Multiple Sclerosis Society of Canada

Cognitive Change and Multiple Sclerosis

COGNITIVE CHANGE AND MULTIPLE SCLEROSIS

Adapted from *Solving Cognitive Problems*, a publication of the National Multiple Sclerosis Society (USA)
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COVER ARTWORK
Diane Estabrook
Gone Forever, Watercolour on paper

"My approach to art is to get away from just painting what I see, to painting from somewhere within."

Diane Estabrook has had MS as long as she has painted. With over 30 years of joy and struggle behind her, she has never given up. Diane bought a business at age 43, achieved a BFA degree at 49 and received a certificate in Arts Management a year later.

Just as when she first began painting, Diane finds that her work 'is focused not on the whole, but within, where balance can exist'.

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Introduction

About MS

Multiple sclerosis involves random attacks on a fatty material called **myelin** in the brain, spinal cord, and optic nerves, the structures that make up the **central nervous system**. When myelin is attacked, the body is able to make some repairs, but eventually patchy areas of scarring (also known as **lesions**) develop on **nerve fibres** where healthy myelin once was. The nerve fibre (or axon) may also be damaged or broken. In addition, MS can result in loss of brain tissue (**atrophy**).

These three types of changes – loss of myelin, damage to axons, and loss of brain tissue – may occur in any part of the central nervous system and account, in part, for the wide variety of possible MS symptoms.

The most common symptoms are problems with balance, strength, vision, fatigue, muscle control, or bladder or bowel activity, and odd sensations such as numbness or tingling.

The brain and behaviour

Brain function determines our personality, emotions, and **intellect (cognition)** – the attributes that make us unique. MS has the potential to affect these brain functions, either directly or indirectly. The idea is upsetting, but the facts emerging from research are encouraging. For example, although problems with intellect are common, they are often not severe.

The first step to take in dealing successfully with cognitive problems caused by MS is to learn the facts. This booklet provides basic information for people with multiple sclerosis, their family members and caregivers.

Cognition is sensitive to many potentially disruptive factors. These include normal aging as well as disease or injury. It can also be affected temporarily by tension, emotional stress, depression, sleep disturbance, menopause, or fatigue. Cognition may be influenced by nutrition; for example, low blood sugar (hypoglycemia). And it can be disrupted by some prescription drugs or by drug or alcohol abuse. As well, many of these factors can and do occur in combination.

Which intellectual functions might be affected by MS?

Although investigators are still in the process of answering this question, some consistent information has emerged.

- **Memory or recall problems** are the most frequently reported. Memory loss seems to be confined largely to recent events. For example, a person may have trouble remembering an important phone number learned in the past year. In contrast, the same person will have little difficulty remembering information from the distant past, such as the meanings of words that were learned in school.

  Studies show that two types of memory processes may be faulty. The first process is the ability to recall information that has been learned and stored. This may be the most common reason for memory problems. A second reason,

supported by more recent research, suggests that some people may have trouble learning to begin with. Not being able to learn certain facts will make it difficult to recall them later.

Using "cues" may help to identify the source of a memory problem. A person who has learned new information but who cannot recall it may be helped when he or she is given a cue. On the other hand, using cues will not aid a person who has not been able to learn the information to begin with.

- **Abstract reasoning and problem-solving abilities** are sometimes affected. Problem solving is multi-faceted and includes analyzing a particular problem, identifying the central components that need altering, planning a sequence of events to bring about the change, and finally putting the pieces together to effect the change. Moreover, flexibility is often required to achieve these goals. Should an approach be too rigid with inflexibility in tailoring the sequences to the particular problem at hand, then the solution may be incorrect. Individuals who cannot manipulate information to bring about the desired outcome are said to have a **"dysexecutive syndrome"**.
- **Visual-spatial abilities** can be affected in MS. These include the ability to recognize objects accurately and to draw or assemble things. Visual-spatial abilities are involved in many everyday tasks such as driving, finding one's way around, or packing a suitcase.

- **Verbal fluency** is another area of cognition affected in MS. Fluency problems are different from MS speech problems, which slow speech down or change voice quality. A fluency problem often shows itself as the "tip-of-the-tongue" phenomena. A person wants to say a word, it's on the tip of the tongue, but she or he just can't think of it.
- **Speed of information processing –** Both recall and verbal fluency skills require rapid processing of information. Slowness in mental speed, also termed 'delayed information processing speed', is the main cognitive problem linked to MS. Cognitive tests that demand quick responses are therefore helpful in unmasking cognitive problems in someone with MS. If given enough time, a person may be able to successfully access stored memory and solve a particular problem. However, performances are slower than those elicited from healthy individuals.

