

**Vocabulary Preview** (see **bolded, underlined words**)

**gait:** (n) a particular way of walking

**transient:** (adj) temporary; synonym = transitory

**remission:** (n) period during which symptoms are reduced or disappear

**chronology:** (n) an arrangement in order of time of occurrence

**vague:** (adj) not clearly shown or expressed

**spasticity:** (n) increased muscle stiffness, which leads to uncontrolled, awkward movements

**A Definition of Multiple Sclerosis**

Multiple sclerosis, or MS, is a lifelong, neurodegenerative disease characterized by inflammation of the central nervous system (CNS). The inflammation occurs specifically in the myelin, the fatty substance insulating nerve fibers. MS tends to occur in attacks known as exacerbations. Over time, these attacks damage the myelin and the underlying nerves as well, leaving scars known as lesions in the brain or spinal cord. The multiple areas of scarred tissue have given rise to its name, “multiple sclerosis.” While MS strikes approximately 1.1 million people worldwide – 300,000 in North America – its incidence is two to three times higher among women. In addition, the disease is more prevalent in individuals of northern European heritage and those who have lived in colder climates. This disease can be further defined by examining its causes, symptoms, diagnostic techniques, and treatment.

To date, the causes of MS remain unknown. However, several theories have emerged to explain why in this autoimmune disease, the body attacks its own myelin. The infectious theory suggests that a common bacterial infection or virus such as herpes triggers the disease. This trigger activates white blood cells in the blood stream, which then enter the brain. Once inside the brain, these cells activate other elements of the immune system to attack and destroy the myelin. Another theory, the genetic theory, is based on the observation that those with parents or siblings with MS have a greater risk of developing the disease than those with no MS in their family. According to a third theory, the environmental theory, people living in colder, more temperate environments seem to be at increased risk versus individuals living in warmer, more tropical climates. For this reason, it is believed that a person might be predisposed to developing MS due to some sort of environmental factor. Finally, nutritional imbalances have been shown to be a possible trigger.

The symptoms of MS are well documented. The demyelination of MS impairs transmission of nerve impulses, which eventually affects the spinal cord, optic nerve, brainstem, and both cerebral hemispheres. Whereas some people with MS lesions remain asymptomatic throughout their lives, for most patients, quality of life is compromised in varying degrees by physical limitations. Common symptoms include chronic pain, severe fatigue, a loss of coordination, and numbness, tingling, weakness, or spasticity in the limbs. Loss of balance, **gait** abnormalities, tremor or paralysis, and difficulty with speaking and swallowing are also quite common. Vision symptoms involve **transient** blindness and double vision, or diplopia. In addition, patients often suffer from the embarrassment of bowel and bladder problems as well as those of cognitive deficits, such as losses in memory.

Since MS progresses at different rates, a number of categories have been established to describe this variance in progression. Three-quarters of MS patients begin with relapsing-remitting MS. This form is characterized by a clearly defined pattern of acute episodes followed by periods of **remission**. While patients can be left with several **residual** deficits, they generally recover. The periods between relapses are irregular and distinguished by no advancement in the disease. Secondary progressive MS initially begins as a relapsing-remitting form of MS but is followed by a later, more progressive period. Although intermittent relapses and slight remissions may still occur, disability sets in more **vigorously** at this point. Approximately 50% of patients who start with relapsing-remitting disease eventually develop secondary progressive MS within 10 years, and 90% develop it within

25 years. A third category, primary progressive MS, is characterized by a slow but continual progression of disability from its onset with no distinct exacerbations or periods of remission.

A confirmed diagnosis of MS typically involves a prolonged process. At first, the doctor takes the patient's medical history. The disease is suggested when classic symptoms, e.g. optic neuritis, are present and a distinct **chronology** of attacks has occurred. However, in many cases, early MS may manifest as a set of **vague**, temporary symptoms that can be **attributed to** several medical conditions. Nevertheless, once MS is suspected, the doctor conducts a neurological test in his office, looking for muscle weakness and abnormalities in eye movements, limb coordination, balance, speech, and reflexes. If MS is still suspected, other investigations are recommended. An evoked potentials examination measures the time taken for the brain to receive and interpret messages. This is done by placing small electrodes on the head, which monitor brain waves in response to visual and auditory stimuli. Normally, the brain's reaction to such stimuli is almost instantaneous, but when demyelination of the CNS is present, a delay may occur. A lumbar puncture test is also commonly used. In this test, cerebrospinal fluid (CSF) taken from the spinal cord is tested for the presence of MS-related antibodies. An MRI scan produces very detailed pictures of the brain and spinal cord, showing the size, quantity, and distribution of existing lesions. While MRI is perhaps the most reliable indicator of MS, it cannot be regarded as definitive as not all lesions are picked up by the scan. In addition, many other conditions produce identical abnormalities, a limitation that is true of the other diagnostic tools as well. For this reason, the doctor uses information from all of the investigations to reach a diagnosis; even so, a confirmed diagnosis of MS is not possible until tests show neurological deficits involving at least two different areas of the central nervous system, and the patient has experienced two separate attacks caused by the effects of these deficits.

