

# Multiple Sclerosis (MS)

## I. Background: Who is affected by Multiple Sclerosis

- In the 19<sup>th</sup> century, Jean-Martin Charcot examined nerve fibers under a microscope. (<http://www.multiplesclerosis.com>)
- MS is a disease that affects the whole family. Its impact is felt throughout the entire family system, affecting communication, relationships and daily functioning (<http://www.nationalmssociety.org>)
- An estimated 54 million persons in the United States, or nearly 20 percent of the population, currently live with disabilities. Data for the period 1970-1994 suggest that the proportion is increasing (<http://www.healthypeople.gov>)
- MS is the most prevalent disabling disorder of young adults in the US and affects more than 350,000 people nationwide; at least 30,000 of them are located in the NY metropolitan area (<http://www.mssm.edu>)
- In fact, MS is the most common neurological disorder in young adults, with most cases diagnosed between the ages of 20 and 50. (<http://www.betaseron.com>)
- 70% of all people diagnosed with MS are women. (<http://www.betaseron.com>)
- MS is estimated to cost approx. \$40,000 per patient, per year (<http://www.mssm.edu>)
- Families with MS can be reassured that the risk of their children acquiring MS at any age is low, varying from about 1 in 100 if an aunt or uncle has MS to approx. 1 in 40 if a parent has MS. This compares to a 1 in 750 chance of a child getting MS over a lifetime in the general population (<http://www.nationalmssociety.org>.)
- Recent evidence is strongly suggesting that the disease process starts long before symptoms begin, and by the time symptoms appear, there are already signs of the brain and spinal cord atrophy ([Http://www.icaa.com](http://www.icaa.com))

## II. Statement to the Problem

What is Multiple Sclerosis?

- Literally means “many scars” (<http://www.betaseron.com>)
- MS is a disease of the Central Nervous System (CNS)...the primary characteristic of this disease is the destruction of myelin...the symptoms severity, and course of MS vary widely depending partly on the sites of the plaques and the extend of demyelization (<http://www.icaa.com>)
  - **Myelin**, a protective fatty tissue, surrounds and protects the nerve fibers of the CNS. Myelin not only protects nerve fibers but also makes their job possible. When myelin or the nerve fiber is destroyed or damaged, the ability of the nerves to conduct electrical impulses to and from the brain (<http://www.betaseron.com>)

- **Demyelization:** multiple patches of hard, scarred tissues call plaques.
  - Sclerosis: GK. Skleros, hard (<http://www.icaa.cc.com>)
- MS is a chronic long term condition that affects the CNS (<Http://www.avonex.com>)
- In MS, myelin is lost in multiple areas, exposing nerve fibers (axons), leaving scar tissue called sclerosis, which disrupts the ability of the damaged nerves to send signals from the brain (<http://www.betaseron.com>)
- The cause of MS is unknown and there is no known cure (<http://www.mssm.edu>) and (<http://www.ninds.nih.gov>)

#### What is an Autoimmune Disease?

- An Autoimmune Disease means that the body's immune system mistakenly attacks itself, targeting the cells, tissues and organs (<http://www.avonex.com>)
- In the case of MS, the target of the immune attack is believed to be component of myelin in the CNS. Myelin is a fatty sheath that surrounds and protects nerve fibers. T Cells, a type of white blood cell in the immune system, become sensitized to myelin and cross the blood brain barrier into the CNS. Once in the CNS, these T cells not only injure myelin, but also secrete chemicals that damage nerve fibers (axons) and recruit more damaging immune cells to the site of inflammation. (<http://www.nationalmssociety.org>)
  - Examples of Autoimmune Disease: Rheumatoid Arthritis, Psoriasis, Type 1 Diabetes, Lupus, Crone's Disease (<Http://www.betaseron.com>)
- Some research is suggesting that all autoimmune diseases are basically due to the same genetic error. A 2001 study found, for example, that the T-cell immune factors in type 1 diabetes target the same antigens as in MS. Both diseases have been associated with cow's milk protein. (<http://www.icaa.com>)

#### How is MS Diagnosed?

- Several tests are required to accurately diagnose MS. No one test can identify or rule out MS (<http://betaseron.com>)
  - Tests include Magnetic Resonance Imaging (MRI): provides detains picture of brain (<http://www.avonex.com>)
  - Evoked Potential Tests: measure how a person's nervous system respond to certain stimulation (<http://www.avonex.com>)
  - Spinal taps: checks spinal fluids for signs of multiple sclerosis (<http://www.avonex.com>)
- Usually begins with a complete neurological examination, discussion of full medical history with a healthcare provider (<http://www.avonex.com>)
- Two basic signs are required to confirm MS
  1. Singns of disease in different parts of the nervous system

2. Signs of at least two separate flare-ups of the disease (<http://www.nationalmssociety.org>)

What are some symptoms of MS?

