**What Are Viruses and How Do They Affect Us?**

Keywords to know:

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* Chromosome
* Deoxyribonucleic acid (DNA)
* Reverse transcriptase enzyme
* Ribonucleic acid (RNA)

**Virus Overview**

 Considering the fact that you’re reading this it’s safe to assume you must be alive and well. Not only that, there’s a definite chance that you’ve been exposed to a virus before within your lifetime. Multiple times at that! Viruses are known to be linked to certain cancers that could cause abnormal growth of cells such as tumors. While acknowledging this, the question of how much of a threat they pose to us comes to mind. To figure this out we must first learn what a virus is and how they initiate the process of infecting their host. The origin of viruses is believed to come from nucleic acids that have broken free from the host cell while still retaining the capability to duplicate itself within host cells. By definition, a virus is made up of nucleic acids that are sealed within a protein coating. They are nonliving particles that can only replicate with host cells or living cells present. A common example that we have all most likely experienced is the flu or influenza virus. Many viruses are normally named after the disease they cause, or the organ in which it affects followed by the word “virus.” Others use code numbers depending on if there are multiple types such as the T1-T7 virus.

**How do they work?**

To begin the process of disrupting the integrity of a living organism, a virus must first find and recognize a host cell. It can then bond to the receptor site found on the plasma membrane of the cell similar to jigsaw pieces coming together. This means that the virus can only bond to a specific kind of cell according to its specific shape rather than just any living cell. Since viruses are generally species and cell-type specific, this attribute can be used against them to help curb the spread of disease and even eradicate them. An example of an eradicated virus is smallpox which is specific to humans only. Smallpox was eradicated by 1980 thanks to the aid of vaccines which are injections of part of the virus or bacteria to help create an immunity to the disease. Viruses that are not species specific normally arise more often and are harder to eradicate, such as the flu which can infect both humans and animals.

Once the virus attaches to the host cell, it can finally enter the host cell by using one of two different methods. Method one involves the virus injecting its own nucleic acid into the cell. Method two involves producing a virus-filled vacuole within the cytoplasm of the host cell and then bursting to release nucleic acid into the host cell. The end result for both is that the metabolism of the host cell ends up being compromised. By altering the host cell’s genetic material it can in turn take over the host cell’s mechanisms to begin replicating new virus particles, and releasing them into the intended host. This can occur through the lytic cycle or lysogenic cycle. The lytic cycle will kill off the host cells after infecting it while in the lysogenic cycle the host cell is kept alive until it enters the lytic cycle. It should also be noted that the lysogenic cycle can continue on for several years before it ever initiates the lytic cycle.

**What Types of Viruses Are There?**

Now that we’ve gotten into how viruses come into contact with their host and take over, it’s time to look at the different types of viruses! The main two types we well be looking over will be proviruses and retroviruses. Proviruses are viruses that have viral **DNA** inserted into a host cell’s chromosome while retroviruses are **RNA** based viruses and are a bit more complex. **DNA or deoxyribonucleic acid**, is a material that self-replicates and is the main component of chromosomes. This is the holder of genetic information. **RNA or ribonucleic acid**, is a nucleic acid that acts as a messenger to deliver instructions for the synthesis of proteins. For some viruses this is where genetic information is held instead of DNA. Lastly, we will move onto prions and plant viruses.

***What are Proviruses?***

Proviruses play a role in viruses like the chicken pox, hepatitis B, or even the herpes simplex I virus which leads to cold sores. Colds sores arise when the provirus initiates the lytic cycle which in turn causes the eruption of another cold sore. There is no specific reason found as to why a provirus activates but it can be safe to assume that physical or emotional stress can play a role in leading up to this. Physical stress for example could be an injury or a simple sunburn while emotional stress can be a state of anxiety. For some proviruses such as chicken pox it can actually be better to have them at a young age rather than later in life. Contracting chicken pox before age ten can give lifelong immunity from another contraction of the chicken pox virus. Unfortunately, the chicken pox virus can remain in your nerve cells and lead to shingles. They can also remain dormant for your entire lifespan. Again, it is not known what the exact cause for the activation of viruses but the wellbeing of the person infected most likely has something to do with this.

