

## Multiple sclerosis, a disease of viral origin

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*Fascinating recent research demonstrates that infection with the Epstein-Barr virus is the trigger for the development of multiple sclerosis.*

Multiple sclerosis (MS) is a chronic inflammatory disease of the central nervous system caused by the breakdown of the myelin sheaths protecting neurons in the brain and spinal cord.

This damage compromises the nervous system's ability to transmit signals, which causes a host of physical (double vision, blindness in one eye, muscle weakness, impaired sensation or coordination), mental and sometimes psychiatric problems.

Symptoms sometimes appear as isolated attacks (recurrent forms) or accumulate over time (progressive forms).

Globally, more than 2 million people are affected by the disease, mainly in countries furthest from the equator. In Canada, for example, the prevalence of MS is one of the highest in the world, with nearly 100,000 people living with the disease.

### UNREGULATED IMMUNITY

MS is an autoimmune disease, meaning that the destruction of the myelin surrounding the nerves is caused by a dysregulation of the immune system. Certain B lymphocytes produced by the bone marrow acquire the ability to settle in the brain and produce antibodies against the glial cells (astrocytes, oligodendrocytes and microglia) responsible for the synthesis of myelin, leading to their destruction and the demyelination of neurons.

It has been suspected for several years that the Epstein-Barr virus (EBV) could play a decisive role in the onset of immune disorders leading to the development of this disease.

On the one hand, this virus is responsible for infectious mononucleosis, and the risk of developing MS has been shown to be increased after mononucleosis.

On the other hand, we also know that after infection, the EBV virus remains present in a latent form in B lymphocytes and is frequently found in demyelinated lesions.

However, a causal link remains difficult to establish, because EBV is an extremely common virus, which infects nearly 95% of adults.

The research challenge is therefore to find a population that is not infected with EBV and to compare its risk of developing MS compared to a population that has been infected with the virus.



### TOWARDS A MULTIPLE SCLEROSIS VACCINE ?

This challenge was successfully met by a study of more than 10 million young adults on active duty in the US military between 1993 and 2013 (1).

Military personnel are subject to regular blood tests (at the start of their career and every two years thereafter), which allowed researchers to determine the presence of antibodies against EBV in the serum of people who developed MS during this period (801 individuals), compared to controls not affected by the disease.

Of the 801 people with MS, 35 were EBV negative when they entered the job, but almost all (800/801) were subsequently infected, a few years before the onset of the disease.

The comparison with the controls enabled the researchers to calculate that infection with the virus increases the risk of developing MS by 32 times and therefore that EBV is undoubtedly the main cause of this disease.

These results therefore raise the exciting possibility of preventing the development of MS with the help of an EBV vaccine.

These vaccines are not yet available, but the company Moderna has recently developed an mRNA-based vaccine against the virus which will be evaluated in a Phase I clinical study over the next few months.

(1) Bjornevik K et al. Longitudinal analysis reveals high prevalence of Epstein-Barr virus associated with multiple sclerosis. *Science*, 2022, 375(6578):296-301.