  Here, a comparison with aspects of neurological function can prove helpful. For example, a person with MS may take longer to walk from point A to point B, but if given enough time, will arrive at Point B. In the same way, when faced with a cognitive challenge, a person with MS may emerge with the correct response, but at a slower rate.

How do cognitive problems arise?

MS may directly give rise to cognitive difficulties in a number of ways. Lesions (or areas of scarring) have been linked to **cognitive problems.**

Studies have found that areas of scarring occur with roughly equal frequency in the right and left halves of the brain, in areas called the cerebral white matter, where myelin occurs in abundance. MS lesions are particularly common near the ventricles – or inner cavities of the brain – through which the cerebrospinal fluid flows. Studies using **magnetic resonance imaging (MRI)** have demonstrated a clear relationship between the presence of these lesions and cognitive problems.

More recent research has shown that MS can bring about a reduction in brain size. This shrinking, called atrophy, is also closely linked to the presence of cognitive difficulties. In fact, shrinking (or atrophy) may be a more likely cause of cognitive problems than brain lesions

Finally, new MRI techniques can now provide information of **pathological changes** occurring in parts of the brain that appear normal to the naked eye. Some of these subtle changes have also been linked to cognitive dysfunction.

In summary, cognitive problems may be caused by shrinking in the brain (atrophy), brain lesions (scarring), and more subtle changes in brain structure that cannot be seen with the naked eye.

How common are cognitive problems?

The number of people with MS found to have cognitive problems will depend on the sample studied. Research has shown that about half of all people with multiple sclerosis living in the community show no evidence at all of intellectual problems. About 40% have mild dysfunction, while about 5-10% have moderate to severe impairments.

But what do mild or moderate problems mean in people's lives? This question is hard to answer because people's circumstances vary so much. For one person, mild intellectual impairment or cognitive problems could require a major life shift – the end of a career or professional practice. But another with the same degree of impairment might need no change in lifestyle at all, because he or she is able to cope using self-help measures or through reasonable **accommodations in the workplace.**

Detecting cognitive problems

A professional evaluation may be called for if you or those closest to you notice a change for the worse in cognitive function. For example, do you have increased trouble remembering things? Is it becoming harder to stay focused on a task? Do you experience lapses of judgment, trouble coming up with words in conversation, slowed thinking, or difficulty organizing projects or daily activities?

An evaluation is particularly in order if any of these changes get in the way of your work or social life, or create a stress for you.

An evaluation may also be in order if you are considering a career change or planning to enter school or a training program. Many people are interested in getting an evaluation because they are starting on one of the **disease modifying therapies** and want to be able to track cognitive changes over time.

If cognitive problems are suspected, then a neuropsychological evaluation is required. This is carried out by a qualified **neuropsychologist**, a specialist in the behavioural changes caused by brain disease or trauma, preferably one who has had experience with people with MS. A psychologist without this training may have difficulty selecting the proper tests and interpreting the results.

Testing entails a detailed examination of the various aspects of cognition described earlier. This process can be lengthy and some **cognitive batteries** take hours. Recently, a group of experts who work with MS patients developed nine cognitive tests they believe are the minimum needed to find out whether cognitive problems exist or not. Called the **MACFIMS (Minimal Assessment of Cognitive Function in Multiple Sclerosis)** these tests take about 90 minutes to complete.

A psychiatrist or neurologist can perform briefer evaluations, but these generally pick up only the more severe forms of **cognitive problems** (Janice Peyser, PhD of the University of Vermont completed a study in which she found that almost half of the patients whom neurologists considered to be without intellectual problems were found to have problems when tested by neuropsychologists).

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Dr. Ralph Benedict, PhD from the Buffalo School of Medicine has developed a new self-report questionnaire designed to detect cognitive problems in people with MS. Two versions of a test with 15 questions each must be completed one by the person with MS and the other by someone who knows this person well, such as a friend or family member. Results show that the friend or family member is often a better judge of whether cognitive problems exist or not. Although this kind of test may be useful when someone does not have access to a neuropsychologist, a full series of tests will provide a much more complete picture of a person's cognitive weaknesses and strengths.

Data reveal that 40-50% of people with MS believe their intellectual functions had been affected by the disease. Professional evaluation showed the statistic to be correct. But the people who were actually affected by cognitive problems are not always the ones who had diagnosed themselves. Some of them were instead suffering from depression. Others who were severely impaired were unaware that any changes had taken place.

