The next step in the war against bacteria

History of Antibiotics

Currently, humans are in the post antibiotic era and soon enough it will reach a point where superbugs are going to be a common occurrence. What are antibiotics and how do they exactly help us? Good question. The antibiotics purpose is to slow down and kill bacterial growth. During the year of 1928, a man by the name of Alexander Fleming discovered the first antibiotic that would change human history as we know it. He discovered the drug penicillin which was used to treat certain infections which were caused by pathogenic bacteria one being *Staphylococcus* which is a bacterium that is mainly located on the surface of the skin. Since then, there has been plenty of advancements in this field, allowing us to progress in this long, and dangerous battle we are having with these micro-organisms that surround us every day in the millions. A few of these different types of antibiotic classes are named such as penicillin (as listed before), tetracyclines, cephalosporins, … These are just a few different antibiotic classes that we handle every-day.

Penicillin- Penicillin G is the drug that was accidently discovered by Fleming and is derived from a penicillium fungi. How they function in inhibiting bacteria is by preventing the cross linking of amino acid chains in the bacterial cell wall. This only affects newly produced bacteria; their cell walls are not thick enough yet and allows for them to rupture.

Tetracyclines- A class of antibiotics that treat infections caused by gram -negative and positive bacteria that are susceptible. It inhibits protein synthesis in the bacteria’s RNA. Doesn’t necessarily kill the bacteria but enables it from being able to multiply or reproduce.

Cephalosporins- Derived from the mold *Acremonium*, this antibiotic is very similar to penicillin, they bind and block the enzyme in the bacteria responsible for making peptidoglycan which is made up in the cell wall and makes up the thickness of it. This drug is effective against a wide range of bacteria, so they are called broad-spectrum antibiotic.

These are just a few of the different antibiotics and how they help us in defending against these small invaders. Unfortunately, we have run into an issue with antibiotics and bacteria. Throughout time, bacteria have built a resistance against certain antibiotics and they are no longer being affected by this treatment. Tetracyclines as listed above, is one of the antibiotic classes that are starting to have a lot of trouble in killing certain bacteria. In this next section, I will discuss some of the issues we are and will be facing in the future with bacteria and antibiotics and why it is happening.

The Post-Era of Antibiotics

Gradually as time moves forward and we continue to use antibiotics to help rid our bodies of these nasty microbes, these organisms seem to grow tired of losing to us in these so-called “bug war”. They start to adapt and change their genetic makeup to try and resist the drugs that have been an issue for them since penicillin. This might not seem like something to be concerned with now, but soon it will be. Eventually, we will reach a point where we won’t be able to produce antibiotics that can overcome these new super bugs and we will really be in trouble. What exactly is a super-bug? Well, you know how through life, depending on your situation you might have had to adapt and over come things that could potentially hurt you? Certain bacteria are doing just that with the antibiotics that hurt them, thus enabling them to stay alive and well, hurt us. Certain bacteria today that wasn’t an issue a decade ago are starting to become more and more resistant and are generating serious medical problems for humans.

Besides growing resistance to the drug over time, the bacteria changes almost everything about itself. It changes the resistance mechanism and even how it interacts with the environment around it, also the host it infects. In a different article, one aspect that is addresses how bacteria becomes resistant and how it increases their fitness.

The first of the two aspects discussed in this article depends on several factors to help bacteria. Mutators or better known as mutations[[1]](#footnote-1)Bacterial population size, the structure and the stability of the environment and the short- and long-term fate of increasing the mutation rate of the bacteria are factors that help decide on whether the bacteria will produce mutations itself that are harmful or beneficial. As expected, mutations speed up the process of antibiotic resistance[[2]](#footnote-2), and will continue to speed up as the bacteria adapts and mutates more and more.

In many different laboratories throughout the world, there is an on going battle to try and see what the next step in taking out these certain “super bugs”. In the last section of this chapter, I will discuss with you a certain practice that many western countries still haven’t accepted but might soon change due to the positive affects that can come from them. If I were to tell you that a virus could potentially save your life from these super bugs, would you believe me? Bacteriophages or phages for short, are viruses that could do just that.

Next Step, Phage Therapy

Before I explain what phage therapy is and how we can utilize it to potentially save countless lives one day, I should tell you just exactly what bacteriophages are and what they can do to help save our body. Bacteriophages are viruses that get inside and infects bacteria, hijacks the whole thing and makes the bacteria itself produce the viral components and burst out of the bacterium in a process we call lysis[[3]](#footnote-3). For millions and millions of years, bacteria and bacteriophages have been natural enemies. So, if phages and bacteria are such natural enemies, why haven’t we been trying to use them, especially when about 23,000 people die from antibiotic resistant bacteria and about 2,000,000 people acquire one[[4]](#footnote-4)? Many western countries are against using phage therapy as the next step after antibiotics is because it can be too risky of a move. One argument I found against phage therapy is that not all phages make good or therapeutic purposes. The reason they are un able to be used is that they can sometimes display something called superinfection immunity, which converts phage-sensitive bacteria to insensitive ones.[[5]](#footnote-5) When you look at the negative aspect of phage therapy, its very minor compared to the positive affects of phage therapy. Phages are nontoxic to us; they rarely disrupt the normal flora that we have in our bodies and they literally are everywhere.[[6]](#footnote-6) These are just a few of the many benefits that phage therapy can bring us.

In conclusion, phage therapy will eventually be after antibiotics start to fail more and more, we will reach a point where we won’t have any other option when it comes to battling bacteria. Pharmaceutical companies are slowing down on producing antibiotics due to the ineffectiveness some are becoming and the lack of money they get from producing them.

References

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1. Persistence of antibiotic resistance bacteria, end of 3rd paragraph [↑](#footnote-ref-1)
2. Persistence of antibiotic resistance bacteria, beginning of 5th paragraph [↑](#footnote-ref-2)
3. Scitable by nature education, bacteriophage definition. [↑](#footnote-ref-3)
4. Antibiotic/ Antimicrobial Resistance CDC [↑](#footnote-ref-4)
5. Pros and con’s of phage therapy, Taylor& Francis online [↑](#footnote-ref-5)
6. Pros and con’s of phage therapy, Taylor& Francis online [↑](#footnote-ref-6)