Treatment of MS aims at slowing progression of the disease and controlling symptoms to maximize quality of life. These goals are accomplished by medication and various forms of therapy. To retard disease progression, drugs that are used in chemotherapy are prescribed. Chemotherapy is ordinarily used to treat cancer because it kills cells that grow and divide rapidly, e.g. cancer cells. However, among the other cells that are killed are white blood cells, which are part of the immune system. As the body's attack on the myelin involves an abnormal, heightened immune response of certain white blood cells, it is theorized that chemotherapeutic agents that diminish the numbers of white blood cells should retard or halt autoimmune destruction. However, despite its benefits, chemotherapy is cardiotoxic and often causes other adverse side effects. Another class of drugs, steroids, may also be prescribed to decrease the severity of exacerbations. Other medicines such as Baclofen, Tizanidine or Diazepam may be used to reduce muscle **spasticity**. To alleviate urinary problems, cholinergic medications may be helpful. Antidepressant medications can also help with mood or behavior symptoms. Amantadine may be given for fatigue, and the patient may also be placed on medication for chronic pain. Still other medications, such as antiemetics, are prescribed to deal with the nausea and vomiting that arise due to treatment. Aside from medication, physical therapy, speech therapy, occupational therapy, and support groups may also be useful. These can help improve the person's outlook, reduce depression, maximize function, and improve coping skills. Finally, a healthy lifestyle is encouraged. Proper nutrition as well as adequate rest can help maintain energy levels, and avoiding fatigue, stress, temperature extremes, and illness can aid in reducing factors that may trigger an MS attack.

In brief, MS is an autoimmune disease that can be classified into three different types, each depicting a pattern of disease progression. While the exact cause is unknown, several factors, including infectious, genetic, environmental – and possibly nutritional imbalances – are thought to be involved. Symptoms, which vary among individuals and can come and go, can affect many systems of the body, resulting in mild to total disability. Diagnosis is not straightforward as individuals, especially those in its early stages, are often unaware that they have the disease due to its **transitory** and vague symptoms; in addition, test results in themselves are inconclusive. Treatment, which aims to slow progression of the disease, involves a great many drugs as well as supportive therapies.

## Multiple Sclerosis Comprehension Questions

1. In the course of the illness, a patient with one form of the disease may subsequently develop another.
  - a. true
  - b. false
  
2. Certain lifestyle modifications can lessen the odds of having an exacerbation.
  - a. true
  - b. false
  
3. Which of the following statements concerning myelin is true?
  - a. It is covered by nerve fibers.
  - b. It causes exacerbations.
  - c. Damage to the myelin causes a delayed response to stimuli.
  - d. Damaged myelin reduces the number of white blood cells in the body.
  
4. The form of the disease characterized by a continuous increase of disability is
  - a. relapsing-remitting
  - b. secondary progressive
  - c. primary progressive
  - d. none of the above
  
5. Which is false regarding treatment?
  - a. Patients are sometimes given drugs that are used to treat cancer.
  - b. Diazepam helps reduce fatigue.
  - c. Chemotherapy slows down damage to the myelin.
  - d. Antiemetics are used to deal with adverse effects of other drugs.
  
6. Which of the following statements about MRI scans is true?
  - a. An MRI scan allows the neurologist to observe how the brain waves are affected by the disease.
  - b. An MRI scan provides a great deal of information about existing lesions in the limbs.
  - c. Most doctors prefer to rely solely on the results of the MRI since it is the most reliable of the tests.
  - d. Positive MS test results on an MRI are not conclusive.
  
7. Most patients with relapsing-remitting MS become permanently disabled.

- a. true
  - b. false
8. Which of the following was not mentioned as being associated with the development of MS?
- a. gender
  - b. age
  - c. place of residence
  - d. food choices
9. Which statement is an inference?
- a. Once test results are obtained, the disease can be definitively diagnosed.
  - b. The results of the neurological examination are not considered with other test results in reaching the diagnosis.
  - c. Lumbar puncture provides information about lesions on the spinal cord.
  - d. Diagnosing the disease could take years.
10. Which of the following is false regarding MS symptoms?
- a. Symptoms can be confused with those that relate to other diseases.
  - b. Some patients do not realize they are ill with MS.
  - c. Symptoms tend to occur on one side of the body.
  - d. Some symptoms appear and then disappear.
11. According to the text, in some cases, multiple sclerosis may be cured.
- a. true
  - b. false
12. One might guess that most MS research is targeted toward treating relapsing-remitting MS, as opposed to other forms of the disease, because
- a. Most patients have this form of the disease at first, and therefore scientists expect that effective treatment of this form may help more people.
  - b. This form affects a minority of patients; therefore, finding a cure would probably be less expensive.
  - c. Those with this form continuously suffer from symptoms, unlike patients with other types of the disease.
  - d. The symptoms of this stage are so debilitating that scientists feel patients with this form of MS need help more than patients with other forms of the disease.
13. Chemotherapy is used to heighten the immune response to the disease.
- a. true
  - b. false

14. The words, on line 20, that mean “predisposed to” are
- a. immune to
  - b. vulnerable to
  - c. unlikely to
  - d. certain to
15. The word whose meaning most closely corresponds to “residual” on line 34 is
- a. remaining
  - b. major
  - c. serious
  - d. painful
16. A synonym for “vigorously” on line 38 is
- a. quickly
  - b. slowly
  - c. powerfully
  - d. weakly
17. The words whose meanings are the closest to those of “attributed to” on line 45 are
- a. unaffected by
  - b. increased by
  - c. lessened by
  - d. caused by
18. “Transitory” on line 87 means
- a. debilitating
  - b. chronic
  - c. indescribable
  - d. temporary