These points are of considerable clinical importance. Depression, which is common in people with MS, can be treated successfully with drugs and/or psychotherapy. Fatigue, which may also lead to a person complaining of cognitive problems may be helped by medication too. And intellectual change arising directly from MS may be helped through cognitive rehabilitation strategies. The choice of appropriate treatment therefore depends on the right diagnosis.

Treatment for cognitive problems

Medication

Research concerning the use of medications is ongoing and a couple of studies have yielded modestly promising results.

A drug called Aricept (the generic name is *donepezil hydrochloride*) is currently used to treat memory problems in Alzheimer's disease. There has been interest in the possible use of Aricept in MS patients. A recent clinical trial in which 69 individuals with MS participated found that Aricept improved performance on memory tasks. Larger clinical trials are needed to confirm these findings. As well, it will be important to see whether positive results from such studies will translate into practical gains in real life.

A drug that is similar to Aricept, namely Rivastigmine, has been used in a small sample of MS patients with cognitive problems. However, the number of people who participated in the study was too small to judge whether the treatment worked well. In theory this medicine holds the same promise as Aricept. More study is needed.

A few studies have also looked at the effects of MS disease modifying drugs (Avonex, Betaseron, Copaxone, and Rebif) on cognitive function. The data are mixed, with improvements found with some drugs, but not others. Since these medications reduce the number and severity of MS attacks, decrease signs of damage to brain tissue as seen on MRI, and delay the progression of disability, they may all, in the long

term, have beneficial effects on cognitive function. The same situation pertains to treatment with Tysabri. Additional studies are needed to shed light on these important therapeutic considerations.

Cognitive Rehabilitation

In the past few years the use of **cognitive rehabilitation** in MS has increased as techniques have been developed for the more common problems.

Cognitive rehab is designed to help people compensate for loss of memory or slowed learning ability. It is provided by neuropsychologists, occupational therapists, or speech/language pathologists.

Ordinarily, cognitive rehab involves one or more sessions a week over several weeks or months. Each session typically lasts about an hour. These sessions will include a variety of activities depending on individual needs. They might include doing exercises designed to enhance memory, concentration, or spatial skills. A good deal of time may be devoted to **"compensatory strategies"** such as learning how to be more organized, how to use a computer effectively, how to manage time, or process paperwork.

The goals of treatment are individualized and progress towards those goals may be checked periodically. In many instances, the cognitive rehab program may include meetings with family members to help them understand the nature of specific problems and how they can help. Stress management, counselling, or psychotherapy can be added to the treatment plan if needed.

i) Compensatory Strategies

A systematic program of cognitive rehabilitation will train the person with MS in the consistent use of techniques that compensate for lapses. We all use some of these methods. Common memory aids include writing things down in notebooks, posting notes on the refrigerator, or carrying a pocket calendar.

Many of us also use time management methods, filing systems, checklists for complex tasks, reading comprehension strategies, and special-purpose diaries. We routinely employ mental tricks to make the most of our abilities.

Compensatory strategies, like their physical cousins, the cane and the walker, do not address the underlying problem. They offer an alternative way to perform a task that has become difficult. In other words, we may not be able to alter an underlying impairment (the weakened memory, for example), but will still find ways to dramatically improve function. Does it really matter whether we get the phone number we need out of our head or from a pocket data bank?

Compensatory strategies make use of a person's remaining cognitive strengths. It is therefore important to find out what these strengths are before deciding which compensatory strategies may prove beneficial. Neuropsychological testing is helpful here because it provides information not only on cognitive problems, but also those residual strengths on which the compensatory strategies are built.

ii) Improving Function

These strategies are remedial in nature. It is tempting to believe that the right exercise might strengthen memory. Some functional improvement methods are based on popular theories concerning the **"plasticity"** of the brain: the ability of the brain to recover from damage, perhaps by shifting functions to undamaged areas. Tests using a certain type of MRI scan, namely functional MRI (fMRI), have shown that the brain has a considerable degree of plasticity when it comes to cognitive abilities. This ability to adapt (known as plasticity) is reduced when brain disease becomes more extreme.

Time has shown that **remedial methods** have not succeeded as well as people hoped they would. Dr. Helmut Hildebrandt PhD, a neuropsychologist in the Department of Neurology in Bremen, Germany, has shown that MS patients with no brain atrophy are the ones likely to get the most benefit from remedial cognitive rehabilitation.

