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Battling with Infectious Diseases

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by Sheila M. Martin-Corbin

Introduction

During my teaching career at Cooperative Arts and Humanities Magnet High School, I have taught different science courses including biology in grade 10, and anatomy and physiology in grade 12. At Coop High School, much emphasis is placed on the specialized Arts classes to be integrated with the academic courses, the goal being to improve student academic performance. Teachers are encouraged to collaborate and team teach in an effort for students to make the connections to real life experiences and experience meaningful and challenging performance tasks.

My goal is to engage students during class and further develop their critical thinking skills, and successfully meet state standards as described in Unit 5 on Diseases and Populations. According to standard D32, students should be able to describe how bacterial and viral diseases are transmitted and be able to explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases. This goal would be achieved through activities such as class debates, discussions, presentations, hands-on activities and experimental design. I would also like for my 10th grade students to explore scientific investigations that model transmission and spread of an infectious disease and provide opportunities for students to conduct research, role play and work in small teams to examine case studies of infectious diseases from different countries and evaluate varied approaches in solving health-related problems caused by infectious diseases.

Objectives

At the end of this unit students in my 10th grade biology class will be able to:

1. Compare infectious and non-infectious diseases, giving examples.
2. Identify pathogens as bacterial or viral.
3. Describe how bacterial and viral infectious diseases are transmitted.
4. Explain how tissues become infected and how the body fights off germs.

5. Explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases.
6. Create a tool, e.g. a pamphlet to inform others about the Immune System and precautionary measures about the spread of pathogens.

Teaching Strategies

Students will respond to pre-assessment questions on the Immune System to assess their prior knowledge of the subject matter and to clarify any misconceptions.

Students will conduct a lab activity, using baking soda solution and red cabbage juice to simulate the spread of disease from one person to another.

Students will work in small groups and conduct research on assigned infectious diseases. Each group will be assigned 3-5 similar infectious diseases. Students will be given class time to research the diseases as a team based on a set of criteria, including cause and symptoms of the disease as related to body temperature, pain, weight fluctuations and/or other noticeable changes in behavior. After the research work is completed, the teacher will review and discuss the research notes with each group. Students will be nominated by the teacher to play the role of specialist for the disease and students to act as patients having the infectious disease. With help from group members the patients nominated by the teacher will compose a story about their condition prior to the doctor's visit. These stories will be reviewed by the teacher who will then prepare an analysis sheet with evidence for the class at the end of the doctor's visit. Each specialist will be provided with a copy of each patient's chart for taking notes during his or her visit. The specialist may refer to his or her research notes as a guide for asking pertinent questions of the patient and to diagnose the disease. This activity will culminate with a dialogue of the diagnosis session of the disease for a better understanding of disease transmission and to debate whether or not the diagnosis is correct based on the clues and information shared by the patients.

Students will create an informational pamphlet or a power point presentation on a health related issue or topic as a way to educate others about the spread of infectious diseases and methods of prevention. The case study of Ryan White's struggle against HIV/AIDS and his decision to become proactive and educate others about this deadly disease will also be discussed.

Students will be able to explain the importance of taking the responsibility for health behaviors and weigh the consequences of individual choices and decisions in saving lives.

Concepts

(adapted from www.seplessons.org/node/226)

A **disease** is any change that disrupts the normal functions of the body. It may be caused by factors originally from an external source, such as infectious disease, or it may be caused by internal dysfunctions, such as

autoimmune diseases. Diseases usually affect people not only physically, but also emotionally, and can alter one's perspective on life, and one's personality. For example, a traumatic brain injury caused by a car accident or a mother's exposure to toxic chemicals while pregnant can increase her risk of being in a mental state of mind. This condition can impact one's thinking, feeling or even one's mood and prevents the body or mind from working normally. A combination of various causes, such as a genetic defect (internal) or environmental stress (external) can influence one's health condition. As students become more informed of the causes, symptoms and effects of infectious diseases, they will hopefully practice precautionary measures to avoid or delay the onset of such diseases.

