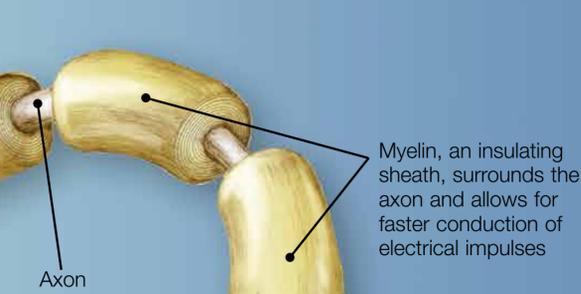
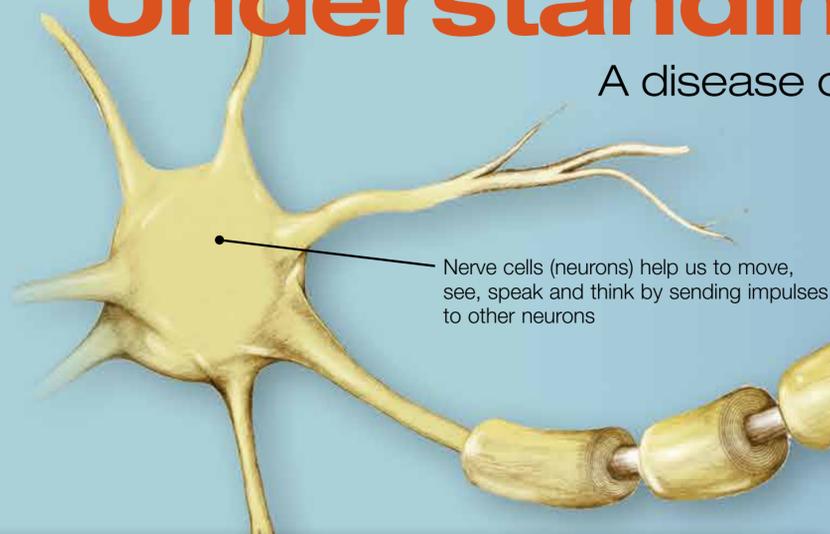


# Understanding Multiple Sclerosis

A disease of the central nervous system



## What is multiple sclerosis (MS)?

MS is an autoimmune disease of the central nervous system (CNS), brain and spinal cord, where the body recognizes myelin in the CNS as a foreign object. Myelin allows the body to transmit electrical impulses from neuron to neuron quickly. With loss of myelin the brain's ability to transmit impulses to the rest of the body is disrupted. Depending on where in the brain or spinal cord myelin is lost, different symptoms can result such as difficulty walking or vision loss.

## What causes MS?

We do not yet understand why MS begins, and there are likely several factors that may contribute to developing the disease. Genetics, environment, and viruses may play a role. In MS, disease-fighting cells enter the brain and also cause damage to the myelin sheath. When scar tissue (sclerosis) replaces the myelin sheath as a result of being attacked the brain's ability to transmit signals to the rest of the body is disrupted.

## Types of MS

**Relapsing-Remitting (RR-MS):** RR-MS is the most common type of MS in people under 40 and accounts for about 70% of people with MS. RR-MS patients have episodes of acute worsening of symptoms (relapses) with recovery and stable course (remissions) between relapses.

**Primary-Progressive MS (PP-MS):** PP-MS accounts for approximately 10% to 15% of patients and is characterized by progressive worsening from the onset of symptoms without interposed relapses. Patients with PP-MS are more likely to be men and older than 40 years of age at symptom onset.

**Secondary-Progressive MS (SP-MS):** After living with the disease for 10 to 20 years (and usually after the age of 40), some RR-MS patients may develop SP-MS. A patient with SP-MS may still experience relapses but does not stabilize between relapses, and their condition gradually worsens.

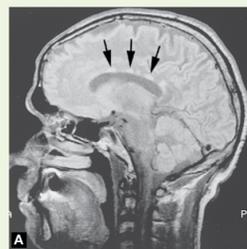
## SYMPTOMS OF MS

- |                               |                        |
|-------------------------------|------------------------|
| ■ Anxiety                     | ■ Problems with        |
| ■ Cognitive impairment        | ● bladder control      |
| ■ Depression                  | ● speech               |
| ■ Dizziness                   | ● vision               |
| ■ Loss of muscle coordination | ● walking              |
| ■ Muscle spasms               | ■ Sexual dysfunction   |
| ■ Numbness or tingling        | ■ Weakness and fatigue |

## How is MS diagnosed?

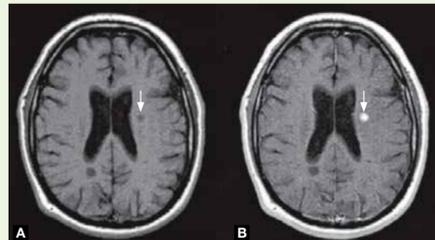
Your doctor will perform a thorough investigation involving several tests, including:

- **Magnetic resonance imaging (MRI):** An important diagnostic tool is MRI, which is used to examine the brain and spinal cord for MS lesions. An MS lesion is an area of inflammation or damage within the CNS. T1, T2, T1 with gadolinium, FLAIR, and proton density refer to different MRI sequences, each providing different information regarding MS lesion location and activity.



**A. Proton density weighted MRI, sagittal brain** (showing tissue from right to left). Observe the multiple high signal intensity lesions within the corpus callosum (arrows). These areas represent the plaques of multiple sclerosis. **B. T2 weighted MRI, sagittal cervical spine.** The arrow points to a lesion within the cervical cord. MRI can also help with prognosis and monitoring treatment response to drugs. MRI findings need to be correlated with other clinical or paraclinical testing (e.g., spinal tap, evoked potentials) testing for the definitive diagnosis.

Credit: Yochum TR, Rowe LJ. Yochum and Rowe's Essentials of Skeletal Radiology, 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2004. Figure 6-87.



**A. Pre-gadolinium MRI. B. Gadolinium-enhanced MRI.** MRI techniques such as these images are used to detect focal lesions in patients with clinical signs of MS. Gadolinium is a dye which is administered to show areas of acute inflammation and blood brain barrier breakdown (arrows). These areas of inflammation can develop into black holes which indicate areas of underlying axonal damage and brain tissue loss. Black holes can be associated with more physical disability. The black hole in the lower left part of the images is most likely from an earlier episode of MS.

Credit: Cohen H. Neuroscience for Rehabilitation, 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 1998. Fig. 5-4. (Courtesy of Drs. C. Ford and W. Brooks, Department of Neurology and the Center for Non-invasive Diagnosis, University of New Mexico, Albuquerque, New Mexico.)

- **Evoked potential tests:** These tests measure electrical signals to the brain as a response to hearing, touch, or visual stimuli and can detect lesions before symptoms become obvious.
- **Lumbar puncture (spinal tap):** If MRI findings are non specific and clinical history is not diagnostic, healthcare professionals may obtain a sample of cerebrospinal fluid and look for proteins and inflammatory cells associated with MS.

## Management of MS

MS is not curable, but new disease-modifying therapies can help in decreasing relapses, MRI activity, and slowing disease progression. Early intervention is key. MS differs from patient to patient, and healthcare providers may try several medications to find what works best for an individual patient.

