crime scene map tell the investigators?* [It helps them determine the sequence of events.]

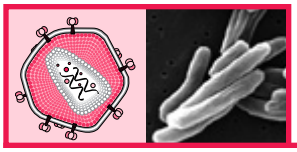
2. Divide the class into 10 HIV/AIDS mapping teams. Provide each team with one of the ten Adult HIV/AIDS Prevalence Rate, by Country tables. If you have fewer than ten teams, give some groups two tables or divide the remaining countries among all teams.
3. Explain that each table lists 16 or 17 different countries for which HIV/AIDS data are available (data are not available for all countries). The number to the right of each country name is the percentage of the adult population in that country living with HIV/AIDS. (For this activity, an "adult" is defined as a person aged 15 to 49.) The data were collected from *The World Factbook* produced by the U.S. Central Intelligence Agency. They are from the year 2009. The percentage of infected adults in each country was calculated by dividing the total adult population by the number of adults living with HIV/AIDS, whether or not they exhibited AIDS symptoms.
4. Create a color legend for the map, or assign one or more students to create the legend. The table below provides suggested percentage ranges to be represented by each color of map pin or adhesive dot. However, you may adjust the legend on your class map to match the colors available.

Suggested Legend

*<0.1%	Purple
0.1% – <0.5%	Blue
0.5% – <1%	Green
1% – <5%	Yellow
5% – <15%	Orange
15% – <26%	Red

*< = less than

5. Have each student team locate its assigned countries on the world map. Then, have students place an appropriately-colored pin or dot in the center of each country to represent the percentage of adults in that country who are living with HIV/AIDS. Some countries may be difficult to locate. A world atlas or access to geography websites will be helpful.
6. When all teams have plotted their countries, have them use the questions on the student page to analyze the total map display.
7. Lead a class discussion of the results. Ask, *Do you see any trends? Where is HIV/AIDS most prevalent?* [central and southern Africa.] *Which country has the highest percentage of adults living with HIV/AIDS?* [Swaziland: 26.1%.] *What are the numbers worldwide?* [34 million people are living with HIV/AIDS.]



Mycobacterium tuberculosis bacteria. CDC\9997 Ray Butler, Ph.D., Janice H. Carr.

Where In the World?

INSTRUCTIONS

1. Working as a team, follow the instructions on the card you have received to place colored pins (or dots) on the large world map. The colors represent the percentage of people living with HIV in each of the countries listed in your table. Place the pin (or dot) in the center of each country.