Infectious diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi; these diseases can be spread, directly or indirectly, from one person to another. Unfortunately, harmful microscopic pathogens can be easily transmitted into our bodies through our respiratory system thereby making a person quite vulnerable to become infected with the germ.

Pathogens causing diseases can infect the body and can spread via indirect or direct contact.

Indirect contact

Typically, germs can linger on an inanimate object, such as a tabletop, doorknob or faucet handle for long periods of time. When a person touches the same doorknob or object which was grasped by someone ill with the flu or a cold, for example, he or she can pick up the germs left behind by that infected person. If she then touches her eyes, mouth or nose before washing her hands, she takes the risk of becoming infected with the pathogen-causing disease. Consider the flu virus, which could become weakened and cannot easily survive drying out; however, this virus can become more infectious in colder temperatures when spread through droplets such as the air. Therefore, when an infected person coughs or sneezes, droplets of the microorganism are expelled into the air and infect other people.

Droplets travel only about three feet because they're usually too large to stay suspended in the air for a long time. However, if a droplet from an infected person comes in contact with one's respiratory organs such as the nose or mouth, he or she may soon experience symptoms of the illness. Crowded, or indoor environments can favor airborne pathogens and may promote the chances of droplet or particle transmission of the germ. Such environmental conditions may explain the increase in respiratory infections during the winter months.

Tuberculosis and SARS are two infectious diseases usually spread through the air, in both particle and droplet forms. Misconceptions and myths of how people get the cold can be discussed and clarified at this time.

Some diseases that are commonly spread by coughing or sneezing include:

- Common cold,
- Influenza,
- Strep throat
- Tuberculosis,
- Whooping cough

Contaminated foodstuffs or drinking water are other ways by which diseases are spread. The risk increases

when people do not wash their hands before preparing food, or untreated sewage being released into a drinking water supply. E. coli is a bacterium present in certain foods, such as undercooked hamburger or unwashed fruits or vegetables. When a person eats foods contaminated with E. coli, chances are he or she will experience food poisoning and become infected with the bacterium. This is a typical mode of transmission for diseases such as cholera, hepatitis A , polio and salmonella.

Vector-borne diseases, caused by pathogens, transmitted by insects and ticks is another method of spreading infectious diseases. However, the best way to fight the disease is to avoid being bitten by such insects and controlling the insect population. If preventative measures fails, drugs like antibiotics have been developed to kill the bacteria without harming human cells. Some diseases that can be vectored to humans include malaria, yellow fever, dengue fever, West Nile virus, and Lyme disease.

The vector-borne spread of germs happens when an insect that carries the germ on its body or in its intestinal tract lands on a person or bites the person. The germs travel into the body and can make the person sick. They use the insect's body to multiply, which is necessary before the germs can infect a new host. [1]

Direct contact

Infectious diseases tend to spread more rapidly through direct versus indirect contact.

Three different ways in which infectious diseases can be spread directly are described below.

- ***Person to person -*** The most common way for infectious disease to spread is through the direct transfer of bacteria, viruses or other germs from one person to another. This can occur when an individual with the bacterium or virus touches, coughs on or kisses someone who is not infected. These germs can also spread through the exchange of body fluids from sexual contact or a blood transfusion.
- ***Animal to person.*** An animal or pet infected with a disease can make one sick if scratched or bitten by that animal or pet.
- ***Mother to unborn child .*** A pregnant woman may pass germs that cause infectious diseases on to her unborn baby. Germs can pass through the placenta, as is the case of the AIDS virus and the toxoplasmosis parasite. Pregnant women with the HIV virus may also receive the drug, Retrovir by intravenous injection to help block transmission of the aids virus to her unborn child.

Sexual activity is another mode of transmission of infectious diseases. Transmission is either directly between surfaces in contact during intercourse, or from secretions which carry infectious agents that get into the partner's blood stream.

