Multiple sclerosis essay

Multiple Sclerosis (MS) is a chronic, often disabling disease that randomly attacks the central nervous system (brain and spinal cord). The progress, severity and specific symptoms of the disease can not be predicted; symptoms may range from tingling and numbness to paralysis and blindness. MS is a devastating disease because people live with its unpredictable physical and emotional effects for the rest of their lives. MS is a well-known disease, but poorly understood. In the United States there are approximately 200 new cases diagnosed each week; MS is a common disease and not always caused by genetics.

Therefore, I feel we all need to have a better understanding of this disease that has no cure yet. I hope to make MS more understanding in my paper. In my paper I will explain what MS is, who gets MS, what MS has to do with the metabolism, some new techniques being used to pinpoint genetic factors, what some of the symptoms of MS is, and some treatments for MS. Multiple Sclerosis Multiple sclerosis (MS) is a progressive disabling illness that affects nerve cells in the brain and spinal cord (Bernard).

Under normal conditions these nerve cells are surrounded by an insulating sheath made of fatty “ myelin,” which speeds the passage of nerve impulses. In MS, this myelin sheath is inflamed or damaged, disrupting nerve impulses and leaving areas of scarring (sclerosis).

The disruption of nerve signals within the brain and spinal cord causes a variety of symptoms that may affect vision, sensation, and body movements. “ These symptoms usually wax and wane through a series of relapses (episodes when symptoms suddenly get worse) alternating with remissions

(periods of recovery, when symptoms improve).” (Brunnscheiler) For many patients, a long history of MS attacks over several decades leads to slowly progressing disability, but for others the disability is more rapid and severe. MS is a life-long chronic disease diagnosed primarily in young adults who have a virtually normal life expectancy. Consequently, the economic, social, and medical costs associated with the disease are significant.

Estimates place the annual costs of MS in the United States in excess of $2. 5 billion. (Melvin) No one knows exactly how many people have MS. It is believed that, currently, there are approximately 250, 000 to 350, 000 people in the United States with MS diagnosed by a physician. (Boyden)

This estimate suggests that approximately 200 new cases are diagnosed each week. Also, MS is the most common nerve disease to develop in young persons after birth, and it affects over 1 million young adults worldwide.

“ Close relatives of a person with MS are 8 times more likely than average to develop the disease themselves, and children of a person with MS run 30 to 50 times the average risk.” (Waxman) Most people experience their first symptoms of MS between the ages of 20 and 40, but a diagnosis is often delayed. This is due to both the transitory nature of the disease and the lack of a specific diagnostic test–specific symptoms and changes in the brain must develop before the diagnosis is confirmed. (Health Central) Although scientists have documented cases of MS in young children and elderly adults, symptoms rarely begin before age 15 or after age 60. Whites are more than twice as likely as other races to develop MS.

In general, women are affected at almost twice the rate of men; however, among patients who develop the symptoms of MS at a later age, the gender ratio is more balanced.

(Waxman) To understand what is happening when a person has MS, it is first necessary to know a little about how the healthy immune system works. The immune system — a complex network of specialized cells and organs — defends the body against attacks by “ foreign” invaders such as bacteria, viruses, fungi, and parasites. It does this by seeking out and destroying the interlopers as they enter the body. Substances capable of triggering an immune response are called antigens. (Hofmann) “ The immune system displays both enormous diversity and extraordinary specificity.

” (Hofmann) It can recognize millions of distinctive foreign molecules and produce its own molecules and cells to match up with and counteract each of them. In order to have room for enough cells to match the millions of possible foreign invaders, the immune system stores just a few cells for each specific antigen.

When an antigen appears, those few specifically matched cells are stimulated to multiply into a full-scale army. Later, to prevent this army from overexpanding, powerful mechanisms to suppress the immune response come into play.

T-cells, so named because they are processed in the thymus, appear to play a particularly important role in MS. They travel widely and continuously throughout the body patrolling for foreign invaders. In order to recognize and respond to each specific antigen, each T cell’s surface carries special

receptor molecules for particular antigens. T cells contribute to the body’s defenses in two major ways.

“ Regulatory T cells help orchestrate the elaborate immune system. ” (Kaser) For instance, they assist other cells to make antibodies, proteins programmed to match one specific antigen much as a key matches a lock. Antibodies typically interact with circulating antigens, such as bacteria, but are unable to penetrate living cells.

Chief among the regulatory T cells are those known as helper (or inducer) cells. “ Helper T cells are essential for activating the body’s defenses against foreign substances. ” (Kaser) Yet another subset of regulatory T cells acts to turn off, or suppress, various immune system cells when their job is done.

Killer T cells, on the other hand, directly attack diseased or damaged body cells by binding to them and bombarding them with lethal chemicals called cytokines. (Kaser) Since T cells can attack cells directly, they must be able to discriminate between “ self” cells (those of the body) and “ nonself” cells (foreign invaders). To enable the immune system to distinguish the self, each body cell carries identifying molecules on its surface. T cells likely to react against the self are usually eliminated before leaving the thymus; the remaining T cells recognize the molecular markers and coexist peaceably with body tissues in a state of self-tolerance. “ In autoimmune diseases such as MS, the detente between the immune system and the body is disrupted when the immune system seems to wrongly identify self as nonself and declares war on the part of the body (myelin) it no longer recognizes.” (Hauser)

Through intensive research efforts, scientists are unraveling the complex secrets of the malfunctioning immune system of patients with MS.