***What are Retroviruses?***

Retroviruses are viruses that lead to the infamous diseases human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS). Both are RNA based viruses. Retroviruses differ from proviruses in this way and integrate their nucleic acid particles into the host cell by first entering the host cell. Once this is complete it creates DNA from its own RNA. This is done by reverse transcriptase, a type of enzyme which is carried within the retrovirus. Using this enzyme, the retrovirus is able to achieve the making of DNA from viral RNA. After creating the DNA, it is then inserted into the **chromosome** of the host cell to become a provirus. A **chromosome** is a structure formed by nucleic acids and protein in the nucleus of a cell. This is what contains our genetic make-up. A key factor in recognizing a retrovirus within the body is any traces of the **reverse transcriptase enzyme**. The **reverse transcriptase enzyme** is an enzyme in retroviruses that generate the process of transcription. Its purpose is to transcribe the retrovirus RNA into DNA.

***What are Prions?***

Now that we have went over proviruses and retroviruses, we can move onto prions! Prions are proteins that do not have any nucleic acid to hold any genetic material. So how exactly do they work? Prions are believed to cause diseases by causing proteins to fold erroneously resulting in an incorrect function of that protein. They are the cause of many animal diseases such as mad cow disease or the outbreak of chronic wasting disease in deer across North America. The disease can be spread to humans through infected meat, and the most common prion disease in humans is Creutzfeldt-Jakob disease (CJD). It is still not known where exactly prion-based diseases originate or what solutions work best to fight diseases caused by prions since the anomaly is fairly new and hard to locate.

***What are Viroids?***

Viroids are made up of a singular strand of RNA in the shape of a circle. They do not have a protein coat but have been known to cause many contagious diseases in plants. The first known plant virus is the tobacco mosaic virus. These viruses require the plant to have bug bites or a wound to enter. They are unlike human and animal viruses in that they do not go through lytic or lysogenic cycles. Some plant viruses are fatal but not all are harmful. For the tobacco mosaic virus, the leaves of tobacco are marked by yellow spots. In tulips, a similar disease causes vibrantly eye-catching stripes which can actually be more desirable than regular tulips that do not have the disease. These diseases are spread easily through contact. An example of such is cutting a stem that contains the disease with clippers and then proceeding to cut another without the disease using the same pair of clippers. This will in turn lead to the plant contracting the disease.

**What Have We Learned?**

Now that we have gone over viruses and how they affect us, let us have a recap of what we learned! The key concepts to remember are that viruses are nonliving particles and are contained within a protein coating or capsid. To enter a host cell, they must first find a host cell with a shape that matches itself. Next, the virus can attach itself to the host cell and enter it to compromise its metabolism. After doing so, the virus can go through a lytic or lysogenic cycle unless it is a plant virus as they do not go through either process. A fun fact is that lytic is Greek for “breaking down.” Therefore, knowing this we can easily remember that in the lytic cycle the host cell is “broken down” and dies off, while in the lysogenic cycle the host cell remains intact until the lytic cycle is initiated. Proviruses contain DNA while retroviruses contain RNA. This is important to know because the two result in completely different diseases. Also, since retroviruses do not have DNA, they must use the reverse transcriptase enzyme to encode viral RNA into double-stranded DNA. Prions and viroids are not viruses but are necessary to mention because they are virus-like particles. Prions are made up of a single protein while viroids are made up of a single strand of RNA in the shape of a circle. It should be made known that viruses can sound scary, but a majority of known diseases caused by viruses can be prevented and not all are harmful as seen in the case of plant viruses. Some can actually be favorable! Lastly, we can be thankful for vaccines in aiding the eradication of diseases caused by viruses. They are a key mechanism in defending against viruses and have made past diseases seldomly come across today.

References

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