- Genital warts
- Gonorrhea
- Hepatitis B
- Syphilis
- Herpes
- HIV/AIDS
- Chlamydia

Some ways to prevent the spread of infectious diseases and decrease the risk of infecting oneself or others:

- **Wash your hands thoroughly when preparing foods, before eating** and after using the toilet.
- **Get vaccinated and keep a record of your immunizations.**
- **Avoid going to work when you have a fever, and or feeling sick.**
- Refrigerate leftovers immediately
- **Practice safe sex at all times.**

Non-infectious diseases are not caused by a pathogen and cannot be shared from one person to another. It may be caused by factors such as the environment, nutritional deficiencies, lifestyle choices, or genetic inheritances. Unlike infectious diseases, non-infectious diseases are not communicable or contagious, although some kinds can be passed down genetically to the children of a carrier. Examples of such diseases include cancer, muscle & joint disease, diabetes and kidney disease to name a few.

Some ways to prevent noninfectious diseases are:

- indulge in a healthy lifestyle - exercise regularly, and eat balanced meals
- avoid smoking and exposure to cigarette smoke
- avoid tanning beds, and prolonged sun's rays as this can lower one's risk of getting cancer
- annual visit to the doctor, screening examinations for people at high risk for cancer
- avoid foods and substances that cause allergic reactions
- watch for and manage any noticeable symptoms of genetic disorders

Hygiene Practices

Hygiene practices are employed as preventative measures to reduce the incidence and spreading of disease. In general, hygiene mostly means practices that prevent spread of disease-causing organisms. Since cleaning processes, say, hand washing, remove infectious microbes as well as dirt and soil, they are often the means to achieve home, medical and everyday life hygiene **.** Medical hygiene pertains to the hygiene practices related to the administration of medicine, and medical care, that prevents or minimizes disease and the spreading of disease. Home hygiene pertains to the hygiene practices that prevent or minimize disease and the spreading of disease in the home and in everyday life settings such as social settings, public transport, the work place, public places to name a few. Hygiene in home and everyday life settings plays an important part in preventing spread of infectious diseases. It includes procedures used in a variety of domestic situations such as hand hygiene, respiratory hygiene, food and water hygiene, general home hygiene, hygiene of environmental sites and surfaces, care of domestic animals, and home healthcare.

At present, these components of hygiene tend to be regarded as separate issues, although all are based on the same underlying microbiological principles. Preventing the spread of infectious diseases means breaking the chain of infection transmission. The simple principle is that, if the chain of infection is broken, infection cannot be easily spread. Thus, when circumstances combine, people become exposed, either directly or via food or water, and can develop an infection. Good home hygiene means targeting hygiene procedures at critical points, at appropriate times, to break the chain of infection, thus, eliminating germs before they can spread further.

Structure and physiology of Bacterial Cells

Bacteria causes disease by invasion of the cell and toxin production. These invasive bacteria establish a protected niche, within which they survive and replicate inside the cell, causing an infection. When bacteria invade a host, injury to and destruction of the host cell and tissues occurs at the site of invasion. The ultimate result of bacterial invasion is due in greater part to the location of the disease process and how critical the involved tissues are to the survival of the host.

Bacteria may be surrounded by three surface layers namely, a capsule, cell wall and cell membrane. The cell wall is composed of complex carbohydrates and surrounds the cell membrane of the cell. It also protects the bacterium from injury and regulates the movement of molecules into and out of the cell. When the cell wall of the bacteria is weakened or damaged by antibiotics such as penicillin, it will render the bacteria less virulent and harmful to its victim.

In pathogenic bacteria, virulence may be related to the presence of a capsule which protects the cell from phagocytosis. Hence, the loss of the capsule may result in a parallel loss of virulence. If the wall of a bacterium is damaged or removed, significant morphologic alterations may occur. [2]

Pre-assessment Questions

The following questions can be discussed in small groups or as a whole class to assess students' knowledge of the unit topic on transmission of infectious disease.

Teacher will record the following words on the chalkboard **: infectious, disease, vector, bacteria, pathogen, genetic, direct transmission, indirect transmission, contagious, virus.**

1. Have students write ten sentences using each word once from the list provided above.
2. Have students then write five sentences that includes two terms from the list provided.
3. Permit students to volunteer and share their sentences with the whole class.
4. Teacher will discuss any misconceptions mentioned during the sharing period.

