A recent study in the journal *Neuron* has found a strong link between two rather obscure and poorly understood families of human herpesviruses and Alzheimer's Disease (AD). This is a fascinating development.

Dr. Joel Dudley of Mount Sinai Medical School and colleagues identified two herpes viruses that were strongly associated with AD. The group found that people who had AD when they were alive had more of two viruses, human herpesvirus-6A (HHV-6A) and HHV-7, in their brains than those who did not.

The paper, which is long and complex, once again raises the possibility that AD is caused by a virus, a theory that has been hotly disputed for years. I wouldn’t bet against Dudley for two reasons:

1. A fundamental but unanswered question about AD has always been whether the plaques that form in the brains of its victims are the cause of the disease or the result of damage from something else, like infection or head trauma. Since all attempts to prevent or dissolve the plaques have failed to impact AD, perhaps something else, like a pathogen, is the causative factor and the plaques are merely the aftermath.

2. Pathogens, especially viruses, are increasingly implicated in diseases in which there was no apparent connection until one was discovered. Dr. Dudley makes this quite clear:

   “Even if the questions remain, this research offers strong support for a long-controversial hypothesis that viruses might be involved in the development of Alzheimer's disease. We didn’t have a horse in this virus race whatsoever. It’s the data that took us there. And now, not only is the viral hypothesis resurrected: it has specific testable pathways and networks..."
I think that it is a given that we will continue to see some important and surprising discoveries that will reveal that pathogens are the root cause of poorly understood maladies, for example, a range of viral infections and the development of autoimmune diseases. Epidemiology certainly backs this up. About 15% of cancers worldwide are attributed to viral infections. Two other cancers are attributed to bacterial infections.

**CANCERS CAUSED BY VIRUSES**

- Infection by both hepatitis B and C cause hepatocarcinoma (liver cancer).
- The human papillomavirus (HPV) causes cancers of the cervix, anus, vagina, penis, and head and neck.
- Kaposi’s Sarcoma, a cancer that was rare before the onset of the AIDS epidemic is caused by human herpesvirus 8 (HHV-8).
- Certain lymphomas and Hodgkin’s disease are caused by the Epstein-Barr virus (EBV, HHV-4) causes mononucleosis as well as
- Human T-cell leukemia virus (HTLV), a retrovirus, causes certain leukemias and lymphomas. Although 10-25 million people worldwide are infected, only 5% of them get any disease from the virus.

**CANCERS CAUSED BY BACTERIA**

- Helicobacter - Ulcers and stomach cancer
- Tuberculous - Lung cancer

There are nine herpes families that infect humans. Most of these are either well-known or at least have recognizable names - HSV-1 and-2, Epstein-Barr, varicella-zoster, cytomegalovirus. But the two herpes families that were found to be associated with AD were HHV-6a and HHV-7, and little is known about either one of them. Almost all humans are infected, primarily during childhood, but disease is rare.

In 2005, Barry J. Marshall and J. Robin Warren won the Nobel Prize in Physiology or Medicine for their discovery of *Helicobacter pylori* and its role in gastritis and peptic ulcer disease. Ulcers were caused by an infectious disease, a startling revelation at that time. Perhaps the Mount Sinai group’s findings will point others in a different direction. One is sorely needed. There are now 5 million Americans living with this awful disease and this number is expected to grow to 17 million by 2050.

If researchers turn their attention to the role of infectious pathogens in causing seemingly unrelated diseases perhaps we will see more surprises like Marshall and Warren’s discovery.
There are plenty of Nobel Prizes out there. Whoever discovers the root cause of Alzheimer's can expect a nice trip to Stockholm.

NOTES:

(1) HHV-6 belongs to the *Roseolovirus* subfamily of herpesviruses. HHV-7 belongs to the *Betaherpesviridae* subfamily.

(2) Derek Lowe over at Science Translational Medicine has frequently written about the failures of drugs that were designed to prevent or modify plaques. His most recent article about Merck's failed attempt can be read [here](http://blogs.sciencemag.org/pipeline/archives/2018/05/04/mercks-bace-inhibitor-alzheimers-wipeout) [5].

(3) Multiple viral infections have been postulated as causes for a host of autoimmune diseases, for example, Type 1 diabetes, rheumatoid arthritis, lupus, and multiple sclerosis.

(4) It's not just humans. Feline leukemia virus (FeLV), as the name implies, causes leukemia, which is a major cause of death in cats that have not been vaccinated.

(5) Retroviruses are particularly nasty concoctions of nature. Like many other viruses their genetic material is RNA but they also have two specialized enzymes differentiate them from normal viruses. One is reverse transcriptase, which uses the viral RNA as a template to build viral DNA. The other is called integrase, which inserts the newly formed DNA into the DNA of the host cell, which changes its genome. Then you're not you anymore. The cells that are infected are transformed into something you weren't born with.