VIRUSES ON THE BRAIN

Viral infections might cause brain damage. Researchers aren’t exactly sure whether the injuries play a role in neurodegenerative diseases, but some studies suggest a connection.

ROUTES OF PASSAGE
Some viruses can enter the body through the nose and mouth and move to the brain by replicating and spreading through the olfactory bulbs; the lingual nerve, which runs down the jawline and into the tongue; or the vagus nerve, which travels through the neck and thorax to the stomach.

CROSSING BLOOD-BRAIN BARRIER
When interacting with the nervous system, viral particles can cross the blood-brain barrier directly or through infection of endothelial cells (below, left), or they can use a Trojan horse approach (center), infecting monocytes that cross the barrier before replicating and bursting out of the white blood cells once inside the brain. Alternatively, some viruses do not cross the blood-brain barrier but invoke an immune response that may spur cytokines or chemokines to breach the divide (right).

DIRECT CROSSING

TROJAN HORSE

IMMUNE RESPONSE

BRAIN DAMAGE
Once inside the brain, viruses can infect cells or their myelin sheaths and kill them (below, left). Viruses don’t necessarily have to enter the brain to cause damage, though. They can also spark an immune response that activates microglia, which then consume otherwise healthy neurons (right).