A comprehensive program of cognitive rehabilitation is likely to use a mixture of retraining (remedial) and compensatory strategies. For example, supervised programs with graded practice can improve attention and concentration levels. This sets the stage for more effective use of compensatory strategies in everyday situations.

What can be done to alleviate cognitive problems?

- **Get it out in the open.** Years ago, professionals advocated not discussing MS-related intellectual problems in public because the issue would upset people. Today, health-care professionals recognize that people with MS almost always want information on this or any other topic. Talk over your concerns with your doctor or nurse. You may want to take a copy of this booklet to your next appointment.
- **Share with others.** Very often, fears about a problem are much worse than the reality. To keep up with the facts, ask questions, read, attend lectures if possible, and talk to others who have similar problems. For the most recent information on MS research, visit the MS Society of Canada's website at **www.mssociety.ca** and click on 'research'.

  In MS support groups or educational meetings, cognitive dysfunction is a frequent topic of discussion. Sharing helps on an emotional level as well as on a practical one. Comparing notes and learning how others cope can help to expand one's own resources and remove the feeling of stigma.
- **Make it a family affair.** Family members may not realize that the person with MS has some cognitive problems due to this disease. When the person with MS forgets parts of conversations, misses appointments, or misplaces things, it may be viewed as laziness, indifference or carelessness. If this happens, family members and friends need help to develop an understanding of what is going on.

- **Get counselling if it seems appropriate.** Not everyone who experiences a few memory lapses needs counselling. However, counselling or psychotherapy do help people deal with the impact cognitive problems have both on self-esteem and on practical everyday living. They also address depression or anxiety, which can adversely affect intellectual function.
- **Explore self-help options.** Here are some practical suggestions that have worked for many:
  - Where memory is weak, try substituting organization. Get a good loose-leaf organizer and learn to use it consistently as your information centre. Set up sections for appointments, to-do's, phone numbers, driving directions – anything that you need to remember but are likely to forget. Get rid of all those little scraps of paper with notes on them that are always getting lost.
  - Consider augmenting the loose-leaf organizer with an electronic gadget. There are many small computer-based personal-information managers and personal digital assistants on the market. Some can be programmed to beep as a reminder of tasks or appointments.
  - When you are trying to learn something new, give yourself extra time to practice. Studies have shown that with extra practice people with MS can improve their ability to recall information later.
  - Set up a family calendar to track everyone's commitments.

- Assign a particular place for storing frequently used items such as your car keys.
- Encourage family members to return borrowed objects to their proper spots. For example, the scissors always go in the top drawer of the desk.
- Work on your focus and concentration. Sometimes we forget things because we never really learned them. Frequently we only half pay attention. Improving your concentration can enhance your recall.
- Plan your most challenging intellectual tasks for your best time of day. Recent studies have documented the existence of **"cognitive fatigue"**. This refers to a temporary decline in cognitive functioning following an extended period of intellectual effort. Strategically scheduled rest periods will also help you avoid this form of fatigue.
- Use mental pictures to aid memory. For example, to increase the likelihood that you will remember to close the windows before leaving the house, visualize a great deluge in which enormous streams of muddy water flood into every room through the open windows. Hold on to that image for a few moments and you are more likely to remember to close windows later.
- When you meet a new person, jot down his or her name as soon as you can gracefully do so. Later, make some notes in your loose-leaf organizer on the most striking things about that person.

- When you encounter word-finding problems, don't persist in trying to think of that elusive word. Try to shift your attention to something else. The word you want will come back to you later.
- Visit your library or bookstore for books designed to help organize time or improve memory. Some of these involve wildly complicated schemes, but many have useful suggestions.

Clearing up misconceptions

Cognitive dysfunction is probably subject to more misconceptions than any other topic in MS, in part because we tend to avoid discussing it. Let's dispel some misconceptions.

➲ **Misconception: MS does not affect the intellect.**

Most people with MS will never be troubled by severe intellectual problems, but mild problems are fairly common. Some professionals still cling to the idea that the intellect is never affected. We need open discussion of this topic in order to deal with it.

➲ **Misconception: People who have cognitive problems are emotionally unstable, or have a mental illness.**

Cognitive dysfunction is not an emotional or mental disorder. Someone can have cognitive problems and be perfectly normal emotionally and mentally. While emotional problems such as depression or anxiety can adversely affect intellect, cognitive problems should not automatically be attributed to these causes.

- **Misconception: Cognitive functioning can be assessed by asking a few simple questions.**

  Cognitive function must be assessed using a battery of standardized tests administered and interpreted by someone with the proper training. The **"bedside mental status"** test can detect only the most severe cognitive problems.

