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Short Communication

# Viruses: A Short Review and Overview

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Viruses dominate our lives today perhaps more than ever, impacting our social habits, families, education practices, travel and of course our health. All the better to inform ourselves.

Viruses are everywhere in the environment: on surfaces we touch, the air we breathe, the water we drink or bath in and inside of our bodies. Most of these are benign and do not make their presence known to us. Sea water, for example, is known to contain up to one million viral particles per milliliter [1]. Soil as well contains ten times as many viral particles as bacteria. Luckily for us most of these viruses infect bacteria and demonstrate no pathogenicity to humans. The presence of so many viral particles begs several questions: what are they doing there, what purpose do they serve, and where do they come from, among others. We cannot answer these questions. We know that nature is in balance when left undisturbed and frugal with resources, so there is likely a reason for all these viral particles.

Viruses are difficult to identify, quantify and kill. Since they do not respirate, eat or defecate, they do not meet the criteria for living organisms. They require a host organism for reproduction. Viruses appear to be designed to hang around in the environment, waiting for a suitable host organism to infect. There is no good estimate of how long a viral particle can remain infectible. Certainly a few days is likely, but much longer is possible. Sanitizers like alcohol and chlorine are partially but not totally effective at denaturing viral particles.

Once inside the host, viral particles latch onto the surface of a suitable cell, inject their DNA or RNA into the cell, hijacking the cellular processes to produce copies of the virus. These are ejected from the cell when it dies, infecting other cells. In our bodies our immune system is constantly on the lookout for unknown or foreign proteins such as those present on the surface of a virus. A virus that our immune system has not seen before will likely have proteins on the outside that are new and cause the immune response to create antibodies to destroy it. This enables the development of vaccines that sensitize the immune system by exposing it to non-infectious novel viral proteins, so that when that virus presents itself in the body, the immune system is already capable of producing antibodies against it.

Viruses inside of our bodies represent a special threat, as once inside they can hide, remaining dormant for decades, becoming virulent again when conditions are favorable. Varicella-zoster, the virus that causes chickenpox is a good example, producing shingles after remaining dormant in the body for over 50 years. Bacteria can play the same game. Alzheimer's and heart disease have been linked to Gingivitis bacteria that have eluded the immune system by hiding in the body after entering through diseased gums [2].

The so-called Spanish flu virus pandemic started in February 1918 and by April 1920 it had infected an estimated 500 million people globally, resulting in up to 100 million deaths. It was an H1N1 virus suspected of originating in birds. Viruses that jump from one species to another are especially virulent as the receiving host population has never been exposed before and has no immunity. This flu was especially lethal to children under 5 years of age. It came and went away without explanation. Could COVID do the same?

Some species of animals have evolved higher body temperatures to prevent viral infection. Cats, dogs and birds, for example, have body temperatures of 101˚F. Vultures are especially prone to infection due to their radical eating habits and have a body temperature of up to 117˚F. Humans, on the other hand, with a body temperature of 98.6˚F are more susceptible to viral infection. Interestingly, human body temperature in the US has been shown to have dropped by about 1˚F over the past 150 years. This is significant as it increases susceptibility to infection and reduces caloric expenditure. The authors postulate that a reduction in chronic inflammation is the cause of the change [3]. There is evidence in plants that exposure to temperatures of up to 107˚F for 4-6 weeks can eradicate infecting viruses [4]. Human body temperature can

be elevated by a fever or artificially by methods such as sauna and hot tubs, resulting in a reduction in viral infection [5].

Not all bad, viruses have contributed at least 9% of the DNA that makes up the human genome [6], contributing useful traits. There is evidence that viruses evolved before bacteria and contributed important genetic material that enabled bacteria, eukaryotic cells, mitochondria and finally multicellular organisms [7].

Viruses are a special problem in food manufacturing, cruise ships and anywhere people congregate in close proximity. The most studied and most common virus in these situations is the Norovirus. It is known as the 24-hour flu as symptoms, mostly gastrointestinal, are short-lived. It infects the intestinal wall of the host in what appears to be a cooperative process, where infected epithelial cells on the surface of the intestinal wall produce and release the viral particles with no apparent harm to the intestinal wall [8]. The host sheds the virus into the environment via their feces. Intestinal distress often accompanies the condition, resulting in a liquid discharge. The viral particles get on surfaces and on the hands of the host. Washing and sanitizing the hands will reduce but not eliminate the virus. Even wearing gloves, which is required for food handlers, is not a perfect barrier. An infected host will shed billions of viral particles per gram in their feces and nearly a million per ml in vomit. Viral shedding can begin two days before symptoms of illness appear and persist for up to 30 days after the host has recovered and no longer exhibits symptoms [9]. Infection can occur with as few as ten viable viral particles. Viral particles can retain viability for several days after being deposited on a dry surface but can also be deposited on foods. Romaine lettuce actually binds the viral particles [10].

COVID-19 is the latest in a long list of human pathogenic viruses. COVID is unique in that it appears to be an engineered virus with special capabilities to produce three proteins on infection of the host [11]. The first is released immediately upon infection and delays the immune response for three days, which is sufficient time for the virus to infect and replicate. Then the virus releases two additional proteins which ramp up the inflammatory response. The result is an overactive immune response which results in serious lung damage and is lethal in extreme cases [12,13]. This is called the Cytokine Storm because the immune system overproduces cytokines which are molecules that control inflammation [14,15]. It appears suspicious when China, with its long history of minimal concern for human life, takes draconian measures to lock down cities, resulting in severe economic and human hardship for the purpose of saving lives, especially when the West has been unwilling to make the same sacrifice. Perhaps they know something we don't.

The COVID virus is constantly changing by random mutation. Being composed of a single strand of RNA, there is no possibility of detecting mistakes in transcription, as occurs in double-stranded DNA, making the mutation rate in RNA up to a million times higher [16]. The Omicron variant has been found to contain about 50 site mutations compared to its predecessor [17]. It may have originated in a man in Africa who had AIDS. His compromised immune system allowed the virus to remain in his body for months, accumulating mutations, before migrating out to infect other people. Luckily, the mutations resulted in a strain that though more contagious is less lethal. The likelihood that future variants will be equally benign is low. Also, it is troubling that the COVID virus has now been found in animal populations. The risk is that it will mutate in the animal population and then at some point migrate back into humans as a different strain of unpredictable pathogenicity.

Humans are evolving as well. Not so much by mutation as in viruses, but in social norms and behaviors such as travel restrictions, mask wearing, social distancing, vaccines, anti-viral drugs, quarantines, etc. We are watching as biological warfare unfolds before our eyes. How we manage the situation will determine the outcome.

We have learned a lot about viruses and ourselves over the past few years. Unfortunately, we still have a lot to learn.

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