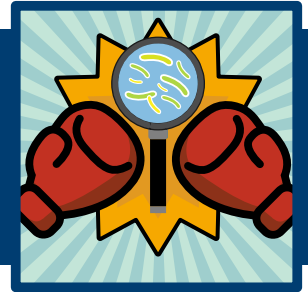


Student Background

UNIT: TUBERCULOSIS

LESSON 3: ME VS. TB - BOOSTING THE IMMUNE SYSTEM TO DEFEAT AN ANCIENT ADVERSARY

Activity 3A: Prove It With CER!



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General Information

Tuberculosis (TB), *Mycobacterium tuberculosis*, is a bacterium that is estimated to have existed nearly as long as humans. Historically, TB infection has been known by different names: white plague, phthisis, and consumption. Most people who are exposed to TB generally recover, usually without even knowing they were infected. Tuberculosis is spread as an aerosol and generally affects the lungs. When an infected person exhales, coughs, sneezes, or even sings, the TB bacteria is carried on droplets and stays suspended in the air for hours. When someone inhales these minute droplets, the TB is carried into the lungs where it attaches to cells within the lung.

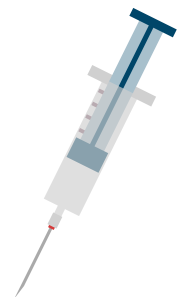
TB Treatment

Antibiotics: Antibiotics are effective at treating bacterial infections, like TB. However, since their discovery, antibiotics have been misused. The prefix “anti-” means against. The affix “-bio” means life. Antibiotics are effective against living pathogens, like TB. They are not effective against non-living pathogens, like viruses.



Prior to antibiotics, treatments for infections included stressing good personal hygiene, like hand washing, and application of alcohol to treat infected surface wounds. For internal infections, treatments were more bazaar, like bloodletting where “infected” blood was drained from the patient. The discovery of antibiotics provided medical professionals with a valuable tool to treat both surface and internal bacterial infections. Antibiotics were seen as a true medical miracle.

Drug Resistance: Antibiotics fight bacteria in different ways by targeting specific parts of the bacteria’s structure or internal function. With the discovery of antibiotics, the medical community had an effective treatment against bacterial infections. One unexpected benefit of the use of antibiotics was an eight-year increase in life expectancy. Despite the miracle of antibiotics, there has been misuse of antibiotics, including overprescribing and patients not taking antibiotics as prescribed. When patients take antibiotics, they can start to feel better in a few days. Thinking they are cured they stop taking the full prescription. However, not taking the full prescription means some bacteria may still be in the body. Having been exposed to the antibiotic but not killed, these bacteria develop resistance to future antibiotic treatments.



MIDDLE & HIGH SCHOOL LEVEL

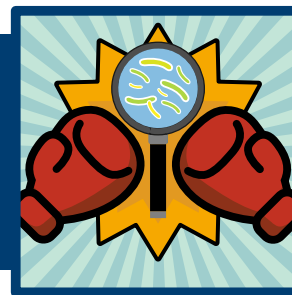
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Drug resistant bacteria result from various processes, including but not limited to:

- › **Natural Selection:** when initially exposed to an antibiotic most bacteria quickly die, but those bacteria who survive will pass on their resistance to subsequent generations.
- › **Mutations:** random mutations in bacterial DNA can create a defense mechanism against antibiotics by preventing the antibiotic from reaching its targeted structure or produce enzymes which neutralize the effects of an antibiotic.
- › **Rapid Reproduction:** bacteria reproduce rapidly, sometimes within minutes. If bacteria are resistant to antibiotics, the ability to reproduce quickly increases the number of antibiotic-resistant bacteria.

Using data from their past research, Texas Biomed scientists had evidence which showed the importance of the immune system in fighting TB. The challenge they faced was finding effective ways to fortify the immune system to fight TB without harmful side effects caused by current antibiotic therapeutics. These scientists examined outcomes of research for other “invasive” conditions in their search for protocols that effectively strengthen the immune system. One such research paper focused on cancer and the effect of Host-Directed Therapies (HDTs) on the immune system. Data from cancer research indicated the addition of HDTs, like Vitamin D, boosted the immune system. The HDTs increased the effectiveness of conventional cancer treatments and shortened the duration of treatments. The Texas Biomed scientists translated the result from cancer research and developed in vitro experiments to test the effectiveness of HDTs on the immune system to improve TB treatments.