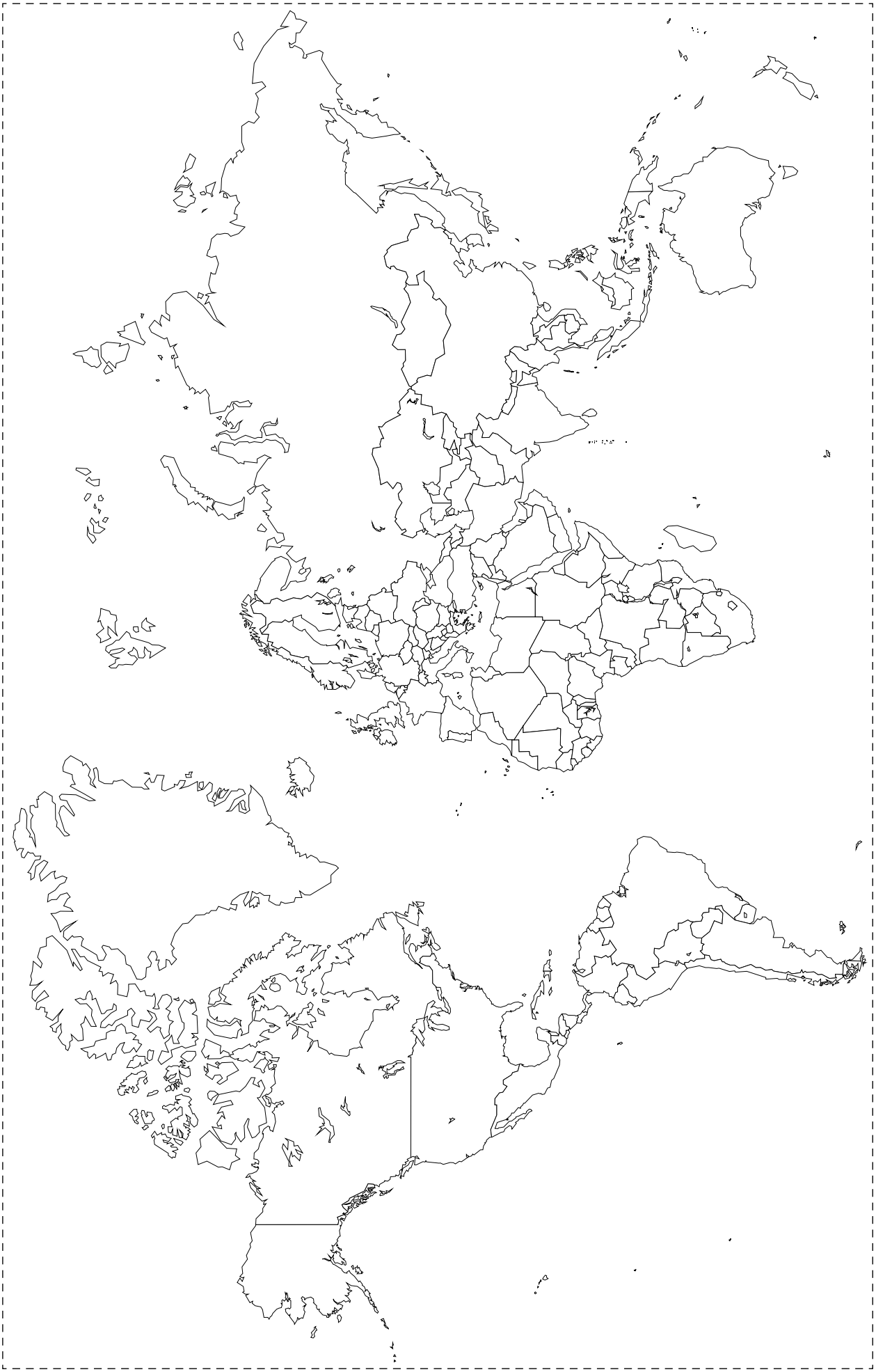
2. When all teams have finished, examine the world map. Do you see any trends in the large map in the distribution of HIV/AIDS? Discuss your observations with your teammates.

3. Write a short paragraph describing the trends you observed.

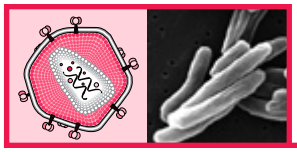
4. Use the "World Map" page to illustrate your observations.

5. Based on your observations, speculate on the general region in the world where HIV/AIDS is likely to have originated. Write your answer below.

6. Imagine that you are an epidemiologist. In what ways could you confirm your speculation about the origin of HIV/AIDS? Share your ideas with your team and write them on the back of this sheet of paper.



Source: Wikimedia Commons.



Mycobacterium tuberculosis bacteria. CDC \ 1997 Ray Butler, Ph.D., Janice H. Carr.

Team Cards

1 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Afghanistan	0.01
Bermuda	0.30
Botswana	24.80
Chad	3.40
Denmark	0.20
El Salvador	0.80
France	0.40
Guyana	1.20
Indonesia	0.20
Jordan	0.10
Luxembourg	0.30
Mauritius	1.70
Rwanda	2.90
Singapore	0.10
Sudan	1.10
Togo	3.20
Venezuela	0.70

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).

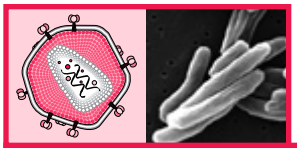
2 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Algeria	0.10
Bahamas, The	3.10
Bulgaria	0.10
Chile	0.40
Congo, Democratic Republic of the	4.20
Ecuador	0.40
Ghana	1.80
Israel	0.20
Kazakhstan	0.10
Lesotho	23.60
Mali	1.50
Niger	0.80
Oman	0.10
Panama	0.90
Saudi Arabia	0.01
Tanzania	5.60
United States	0.60

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).



Mycobacterium tuberculosis bacteria. CDC \ 9997 Ray Butler, Ph.D., Janice H. Carr.

Team Cards

3 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Angola	2.0
Bangladesh	0.10
Cambodia	0.50
Cote d'Ivoire	3.40
Germany	0.10
Guinea-Bissau	2.50
Haiti	1.90
Japan	0.10
Kyrgyzstan	0.30
Malawi	11.00
Morocco	0.10
New Zealand	0.10
Paraguay	0.30
Serbia	0.10
Sri Lanka	0.10
Tajikistan	0.20
United Kingdom	0.20

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).

