Infectious Diseases vs. the World

**Introduction**

Most people like to think of diseases and its many parts, such as bacteria, a virus or protozoa, as the ultimate enemy. It’s us against them–the targeted hosts (us) vs. the infecting microbes (them)–according to the germ theory of disease, which was initially suggested in the 19th century. It ultimately surmised that illness flows solely from the actions of these invading microorganisms (2). This theory was imperative in discovering countless diseases that were a result of microbes as well as identifying many different ways to inhibit said diseases whether that be by sanitation, immunization or treatment. However, this outlook was quickly shattered with the the discovery of bacteria that are resistant to antibiotics as well as the appearance of diseases such as HIV/AIDS, SARS and West Nile virus that left scientists baffled in regards to the relationship between hosts and microbes. Today, scientists realize that there must be more of an ecological point of view when taking a look at the microbial world, that hosts and microbes do in fact depend on one another in order to thrive and survive. Contrary to popular belief, there are more helpful microorganisms in the world that aim to protect the body’s functions against other competing organisms, but they take a back seat when compared to the microorganisms that aim to cause disease, which seem to draw quite a bit more attention (1). The WHO, or in other words; World Health Organization, stand by the fact that there are indeed new and evolving infectious diseases which are constantly emerging not to mention old diseases popping up in places that have never before seen them, ultimately creating a path of death wherever they go. This chapter takes a more in-depth look at these deathly infectious organisms and exactly what they do.

**What Exactly Is An Infectious Disease?**

There are countless different factors that ultimately supply the definitive definition of the term ‘infectious disease,’ so many in fact that generalizations have to be made just to summarize it. An infection is a state in which microbes (protozoa, viruses, helminthes, fungi and bacteria) thrive and replicate in a host’s tissues. Once the microbe causes a sufficient amount of tissue damage through whatever mechanism it choses, the term infectious disease can then apply (2). To simplify it, a microorganism, which can be defined as an organism that cannot be seen with the naked eye because it’s too small, secures itself into a body to go on to replicate and damage what it can. Microbes enact themselves as “colonists,” by surviving in the complex community that is the body deriving benefits along the way, most of the time without harming us. If microorganisms are to succeed, that must be able to adapt through time, which they have done quite well throughout the history of the world. Thanks to natural selection, the organisms which are genetically superior are better suited to their environment, thus able to have the greatest number of offspring and transfer the most desirable traits to further generations (1). Because their replication process is so fast, microorganisms can amass immense numbers along with great diversity in their community. Ultimately signaling that in some way, shape or form, microbes will survive, gaining a huge advantage over humans when it comes to survival.

**How Does An Infectious Disease Work?**

There are five major categories of infectious agents known to the world: protozoa, viruses, helminthes, fungi and bacteria. Viruses are very small, measured to around 20-400 nanometers in length. In regards to just how small they are, billions can fit on one pin head ranging in shapes from rods to cocci (round circles) and might or might not have 20 or so sides. To be short, they are pockets of nucleic acid, whether that be DNA or RNA, and coated in a hard protein shell or fatty materials known as lipids (2). If it is not present in a living cell, the virus is dormant and does not have the capacity for reproduction. But if it is indeed inside a cell, it latches on and steals the metabolic machinery so that it can make constant copies of itself that can go on to infect other cells. Viruses causes the largest range of diseases, ranging from the common cold to AIDS. Bacteria in comparison are 10-100 times bigger than a virus and are comparatively much more self-sufficient. Bacteria is a single-celled organism that most of the time can be seen under microscope and has three distinct shapes: coccus (spherical-like), bacillus (rod-like) and spirillum/spirochete/vibrio (curved). For the most part, bacteria have a single circular molecule of DNA that encodes (or programs in a way) the necessary genes for replication and other function needed by the cell. They also have the capacity to carry small accessory rings of DNA that are called plasmids, which encode for specific specialized functions, such as antibiotic resistance. Because bacteria are not a completely complex form of life, they only have one set of chromosomes rather than two, and reproduce through dividing into two cells, otherwise known as binary fission. These two offspring cells are completely identical including the same exact genetic material. Bacteria also have to ability to acquire new genetic material from other sources such as plants, yeasts, viruses and even other bacteria (2). This signifies that they have no problem evolving rapidly and very suddenly, instead of having to slowly adapt over time. They are one of the oldest organisms, with evidence proving that they existed over 3 billion years ago and have been constantly evolving ever since. The most known bacterial infections are those such as urinary tract and blood infections, staph skin infections, strep throat and tuberculosis. The infections agent fungi are a spore-forming organism that varies from bread mold to ringworm to the deadly histoplasmosis, protozoa are the agents that lead to malaria and dysentery whereas helminthes are parasitic worms that can also be known as hookworm and can lead to trichinosis (2). All these infectious agents enter the human host whether that be by skin to skin contact, common vehicles such as food, water or blood, vectors such as rats, fleas, mites, ticks or even dogs, and airborne transmission through evaporated droplets or dust particles.

**Preventing/Treating Infectious Diseases**

Although many infectious diseases are unavoidable, there are still countless amounts of ways to shield a body from infection as well as many ways to help treat it once it has been established. These preventative steps and treatments can either be simple or complex in their own ways, on a national level to even global status. But it all comes down to making sure that communities and the world stay safe and healthy. Vaccines are a major key in preparing a body to provide immunity from a specific disease. It is a preventative measure that consists of a reagent that is somewhat like the disease you are trying to prevent. It helps the immune system to recognize it as a threat, kill it, and then to remember it so that if it ever does come into contact with the disease microorganism again, it will destroy it right away. By doing so, this also diminishes the risk of infected peoples from spreading the disease to other healthy people. In fact, this preventative measure has helped to eliminate many deathly diseases in the United States, such as polio, mumps, and measles (1). In order to treat bacterial infections, antibiotics have been the go-to treatment measure. Antibiotics are known to kill or stop bacteria from duplicating, thus helping the body’s internal defenses to completely eradicate the pathogens. Lately however, antibiotic resistance has become a huge problem with the effectiveness of the antibiotics as diseases adapt and change. They also are known to have no power against viral infections, which are viruses like the flu or cold. So in the case of a flu or cold, antiviral drugs are used to inhibit the viral infection’s capability to duplicate or to build up an immune response to the virus. These antiviral drugs are currently being used to treat a number of different cases such as HIV, hepatitis B, influenza or herpes (2). Preventative measures and treatments are constantly evolving to help treat the major disease cases that are currently a problem in the world today, and can only improve from now.

**Conclusion**

The world population encounters microbes every single day, and although a majority of them might now pose an immediate threat, the ones that do can’t be ignored. As scientists discover advances in medicine and technology, great strides in preventing and controlling infectious diseases are being made. However, there is still a lot to learn and still a vast amount of knowledge about infectious diseases that haven’t been discovered yet. By dedicating time and attention to these studies, the health and safety of the world might always be ensured.

**References**

1. Barber, Nicola C., and Louisa A. Stark. “Online Resources for Understanding Outbreaks  and Infectious Diseases.” *CBE Life Sciences Education* 14.1 (2015): fe1. *PMC*. Web. 10 Mar. 2018.
2. Institute of Medicine. 2011. *What You Need to Know About Infectious Disease*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/13006>