- **Misconception: All people with MS should have a detailed cognitive assessment.**

  Not at all. A comprehensive assessment is necessary only if problems occur and then only after thorough consultation to rule out other factors.

- **Misconception: When cognitive problems appear, they worsen rapidly.**

  Although very few long-term studies have been completed, clinical experience so far suggests that these problems progress slowly.

- **Misconception: Cognitive problems only occur in people who are severely disabled.**

  On the contrary, people who are severely disabled physically may have no cognitive problems at all. Studies completed by Dr. Robert Heaton, PhD, and his colleagues at the University of Colorado and by Dr. William Beatty, PhD, now at the University of Oklahoma Health Sciences Centre, have shown that there is only a very weak relationship between extent of physical disability and cognitive dysfunction in MS.

On the other hand, recent data from Dr. Maria Amata at the University of Florence, Italy have shown that even people with benign MS (defined as minimal physical disability after many years of illness) can experience cognitive problems.

➲ **Misconception: Cognitive problems only occur late in the course of MS.**

Doctors Beatty and Heaton found that there is little relationship between duration of MS and the severity of cognitive dysfunction.

➲ **Misconception: Cognitive problems only occur in people with progressive MS.**

Cognitive dysfunction is likely to be somewhat worse in people with progressive MS. Memory deficits appear to be common among persons with relapsing-remitting MS. Individuals with any kind of MS can experience cognitive problems.

➲ **Misconception: Relapses or attacks of MS do not affect cognitive functions.**

Not true. People with MS can have attacks in which cognitive problems become dramatically worse very quickly. The problems can then improve as remission proceeds.

➲ **Misconception: People with MS-related cognitive problems have euphoria.**

Euphoria involves exaggerated and unrealistic expressions of happiness, often accompanied by a lack of concern about oneself. Euphoria is actually rare, affecting approximately 10% of the MS population. It occurs almost exclusively in people with the most severe cognitive impairments.

➲ **Misconception: Cognitive problems in MS are similar to Alzheimer's disease.**

No. MS bears little resemblance to Alzheimer's disease. MS-related cognitive dysfunction is almost never as severe as Alzheimer's.

MS-related cognitive problems are usually limited to the functions discussed in this booklet. The problems may stabilize at any time, and no further progression will occur.

In contrast, Alzheimer's affects many different functions. The deficits it causes increase rapidly and often predictably. Language declines along with memory, and a person with Alzheimer's will eventually be unaware of where he or she is and forget even his or her own name.

Dr. Christopher Filley, MD, and colleagues at the University of Colorado, have published a study that compared cognitive aspects of the two diseases. A recent review article confirmed the differences between what is generally observed in MS and in Alzheimer's.

Glossary of terms

Abstract reasoning: Thinking in non-concrete terms. This allows a person to extract relevant information from a concept.

Accommodations (workplace): Workplace accommodations are any changes in your work environment that give you an equal opportunity to do your job.

Atrophy: A wasting away or decrease in size of a cell, tissue, or organ of the body because of disease or lack of use.[1]

Bedside mental status test: There are a number of brief cognitive examinations that can be administered without the expertise of a neuropsychologist. The most widely cited is the Mini-Mental State Examination. These tests take a few minutes to complete and provide a quick, albeit rough guide to a person's cognitive function.

Central Nervous System: Made up of the brain, spinal cord and optic nerves. All parts of the central nervous system (CNS) can be affected by multiple sclerosis.

Cognition: High level functions carried out by the human brain, including comprehension and use of speech, visual perception and construction, calculation ability, attention (information processing), memory, and executive functions such as planning, problem-solving, and self-monitoring.[2]

1 From, *Multiple Sclerosis: The questions you have, the answers you need,* 3rd edition. Rosalind C. Kalb, editor. New York: Demos Medical Publishing, 2004.

2 From, *Multiple Sclerosis: The questions you have, the answers you need,* 3rd edition. Rosalind C. Kalb, editor. New York: Demos Medical Publishing, 2004.

Cognitive batteries: A series of tests, procedures, or diagnostic examinations given to or done on a patient[3] with the purpose of assessing cognition.

Cognitive fatigue: People who experience cognitive fatigue have difficulties in sustaining mental functions such as such as verbal learning, memory, and attention span.