Students will respond and discuss the following questions in small groups.

- name two infectious diseases you know about and describe their symptoms.
- What makes the diseases you mentioned in question #1 contagious?
- What precautionary measures can you take to minimize the transmission of infectious diseases?

Activity #1 Lab. Investigation: "Simulation of the spread of an infectious disease"

Objectives :

1. Students will be able to understand how infectious disease spread through a population.
2. Students will be able to identify behavior that increase or decrease the risk of infection.
3. Identify and use the elements of scientific inquiry to solve problems.
4. Use and interpret data collected to formulate conclusions.

Introduction

Pathogens are spread by a variety of vectors including the air, food, water and physical contact. This activity simulates disease transmission through exchange of bodily fluids in a manner similar to HIV and hepatitis. An infected person may or may not show symptoms of the disease and is referred to as a 'carrier' of the virus. Thus, a person being unaware and misinformed regarding his or her health, can impact the spread of a virus within a population.

Materials

- disposable cup
- disposable pipette
- tap water
- sodium bicarbonate
- phenolpthalein (indicator

Lab. Safety Measures

Students must wear safety eye goggles. Students must wash their hands after the lab. simulating activity. If there is a spill, students must wash the affected area with water. Students must NOT taste or smell any of the liquids used in the laboratory investigation.

Procedure :

1. Each student obtains a small vial containing a clear liquid and an eyedropper. Tell students that each vial represents their body and that one student is "infected" with a contagious disease. It is unknown to the students who that person is.
2. Students will interact with a partner and simulate the exchange of body fluids by placing five drops of their liquid into their partner's vial without making contact with the other students' liquid or vial. (Both partners will fill up their eyedropper with liquid from their vial and place five drops into the vial of their partner).
3. Students will move around the classroom and find another partner to exchange liquid with and avoid contamination with the liquids. Students will empty the remaining liquid into their vial and use their eyedropper to mix the liquid. Students will repeat steps #2 and #3 with five different students. and then return to his or her seat. Students can hypothesize the number of infected students for each interaction.
4. Each student will test his or her liquid for the infectious disease by placing 1-2 drops of phenolphthalein,

the indicator into his or her vial. If he or she tested positive, the liquid will turn pink. If tested negative, the liquid will remain clear.

5. Have students record the cup number of the students that they interacted with in their charts, and create a flow chart to help them figure out who infected them and whom they subsequently infected. Also, eventually identifying the origin of the disease.
6. The teacher will then record the results in a data chart on the chalkboard. Have students graph the number of infections versus the number of interactions. Students may estimate the number of infected students after 5 interactions. Students will notice that the number of infections seem to double with each additional interaction.

Exit Pass **:**

Students will discuss how this type of activity compare to the transmission of a real disease such as HIV.

Students will determine who infected them and who they subsequently affected.

Students will explain how an airborne disease would spread differently and why? Discuss ways of preventing or 'catching' an airborne disease.

Students will suggest precautionary measures that can be taken to prevent the transmission of infectious diseases.

Exchange Activity Sheet

	CUP Number	**Test Results (+/-)**
Your Cup		
First Exchange		
Second Exchange		
Third Exchange		
Fourth Exchange		
Fifth Exchange		

Activity #2

Herd Immunity

(adapted from: www.cdc.gov/scienceambassador/lesson-plans/2013-herd-immunity.pdf and http://www.ovg.ox.ac.uk/herd-immunity)

When a high percentage of the population is vaccinated, it is difficult for infectious diseases to spread because there are not many people who can be infected. For example, if someone with measles is surrounded by people who are vaccinated against measles, the disease cannot easily be passed on to anyone, and it will quickly disappear again. This is called ‘herd immunity’, and it gives protection to vulnerable people such as newborn babies, elderly people and those who are too sick to be vaccinated.