#### Early Symptoms

- Optic Neuritis (inflammation of the nerves in the eye) occurs in 16% of patients. Vision, usually in one eye, becomes unclear or double, and there may be a shimmering effect. Pain or nystagmus (involuntary jerking or movement of the eye) may also occur. In many patients this is the first symptom. In 20% of MS patients, MS develops within 2 years after the onset. In 45%-80%, MS develops within 15 years. About 17% of people experience impaired eye movement.
- Fatigue: typically worse in the afternoon and may be accompanied by an increase in body temperature. This initially occurs in about 20% of patients, but becomes more significant in all patients as the disease progresses
- Changes in sensation in the arms and legs: can experience heaviness, weakness or clumsiness in the limbs. Tingling or loss of sensations can occur, most commonly in the legs. (The first symptoms for patients with PPMS often develop slowly in the upper legs)
- Poor coordination/ spasticity/ disturbances in the bladder
- Lhermitte's sign: an electrical sensation that runs down the back and into the legs, which is produced by bending the neck forward.

#### Symptoms that Gradually Appear

- Imbalance or heaviness/ tremors/ facial pain/ speech difficulties/ difficulty swallowing/ emotional mood swings/ symptoms in the gastrointestinal, urinary and genital tracts.
- Spasm-related symptoms: among the other types of pain and spasm-related symptoms that can occur during attacks are burning, itching, aching, speech difficulties and quivering sensations. They usually occur in the extremities and last seconds to minutes.

#### Possible symptom triggers:

- Stress: there is a significant correlation between severe stress and exacerbation of MS symptoms. For example, in one 2002 study, 85% of instances of worsening MS were associated with stressful events that occurred within an average of 14 days before the episode. (stress is not a cause of MS)

- Above according to icaa.com

What are the potential causes of MS?

- The exact cause of MS has not yet been discovered. Evidence suggests that environmental factors and infectious agents such as viruses and bacteria have been proposed as triggers. Although there is currently no way to decrease a person's risk of

developing multiple sclerosis we know that risk is slightly higher if a parent or sibling has it. (<http://www.avonex.com>)

- No single gene, however, is thought to be responsible for causing MS. Rather the most popular current theory is that the disease occurs in people with a genetic susceptibility that are exposed to some environmental assault (a virus or toxin) that disrupts the blood brain barrier. (<http://www.icaa.com>)
- MS appears to be more common in people living in cooler areas as opposed to those in hot climates. (<http://betaseron.com>)
- The Hygiene Theory: Early Infections as Protection against Allergies and Autoimmune diseases. Over the past few decades, there has been a dramatic increase in asthma and other autoimmune diseases, such as MS. One theory blames this rise on the reductions in childhood infections that have decreased because of modern hygiene and antibiotic use.
  - (<http://www.umm.edu>)

### Forms of Multiple Sclerosis

- A. Relapsing Remitting MS (RRMS): About 75 to 85 percent of people with MS begin with (RRMS)
  - a. Clinically Isolated Syndrome: CIS is one time event characterized by symptoms that are related to the loss of myelin.
- B. Secondary-Progressive MS (SPMS): approximately 10 years after onset of MS, about 50% of people with RRMS will progress to the secondary-progressive type of MS.
- C. Primary Progressive MS (PPMS): relatively rare type of MS, about 5% of the population
- D. Progressive Relapsing MS (PRMS):
  - All according to <http://www.betaseron.com>
- E. Pediatric (Childhood) MS: Since 1980 over 400 cases of childhood MS have been recorded in over 25 medical publications. Initial symptoms have been seen as early as 13 months old, with diagnosis as young as 2 years of age. Of the 400,000 Americans that have MS, 8-10,000 are children or adolescents. An additional 10-15,000 have experienced at least one symptom suggestive of MS. Some of them will go onto develop MS, although in most cases, they will not actually be diagnosed until they are adults. (<http://www.nationalmssociety.org>)

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- A. Relapsing Remitting- characteristic feature of RRMS is the attack lasting at least 24 hours up to several days (flare-up/exacerbation)
- B. Chronic Progressive: subcategorized as
  - a. Primary-Progressive MS: progresses continuously and gradually without remission. It occasionally levels off, and minor improvement is even possible. This occurs in about 10% of patients, who tend to be older than average at the time of diagnosis

- b. Secondary-Progressive MS: occurs after the initial RR phase in about half of patients during the first 10 years and nearly all of them within 25 years. It follows a progressive course of nerve and muscle deterioration with occasional acute flare-ups, remissions and plateaus.
- c. Progressive-Relapsing MS: progressive from the start with acute symptom flare-ups and continued deterioration between relapses. It occurs in less than 5% of patients.
- About 20% of MS patients (usually those whose first symptoms occur after the age of 45) have the chronic-progressive form without first developing RMSS. CPMS generally follows a downhill course, but its severity varies widely.
- The natural courses of primary progressive and progressive relapsing MS are similar; some experts believe this distinction is unnecessary.
  - All according to <http://www.icaa.com>