Components of myelin such as myelin basic protein have been the focus of much research because, when injected into laboratory animals, they can precipitate experimental allergic encephalomyelitis (EAE), a chronic relapsing brain and spinal cord disease that resembles MS. The injected myelin probably stimulates the immune system to produce anti-myelin T cells that attack the animal's own myelin. (Leuven) Investigators are also looking for abnormalities or malfunctions in the blood/brain barrier, a protective membrane that controls the passage of substances from the blood into the central nervous system. It is possible that, in MS, components of the immune system get through the barrier and cause nervous system damage. " Scientists have studied a number of infectious agents (such as viruses) that have been suspected of causing MS, but have been unable to implicate any one particular agent.

" (Mayo Clinic)

Viral infections are usually accompanied by inflammation and the production of gamma interferon, a naturally occurring body chemical that has been shown to worsen the clinical course of MS. It is possible that the immune response to viral infections may themselves precipitate an MS attack. " The genes a person inherits may help determine whether that person is at increased risk for developing MS." (Melvin) While there is evidence from studies that this genetic component exists, it appears to be only one factor among several.

Most likely an individuals genetic blueprint ultimately determines if that individual will be susceptible to a triggering factor, which in turn initiates the autoimmune process that leads to the development of MS. In the past few years, scientists have developed a set of tools that gives them the ability to pinpoint the genetic factors that make a person susceptible to MS. “ These tools are the methods of molecular geneticstechniques used to isolate and determine the chemical structure of genes.” (Colin) In the 1980s, scientists began to apply the tools of molecular genetics to human diseases caused by defects in single genes.

This work led to major advances in understanding diseases such as Duchenne muscular dystrophy and cystic fibrosis. The situation for diseases such as multiple sclerosis is more complicated.

Scientists now believe that a person is susceptible to multiple sclerosis only if he or she inherits an unlucky combination of several genes. (Colin) Advances in molecular genetics and the identification of large families in which several members have MS” multiplex” MS familieshave made possible research to uncover MS susceptibility genes. “ Since 1991, the National MS Society has supported an international project searching for these genes.” (National Multiple Sclerosis Society) However, even though genetic (inherited) factors seem to play a large role in the development of MS, no single MS gene has been identified so far. Instead, scientists suspect that MS develops because of the influence of several genes acting together.

Many multiplex families from throughout the world have agreed to participate in these studies.

The researchers are looking for patterns of genetic material that are consistently inherited by people with MS. These recognizable patterns are called “ DNA markers.” (Melvin) When one of these markers is identified, scientists focus on that area, seeking additional markers closer to that gene. Eventually the location of that gene can be identified.

This process of moving closer to the gene until it is identified has to be repeated for each of the marker regions from the multiplex families. (Melvin) By 1996, as many as 20 locations that may contain genes contributing to MS were identified, but no single gene was shown to have a major influence on susceptibility to MS. (Melvin) Research will likely find that other, as yet unidentified, genes contribute to MS. After the location of each susceptibility gene is identified, the role that the gene plays in the immune system and neuralgic aspects of people with MS will have to be determined.

Because the immune system is so involved in MS, many scientists think at least some of the susceptibility genes are related to the immune system. Already there have been reports linking some immune system genes to MS. Further indications that more than one gene is involved in MS susceptibility comes from studies of families in which more than one member has MS. Several research teams found that people with MS inherit certain regions on individual genes more frequently than people without MS. Of particular interest is the human leukocyte antigen (HLA) or major histocompatibility complex region on chromosome 6. HLAs are genetically determined proteins that influence the immune system.

(Kaser) The HLA patterns of MS patients tend to be different from those of people without the disease. Investigations in northern Europe and America have detected three HLAs that are more prevalent in people with MS than in the general population. Studies of American MS patients have shown that people with MS also tend to exhibit these HLAs in combination–that is, they have more than one of the three HLAs–more frequently than the rest of the population.

Furthermore, there is evidence that different combinations of the HLAs may correspond to variations in disease severity and progression. (Kaser) Studies of families with multiple cases of MS and research comparing genetic regions of humans to those of mice with EAE suggest that another area related to MS susceptibility may be located on chromosome 5. Other regions on chromosomes 2, 3, 7, 11, 17, 19, and X have also been identified as possibly containing genes involved in the development of MS.

(Hauser) These studies strengthen the theory that MS is the result of a number of factors rather than a single gene or other agent. Development of MS is likely to be influenced by the interactions of a number of genes, each of which (individually) has only a modest effect. Additional studies are needed to specifically pinpoint which genes are involved, determine their function, and learn how each gene’s interactions with other genes and with the environment make an individual susceptible to MS. “ In addition to leading to better ways to diagnose MS, such studies should yield clues to the underlying causes of MS and, eventually, to better treatments or a way to prevent the disease.” (Ronthal)

Finding the genes responsible for susceptibility to MS may lead to the development of new and more effective ways to treat the disease. Such research could also uncover the basic cause of the disease and help predict the course of the disease in an individual.