However, "herd immunity" does not always protect people against those diseases which can be prevented by

use of a vaccine. For example, tetanus, is caught from a bacteria in the environment, not from other people with the disease. Therefore, regardless of how many people around you are vaccinated against tetanus, this population of people will not protect other people from being inflicted with tetanus. Herd immunity is only effective when most people in the population are vaccinated against the disease. If people are not vaccinated, herd immunity is not guaranteed to protect them.

If you live in an area where vaccine coverage is low, and your child is not vaccinated, it's quite likely that many of the people they come into contact with will not be vaccinated either. If one of these people contracts an infectious disease like measles, that person can transmit the disease to the other unvaccinated people they come in contact with, and cause the disease to spread very rapidly through the population.

Unlike vaccination, herd immunity does not give a high level of individual protection, and should not be regarded as a good alternative to getting vaccinated. [3]

Some people in the community rely on herd immunity to protect them. Examples of such groups of people are particularly vulnerable to disease, and most likely cannot safely receive vaccines:

- People without a fully-working immune system
- People on chemotherapy treatment whose immune system is weakened
- People with HIV
- Newborn babies who are too young to be vaccinated
- Elderly people
- Patients who are very ill in the hospital

Overview: Laboratory investigations 1 and 2 were adapted from the SEP and CDC website. Procedural steps and lab rules (coincides with my classroom lab. rules) were modified and made simple for students' engagement, understanding of concepts and having fun doing hands-on science.

With the on-going challenges presented in my science classes, the design and format of laboratory activities is constantly dictated by availability of equipment and materials and the make-up of my classes.

Objectives: 1. Describe the concept of herd community and why it is important.

1. Discuss reasons why some people are not immunized.
2. Calculate number and percentage of students in class need to be

immunized to prevent transmission of disease.

Materials: Bag of colored jelly beans (red, blue and green)

Brown paper lunch bag

Soft stuffed animal (small)

Red jelly bean will represent students with the communicable disease

Blue jelly bean will represent students unvaccinated

Green jelly bean will represent students being vaccinated

Procedure:

1. Place equal number of green and blue jelly beans in brown lunch bag with two red jellybeans. The total number of jelly beans in bag must total the number of students in the class. For example, in a class of 20 students, there should be two red jelly beans, nine blue jelly beans and 9 green jelly beans. Emphasize to students not to eat the jelly beans as they will be used again in the game.
2. Have each student randomly pick one jelly bean from the bag.
3. Tell all students with a red jelly bean to remain in their assigned seats while students with blue and green jelly beans should stand. Explain to students that when the teacher says, "strike" they will throw the stuffed animal at anyone who is standing (with a blue or green jelly bean).
4. Explain to students that vaccinated students with green jelly beans are protected and allowed to use their hands to deflect the stuffed animal to keep from getting hit with the stuffed animal. Unvaccinated students with blue jelly beans are not protected and must keep their hands to their side. Any unvaccinated student who gets hit must sit down. They are now sick and will be given a stuffed animal to throw at students standing. Vaccinated students who get hit should remain standing. Students will eventually noticed that those students who were not vaccinated will get hit with the stuffed animal and have to sit.
5. Establish the number of throws per student. Students will notice that the number of sick people begin to increase. Teacher may decide on the number of throws according to the severity of the disease. For example, a moderately contagious disease such as influenza could be represented by each sick student (having a red jelly bean) getting four throws whereas a highly contagious such as measles could be represented by each sick student getting ten throws.
6. Collect the colored jelly beans and reassign them. Again, tell the sick students to sit, while the well students remain standing. This time, all unvaccinated students will stand inside a barricade of vaccinated students.
7. The sick students will try to hit the unvaccinated students with the stuffed animal. Students will soon discover that they will have difficulty doing so because they are protected by students who are vaccinated. Explain to students that eventually a point will be reached when it would be virtually impossible for those students inside the circle (with blue jelly beans) to get hit with the stuffed animal. This point represents the threshold for herd immunity.

Activity 3

This activity promotes the practice of healthy behaviors.