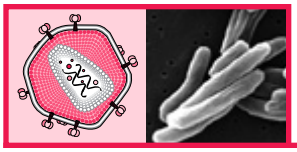
4 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Argentina	0.50
Benin	1.20
Brunei	0.10
Central African Republic	4.70
Czech Republic	0.10
Equatorial Guinea	5.0
Finland	0.10
Guinea	1.30
Hong Kong	0.10
Iraq	0.10
Madagascar	0.10
Mozambique	11.50
Norway	0.10
Qatar	0.10
Sierra Leone	1.60
Switzerland	0.40
Vietnam	0.40

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).



Mycobacterium tuberculosis bacteria. CDC\9997 Ray Butler, Ph.D., Janice H. Carr.

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5 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Armenia	0.10
Belize	2.30
Brazil	0.60
Cape Verde	0.04
Djibouti	2.50
Fiji	0.10
Guatemala	0.80
Iceland	0.30
Jamaica	1.70
Lebanon	0.10
Namibia	13.10
Nepal	0.40
Peru	0.40
Senegal	1.00
Slovakia	0.10
Syria	0.10
United Arab Emirates	0.20

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).

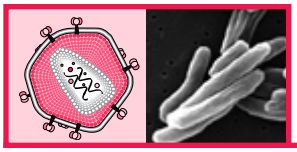
6 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Australia	0.10
Belarus	0.30
Bolivia	0.20
Canada	0.30
Congo, Republic of the	3.40
Egypt	0.10
Ethiopia	2.10
Greece	0.10
Ireland	0.20
Kuwait	0.10
Lithuania	0.10
Russia	1.0
South Africa	17.80
Spain	0.50
Svalbard	0.00
Uzbekistan	0.10
Yemen	0.10

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).



Mycobacterium tuberculosis bacteria. CDC\1997 Ray Butler, Ph.D., Janice H. Carr.

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7 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Austria	0.40
Barbados	1.40
Burkina Faso	1.20
Cameroon	5.30
Cuba	0.10
Dominican Republic	0.90
Eritrea	0.80
Gambia, The	2.0
Italy	0.30
Laos	0.20
Maldives	0.10
Mongolia	0.10
Nigeria	3.60
Portugal	0.60
Swaziland	25.90
Thailand	1.30
Uruguay	0.50

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).

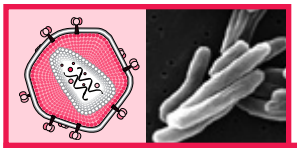
8 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Azerbaijan	0.10
Bosnia and Herzegovina	0.10
Colombia	0.60
Cyprus	0.10
Estonia	1.20
Honduras	0.80
Iran	0.20
Libya	0.30
Netherlands	0.20
Philippines	0.10
Romania	0.10
Slovenia	0.10
Sweden	0.10
Trinidad and Tobago	1.50
Turkey	0.10
Ukraine	1.10
Zambia	13.50

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).



Mycobacterium tuberculosis bacteria. CDC \ 9997 Ray Butler, Ph.D., Janice H. Carr.

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9 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Bahrain	0.20
Bhutan	0.20
Burma	0.60
China	0.10
Croatia	0.10
Georgia	0.10
Hungary	0.10
India	0.30
Korea, South	0.10
Latvia	0.70
Macedonia	0.10
Malta	0.10
Pakistan	0.10
Papua New Guinea	0.90
Somalia	0.70
Tunisia	0.10
Zimbabwe	14.30

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).

10 Adult* HIV/AIDS Prevalence Rate by Country

* Persons between the ages of 15 and 49 who are infected.

Locate the following countries on the world map. Place a colored pin or colored dot in the center of each country with different colors representing the percentage of people in each country who are living with HIV/AIDS.

Belgium	0.20
Burundi	3.30
Comoros	0.10
Costa Rica	0.30
Gabon	5.20
Kenya	6.30
Liberia	1.50
Malaysia	0.50
Mauritania	0.70
Mexico	0.30
Moldova	0.40
Nicaragua	0.20
Poland	0.10
Suriname	2.40
Turkmenistan	0.10

Source: *The World Factbook,* U.S. Central Intelligence Agency (2009 estimates).