Hiding in Plain Site:
The Immune System, Tuberculosis, and Antibiotic Resistance

Mark Stephansky
mark.stephansky@whrsd.org

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Teacher Guide

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TEACHER GUIDE

I. **Overview**

should also be familiar with the concepts of evolutionary theory. Teachers are encouraged to utilize the brief online video from PBS's Teacher's Domain, *Evolving Ideas: Why Does Evolution Matter Now?* as a lead in to this unit. This video will introduce multi-drug resistant tuberculosis and highlight one reason why it is important to understand evolution. (http://www.teachersdomain.org/)

Another good resource for immune system information comes from the Harvard University Life Sciences/HHMI Outreach Program. Here you can find a number of online lectures and animations for the immune system. http://outreach.mcb.harvard.edu/index.htm Look for video "Understanding Resistance to Tuberculosis" by Dr. Barry Bloom at http://outreach.mcb.harvard.edu/videos.htm

III. Student Outcomes:

The content of this unit covers the immune syst37G04( )-0.4g,.50724( )-06.28802258417 4.5687450657(n)9.1637(8)3(4)-(

- For Bacterial Transformation – most materials are found in the kit. Items not found in the kit include:
    - Marker
    - Clear tape
    - Microfuge tube rack
    - Container with ice
    -

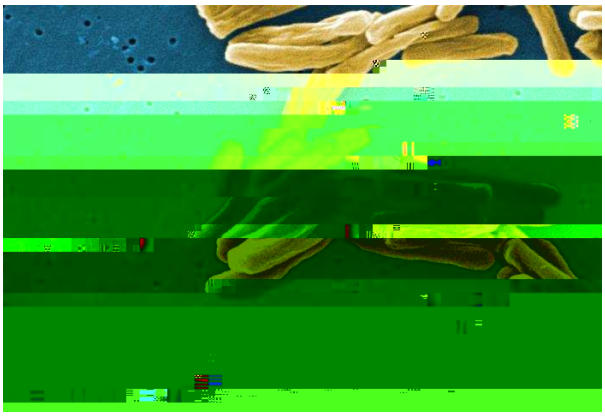
STUDENT SECTION

I. Rationale

As you are reading this laboratory guide your body is under attack! Pathogens – viruses, bacteria, protists and fungi – are trying to penetrate your protective outer coverings in an attempt to get a foothold and carry out their own life activities. When you think about it, your body is an ideal place for pathogens to grow and reproduce as there is a rich supply of nutrients within a protected setting. And these pathogens are everywhere, on every surface, in every environment. What's keeping them at bay is your immune system.

V. Discussion/Analysis

Throughout this unit you have learned about the immune system, how the principle of antibody/antigen interaction is used to indirectly test for the presence or absence of disease causing pathogens such as HIV or Mycobacterium tuberculosis, tuberculosis disease and how bacteria evolve through transformation. As you have no doubt learned during the Tuberculosis Web Investigation/Fact Sheet lesson, MTB is the scourge that it is upon humanity because of its unique growth and anatomical characteristics. It has a cell wall that is particularly good at protecting the cell and the bacterium has a very slow cell division rate. This slow reproduction rate along with human error during the long treatment process allows the microbe sufficient time to mutate via evolution-based methods.



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8. The cytotoxic T cell has T-cell receptors that are specific for the displayed antigen on the infected cell.
9. The cytotoxic T cell binds to the infected cell displayed antigen and becomes activated.
10. Once activated the cytotoxic T cell proliferates. The cytotoxic T cells all have the same specificity to the antigenic determinant. Once it encounters the same antigen on another infected cell, the cytotoxic T cell releases perforin molecules which poke holes in the target cell causing it to lyse and die.
11. All body cells display proteins on their surface. Early in their development cytotoxic T cell as well as Helper T cells undergo a screening test to make sure they do not recognize “self” cell proteins. Foreign cells have ‘nonself’ proteins and thus are recognized and attacked. Cancerous cells produce mutant proteins that are also recogni

4. Systemic Lupus Erythematosus
5. Sera/Serum is a clear watery fluid obtained after removing blood cells and other components from blood by centrifugation that will contain antibodies. The purple tube was added as a counterbalance in the centrifuge.
6. Serial dilutions are made in order to determine the level of the antibody in the sample. Highly diluted samples will not appear positive if there is a low titer of antibody in the sera.
7. A plastic 96-well ELISA Microplates, Flat-bottom
8. Proteins such as antigens and other biological materials can, under proper conditions, physically bind to the plastic material composing the wells of the ELISA plate.