Cognitive problems: Changes in cognitive function caused by trauma or disease process. Some degree of cognitive problems occur in approximately 50-60 percent of people with MS, with memory, information processing, and executive functions being the most commonly affected functions. See **Cognition.**[4]

Cognitive rehabilitation: Techniques designed to improve the functioning of individuals whose cognition is impaired because of physical trauma or disease. Rehabilitation strategies are designed to improve the impaired function via repetitive drills or practice, or to compensate for impaired functions that are not likely to improve. Cognitive rehabilitation is provided by psychologists and neuropsychologists, speech/language pathologists, and occupational therapists. While these three types of specialists use different assessment tools and treatments strategies, they share the common goal of improving the individual's ability to function as independently and safely as possible in the home and work environment.[5]

3 Taber's Cyclopedic Medical Dictionary

4 From, *Multiple Sclerosis: The questions you have, the answers you need,* 3rd edition. Rosalind C. Kalb, editor. New York: Demos Medical Publishing, 2004.

5 From, *Multiple Sclerosis: The questions you have, the answers you need,* 3rd edition. Rosalind C. Kalb, editor. New York: Demos Medical Publishing, 2004.

Compensatory strategies: Methods or approaches which make up for a deficiency.

Disease-modifying therapies: Treatments that impact the underlying disease; these therapies reduce the frequency and severity of MS relapses and have a positive impact on the development of disability. In Canada there are five approved DMTs.

Dysexecutive syndrome: A cluster of impairments generally associated with damage to the frontal lobes.

Information processing speed: This refers to cognitive speed, that is the speed at which an individual thinks as part of accessing memory or solving a problem.

Intellectual functions: processes that relate to the mind and understanding; to the capacity to comprehend relationships, the ability to think, to solve problems and to adjust to new situations.[6]

Lesions (also known as plaques, or scars): An area of inflamed or demyelinated central nervous system tissue.[7]

6 Taber's Cyclopedic Medical Dictionary – From definitions for 'Intellectual' and 'Intelligence'.

7 From, *Multiple Sclerosis: The questions you have, the answers you need,* 3rd edition. Rosalind C. Kalb, editor. New York: Demos Medical Publishing, 2004.

Magnetic Resonance Imaging (MRI): A diagnostic procedure that produces visual images of different body parts without the use of X-rays. Nuclei of atoms are influenced by a high frequency electromagnetic impulse inside a strong magnetic field. The nuclei then give off resonating signals that can produce pictures of parts of the body. An important diagnostic tool in MS, MRI makes it possible to visualize and count lesions in the white matter of the brain and spinal cord.[8]

Minimal Assessment of Cognitive Function in MS (MACFIMS): A standardized battery of nine cognitive tests recommended by a panel of experts for use in assessing cognitive dysfunction in patients with multiple sclerosis.

Myelin: A soft, white coating of nerve fibres in the central nervous system, composed of lipids (fats) and protein. Myelin serves as insulation and as an aid to efficient nerve fibre conduction. When myelin is damaged in MS, nerve fibre conduction is faulty or absent. Impaired bodily functions or altered sensations associated with those demyelinated nerve fibres are identified as symptoms of MS in various parts of the body.[9]

Nerve fibre (Axon): The slender, long branch extending from a nerve cell that carries nerve impulses to adjacent nerve cells throughout the body. Most nerve fibres are surrounded by 1 - 200 layers of myelin.

8 From, *Multiple Sclerosis: The questions you have, the answers you need,* 3rd edition. Rosalind C. Kalb, editor. New York: Demos Medical Publishing, 2004.

9 From, *Multiple Sclerosis: The questions you have, the answers you need,* 3rd edition. Rosalind C. Kalb, editor. New York: Demos Medical Publishing, 2004.

Neuropsychologist: A psychologist with specialized training in the evaluation of cognitive functions. Neuropsychologists use a battery of standardized tests to assess specific cognitive functions and identify areas of cognitive impairment. They also provide remediation for individuals with MS-related cognitive problems.[10]

Pathological changes: In multiple sclerosis this refers to the abnormalities affecting the central nervous system.

Plasticity (brain): The ability of the brain to recover from damage, perhaps by shifting functions to undamaged areas.

Remedial methods: cognitive strategies designed to bring about an improvement in various aspects of cognitive function.

10 From, *Multiple Sclerosis: The questions you have, the answers you need,* 3rd edition. Rosalind C. Kalb, editor. New York: Demos Medical Publishing, 2004

NOTES

How to reach the MS Society of Canada

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Our Mission

To be a leader in finding a cure for multiple sclerosis and enabling people affected by MS to enhance their quality of life.

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