Objective: Students will design a poster or a brochure to illustrate a healthy behavior which will help to prevent the spread of infectious disease. Students will summarize the message of their illustration on their poster or brochure describing how diseases are spread.

Activity 4

Students will work in small groups to examine real-life cases of infectious diseases from different countries and diverse approaches in solving the health problems caused by infectious diseases. Students learn about people and organizations that help prevent the spread of infectious diseases.

Identify health challenges and solutions in the following case studies:

1. Diarrheal diseases
2. HIV/AIDS-Ryan White
3. Smallpox
4. Malaria

Case Study Note-taking Sheet

Title: _____

Student Name: Case:

Summarization:

Summarize the Case Study by answering the following questions:

1. What is the health challenge highlighted in your case study?
2. What are some causes of the health challenge?
3. What are the solutions applied to the health challenge?
4. How does the solution(s) address the health challenge?
5. Who is involved in solving or addressing the health challenge?
6. Do you consider the solution(s) effective/successful? Why or why not?

Activity 5

Introduction:

Antibiotics and ribosomes: Inhibitors of protein synthesis

Both bacteria and human cells possess similar cell organelle, ribosome, for protein synthesis. However, bacterial and eukaryotic cells have ribosomes which are different in structure in regards to their molecular weight and shape. This difference allows antibiotics the ability to specifically target one type of cell and not the other.

Tetracycline, an antibiotic, inhibits bacterial growth by stopping protein synthesis on ribosome. This antibiotic is capable of accumulating in high concentrations in the cytoplasm of bacterial cells. However, in human cells, tetracycline does not accumulate in such concentrations to stop protein synthesis.

Antibiotics bind to subunits at specific sites on the ribosomes, preventing the attachment of tRNA, and halting the growth of the polypeptide chain. [4]

Germs are all around us. These microorganisms can be found on many different surfaces such as door knobs, computer mouse, cell phone, desktops, tables to name a few, which are culprits for causing a person to become sick.

For this reason, we need to control and/or minimize the number of microbes around us in an effort to diminish our chances of becoming ill.

Objective: Students will test different household substances to see which one kills the most bacteria on the surface of their desks. Students will grow colonies of bacteria on agar plates, which provides food and vitamins for bacterial growth. Prior to collecting bacteria cultures, the surface of the desks should be cleaned with the different disinfectants including water.

Materials:

Disinfectants **:**

Lysol spray

10% Bleach solution

70% Rubbing alcohol

Distilled water

Safety eye goggles

Disposable gloves

Nutrient agar plates

Masking tape

Table/desk tops

Cotton balls

Permanent marker

Sterile cotton tipped applicator

Tweezers

Small plastic cups for disinfectant

Procedure:

1. Use masking tape to section off four equal squares on desk/table top. Number each square 1 through 4.
2. With protective gear on, use cotton ball to cleanse each square with a different disinfectant. Be sure to

control all variables. For example, use the same amount of each disinfectant to cleanse the designated area.
3. Allow each area to air dry for a specified amount of time.
4. Use a clean cotton swab to obtain bacterial culture from each square onto corresponding marked nutrient agar plate. (Distilled water will be used as a negative control).
5. Be sure not to let the tips of the cotton swab to contact or contaminate any other section of the desk top during the application process.
6. Carefully replace lids on agar plates and place in an incubator or warm place at room temperature for 1-2 days.
7. Observe any growth of bacterial colonies on agar plates.
8. Count the number of bacteria colonies on each nutrient agar plate and record results and any other observations in the data table. Pictures may also be taken of the bacterial colonies for comparison.
9. Graph the results and compare the activities observed of the different disinfectants resulting in growth or no growth of bacteria.
10. Dispose of bacterial culture according to the teachers direction and be sure to wash your hands thoroughly after handling bacterial specimen and other materials used in this laboratory investigation.