   The coating procedure must be done carefully. If too little antigen is used, bare spots will permit antibody or other protein to stick, leading to a false-positive reaction. If too much antigen is used, the excess will be able to bind SLE antibody from patient sera but then will be washed away, creating a false-negative reaction.

   The addition of antigen is the crucial first step in the chain of recognition events between antigen and antibody that will end with the formation of color from the enzyme bound to the second antibody.
9. An ELISA may be subject to many errors. One is that the biological and chemical reagents used in ELISA can change with time. Anothe309(i)-5.007(m)15.6722(e)-(h)-0.95716450724(n)-0324(l)-5.15007(o)-0.9

14. ELISA Protocol summary
    a. The sample is bound to the ELISA plate
    b.

may also become involved with the infection and usu

- "Chopin and The Nightingale": a dramatic reading with music in six acts for narrator, two sopranos and piano. It enacts the true-life romance of Chopin and Jenny Lind with reference to The Nightingale story by Hans Christian Andersen. Playwrights: Cecilia and Jens Jorgensen,Icons of Europe (Brussels).

Novels:

- The latter half of Erich Maria Remarque's novel Three Comrades focuses on Patricia Hollman's love of life in light of her ultimately futile struggle with tuberculosis.
- Tuberculosis patients were frequent characters in 19th century Russian literature, examples of which include Katerina Ivanovna from Fyodor Dostoevsky's Crime and Punishment, Kirillov from Dostoevsky's Demons (aka The Possessed), and Ippolit and Marie from Dostoevsky's The Idiot.
- Thomas Mann's The Magic Mountain takes place at a S

- Raistlin Majere of the high fantasy Dragonlance series is afflicted with a magical illness that closely mirrors tuberculosis.
- In A Tree Grows in Brooklyn Johnny Nolan's eldest brother Andy becomes ill and dies from "consumption".
- Beth March, the third daughter in Little Women, die nlano272(h)-0.9794t"i s 9(f)2.3678(f)2.3678(l0.956
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yakuza (Toshiro Mifune) whose illness is being used by his organization as a biological weapon.

l. Active tuberculosis will kill about two of every three people affected if left untreated. Treated tuberculosis has a mortality rate of less than 5%. The standard "short" course treatment for tuberculosis (TB), is isoniazid, rifampicin(also known as rifampin in the US), pyrazinamide, and ethambutol for two months, then isoniazid and rifampicin alone for a further four months. The patient is considered cured at six months (although there is still a relapse rate of 2 to 3%). For latent tuberculosis, the standard treatment is six to nine months of isoniazid alone.If the organism is known to be fully sensitive, then treatment is with isoniazid, ri<-2.(a)3-0.956417(9756(b)-1(t)-2.536T2.

The good news is that HIV-infected persons with either latent TB infection or active TB diseasecan be effectively treated. The first step is to ensure that HIV-infected persons get a test for TB infection and any other needed tests. The second step is to help the people found to have either latent TB infection or active TB disease get proper treatment. Rapid progression from latent TB infection to active TB disease can easily be prevented.

n. TB bacteria can become resistant to the medicines used to treat TB disease. This means that the medicine can no longer kill the bacteria. Resistance to TB drugs can occur when these drugs are misused or mismanaged. Examples include
    - when patients do not complete their full course of treatment;
    - when health-care providers prescribe the wrong treatment, the wrong dose, or wrong length of time for taking the drugs;
    - when the supply of drugs is not always available; or
    - when the drugs are of poor quality.

o. Antibiotic resistant bacteria are resistant to treatment by first line drugs and must be treated with second line drugs which are generally more expensive and must be used for longer periods of time. In addition to the increased

particles reach the alveoli sacs in the lungs, macr

Part 5, Page 18 Suggested Rubric for Narrative Essays

	Points Possible	**Points**

- **Immune System**

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Tutorial 18.4 Cellular Immune Response

- **Tutorial 18.4 Cellular Immune Response**

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