### III. Epidemiologic Picture of the Problem:

- The average number of relapses per year with a person with RRMS can range from 0.14-1.1 per year and 20% of MS patients (usually those whose first symptoms occur after 45) have the chronic progressive (<http://www.icaa.com>)
- Age: Onset occurs between the ages of 20-40 years in 70% of patients with the age being 30 and the peak incidence occurring in the mid-twenties. It rarely develops before the age 15.
- Gender: MS is more common among woman than men. According to research presented at the American Academy of Neurology annual conference, the ration between women to men has been growing. Researchers found that in the 1940s, the ratio of woman to men was 2 to 1. By 2000, the ratio has grown to 4 to 1.
- Ethnicity: MS occurs worldwide but is most common in Caucasian of the northern European origin, especially those of Scottish descent. It is extremely rare for Asians, Africans, and Native Americans. Specific groups (gypsies, Eskimos (etc.) never have reported a case. While the risk for MS for African-Americans is around half that of Caucasians, a recent study suggested that African-Americans are more like to get a more aggressive form of the disease and to suffer impaired mobility.
- Geography: The risk for MS is higher in different regions of the world. In general, it is more prevalent in temperate regions than in the tropics. Specifically, prevalent is higher in northern and central Europe (except northern Scandinavia). Low risk areas include Africa and Asia, the Caribbean, Mexico, and possibly northern South America. It is uncertain whether this pattern is attributable to environmental factors, genetics or both.
  - According to <http://www.umm.edu>

### IV. Solutions to the Problem:

- The cause of MS is unknown and there is no known cure (<http://www.mssm.edu>) (<http://www.ninds.nih.gov>)

- Research Directed at the Role of Immune System in MS: much of the ongoing research in MS is directed towards finding answers to questions about the role of the immune system in the development of MS (<http://www.nationalmssociety.org>)
- Medications for Remittance Relapsing MS:
  - Beta Interferons: Interferon beta-1b (Betaseron) and interferon beta-1a (Avonex, Rebif) are genetically engineered copies of proteins that occur naturally in your body. They help fight viral infection and regulate your immune system. Used in different ways they reduce, but do not eliminate, flare-ups.
  - Glatiramer (Copaxone): this medication is an alternative to beta Interferons if you have RRMS. Doctors believe Glatiramer works by blocking your immune system's attack on myelin.
  - Natalizumab (Tysabri): this drug is administered intravenously once a month. It works by blocking the attachment of immune cells to brain blood vessels—a necessary step for immune cells to cross into the brain—thus reducing the immune cells' inflammatory action on brain nerve cells. (taken off the market recently)
    - Above <http://www.mayoclinic.com>
- Medications for Progressive MS:
  - Corticosteroids: Dr's often prescribe short courses of oral or I.V. corticosteroids to reduce inflammation in nerve tissue and to shorten the duration of flare-ups.
  - Muscle Relaxants. Baclofen (Lioresal) and tizanidine (Zanaflex) are oral treatments for muscle spasticity.
  - Meds to reduce fatigue: Dr's prescribe antidepressant medications because of their stimulant properties such as the antiviral drug amantadine (Symmetrel) or a medication for narcolepsy called modafinil (Provigil)

## V. Internet Resources:

- The Corinne Goldsmith Dickinson Center for Multiple Sclerosis ([www.mssm.edu/neurology](http://www.mssm.edu/neurology))

The goal of this organization is to implement a multidisciplinary approach to MS by utilizing an array of genuinely concerned specialists in the field who goals are to understand the causes of Multiple Sclerosis and overcome the consequences of this destructive condition. This center is located in New York City, a metropolitan area where about ten percent of MS victims reside.

- National Multiple Sclerosis Society ([www.nationalmssociety.org](http://www.nationalmssociety.org))

The National MS Society is committed to building a movement by and for people with MS that will move us closer to a world free of this disease. This site indicates an array of information and additional links, which explains a multiplicity of different facets of the condition, including recent studies, medical breakthroughs and alternate theories on the disease. The National MS society, the leading private financial contributor of MS research, “established

the first-of-its kind network of Pediatric MS centers of Excellence. The centers were established in geographically diverse areas so they can serve as regional centers for as many children and adults living with MS as possible”. A few of these centers are

- Center for Pediatric-Onset Demyelinating Disease at the Children’s Hospital of Alabama, University of Alabama at Birmingham
- Pediatric MS Center of the Jacobs Neurological Institute, University of NY at Buffalo
- Mayo Clinic T. Denny Sanford Pediatric Outpatient Center, Minnesota

**VI. Bibliography:**

International Curriculum and Assessment Agency <http://www.icaa.com>

National Institute of Neurological Disorder and Stroke, <http://www.ninds.nih.gov>

National MS Society, <http://www.nationalmssociety.org>

University of Maryland Medical Center, <http://www.umm.edu>

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## Class Handout for Multiple Sclerosis

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What are some symptoms of MS?

- Optical Neuritis, Fatigue, Poor coordination, depression can arise from the primary symptoms\

What is the cause of MS? Causes of MS?

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Facts about MS

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