Data Table

Petri dish #	Name of disinfectant	Number of bacteria colonies	Observation

Reading List

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2. Friedlander Jr., Mark P. *Outbreak: disease detectives at work* . Copyright 2003 by Lerner Publications Company describes the field of epidemiology, presenting historical and modern case studies- biological explanations of some diseases and discussions of the microbes most likely to be used by terrorists.
3. Friedlander Jr., Mark P. & Phillips, Terry M. *The Immune System.* Copyright 1998 by Lerner Publications Company describes the major components of the Immune System.
4. Henderson, Brian, Michael Wilson, Rod McNab, Alistair J. Lax. *Cellular Microbiology: Bacteria-Host Interactions in Health and Disease* . Copyright 1999 by John Wiley & Sons Ltd. describes how bacteria interact with host eukaryotic cells during infections and explains the interactions with the immune system.
5. Klainer, Albert & Irving Gels. *Agents for Bacterial Disease.* Copyright 1973 by Harper & Row, Publishers, Inc. provides basic information concerning bacterial physiology and biochemistry.
6. Ollhoff, Jim . Copyright 2010 by Abdo Consulting Group, Inc. *The Flu* fascinating photos and illustrations associated with the flu.
7. Silverstein, Dr. Alvin, Virginia and Laura Nunn. *Common Colds.* Copyright 1999by Grolier Publishing explains how people catch colds and how the body fights germs; what precautions people can take against them.

Websites

1. http://apps.nlm.nih.gov/againsttheodds/get_involved/index.cfm#JTC
2. http://shs.sdsu.edu/healthpro/brochures/commoncold.html
3. http://www.pbs.org/wgbh/nova/typhoid/ discusses Nova video: The most dangerous woman in America, the story of Typhoid Mary
4. http://www.nlm.nih.gov/againstthe odds/HIV/AIDS (Ryan White)
5. http://www.microbeworld.org/ describes different types of microbes
6. www.colorado.edu/outreach/BSI/K12/activities/interactive/actidoutgroundz.htm
7. www.eduplace.com/rdg/gen_act/survival/survive.html has all kinds of activities for students
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14. Wikipedia contributors (2013), July 30). Disinfectant. https//en.wikipedia.org/w/index.php?title=Disinfectant&oldid=566424697
15. www.health.howstuffworks.com/human-body/systems/.../immune-system3.htm
16. www.wisekeakhealth.com/how-does-the-human-body-fight-infections.htm Article: "Who is afraid of a little Vaccine?" by Jeffrey Kluger

Appendix - Implementing District Standards

The culminating unit for the tenth grade biology curriculum (State of Connecticut Core Science Curriculum) relates previous topics covered during the academic year to the interactions of living organisms in their environment. In accordance with the New Haven Public School District Science Standards, students will be able to do the following at he end of this unit:

D39 - describe the difference between infectious diseases and genetic diseases

- describe the difference between infectious diseases and non-infectious diseases

D32 - describe how bacterial and viral infectious diseases are transmitted

- explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases.

This unit engages students in the elements of scientific inquiry so that they will become skilled to perform successfully on the District Quarterly Exams. and common assessments. Students will be encouraged to demonstrate their understanding of experimental design, making observations, and formulating conclusions based on scientific data. Students will have the opportunity to discuss, conduct research work on infectious disease transmission, and integrate the Arts in their design of a poster or brochure. This product will be shared

with their peers and will act as the vehicle for advertising healthy habits and avoid getting ill from harmful germs.

Notes

1. Vector-borne infections - article provides examples and description of disease transmission by insects and ticks - Mosquito Zone. http://www.mosquitozone.com/sites/default/files/Vector-Borne-Diseases.pdf
2. Structure of bacterial cells: Online textbook of bacteriology, Kenneth Todar, PhD
   http://textbookofbacteriology.net/structure.html
   http://www.abpischools.org.uk/page/modules/infectiousdiseases_pathogens/pathogens7cf
3. Vaccines & Immunizations - contains information on all vaccine preventable diseases. http://www.cdc.gov/vaccines/
4. Fight the pathogens - Wikipedia contributors(July 30, 2013). Disinfectant.
   https://en.wikipedia.org/w/index.php?title=Disinfectant&oldid=566424697