This would make it easier for physicians to tailor therapies and provide information to help people make life decisions. Another possible benefit may be the early diagnosis of people in families where one or more member already has MS. Many physicians believe that the earlier MS is diagnosed and treatment begun, the better the outcome will be. Symptoms of MS may be mild or severe, of long duration or short, and may appear in various combinations, depending on the area of the nervous system affected. Complete or partial remission of symptoms, especially in the early stages of the disease, occurs in approximately 70 percent of MS patients.

“ The initial symptom of MS is often blurred or double vision, red-green color distortion, or even blindness in one eye.” (Brunnscheiler) Inexplicably, visual problems tend to clear up in the later stages of MS. Inflammatory problems of the optic nerve may be diagnosed as retrobulbar or optic neuritis. Fifty-five percent of MS patients will have an attack of optic neuritis at some time or other and it will be the first symptom of MS in approximately 15 percent.

This has led to general recognition of optic neuritis as an early sign of MS, especially if tests also reveal abnormalities in the patient’s spinal fluid. (National Multiple Sclerosis Society) Most MS patients experience muscle weakness in their extremities and difficulty with coordination and balance at some time during the course of the disease. These symptoms may be severe

enough to impair walking or even standing. In the worst cases, MS can produce partial or complete paralysis. “ Spasticity, the involuntary increased tone of muscles leading to stiffness and spasms–is common, as is fatigue.” (Brunnscheiler) Fatigue may be triggered by physical exertion and improve with rest, or it may take the form of a constant and persistent tiredness.

Most people with MS also exhibit paresthesias, transitory abnormal sensory feelings such as numbness, prickling, or “ pins and needles” sensations; uncommonly, some may also experience pain. Loss of sensation sometimes occurs. Speech impediments, tremors, and dizziness are other frequent complaints. Occasionally, people with MS have hearing loss.

(Brunnscheiler ; National Multiple Sclerosis Society) Approximately half of all people with MS experience cognitive impairments such as difficulties with concentration, attention, memory, and poor judgment, but such symptoms are usually mild and are frequently overlooked. In fact, they are often detectable only through comprehensive testing. Patients themselves may be unaware of their cognitive loss; it is often a family member or friend who first notices a deficit. Such impairments are usually mild, rarely disabling, and intellectual and language abilities are generally spared.

(Brunnscheiler)

“ Cognitive symptoms occur when lesions develop in brain areas responsible for information processing.” (Brunnscheiler) These deficits tend to become more apparent as the information to be processed becomes more complex. Fatigue may also add to processing difficulties. Scientists do not yet know whether altered cognition in MS reflects problems with information

acquisition, retrieval, or a combination of both. Types of memory problems may differ depending on the individual’s disease course (relapsing-remitting, primary-progressive, etc.), but there does not appear to be any direct correlation between duration of illness and severity of cognitive dysfunction.

(National Multiple Sclerosis Society) “ Depression, which is unrelated to cognitive problems, is another common feature of MS. (Brunnscheiler) In addition, about 10 percent of patients suffer from more severe psychotic disorders such as manic-depression and paranoia. Five percent may experience episodes of inappropriate euphoria and despair–unrelated to the patient’s actual emotional state known as “ laughing/weeping syndrome.”

This syndrome is thought to be due to demyelination in the brainstem, the area of the brain that controls facial expression and emotions, and is usually seen only in severe cases. (National Multiple Sclerosis Society) As the disease progresses, sexual dysfunction may become a problem.

Bowel and bladder control may also be lost. (Health Central) In about 60 percent of MS patients, heat, whether generated by temperatures outside the body or by exercise may cause temporary worsening of many MS symptoms. In these cases, eradicating the heat eliminates the problem. Some temperature-sensitive patients find that a cold bath may temporarily relieve their symptoms. For the same reason, “ swimming is often a good exercise choice for people with MS.” (Wenzel) The erratic symptoms of MS can affect the entire family as patients may become unable to work at the same time they are facing high medical bills and additional expenses for housekeeping assistance and modifications to homes and vehicles.

The emotional drain on both patient and family is immeasurable. Counseling may help MS patients, their families, and friends find ways to cope with the many problems the disease can cause. (Lambert) “ There is as yet no cure for MS. Many patients do well with no therapy at all, especially since many medications have serious side effects and some carry significant risks.” (Health Central) Naturally occurring or spontaneous remissions make it difficult to determine therapeutic effects of experimental treatments; however, the emerging evidence that MRIs can chart the development of lesions is already helping scientists evaluate new therapies. Until recently, the principal medications physicians used to treat MS were steroids possessing anti-inflammatory properties; these include adrenocorticotropic hormone (better known as ACTH), prednisone, prednisolone, methylprednisolone, betamethasone, and dexamethasone.

Studies suggest that intravenous methylprednisolone may be superior to the more traditional intravenous ACTH for patients experiencing acute relapses; no strong evidence exists to support the use of these drugs to treat progressive forms of MS. Also, there is some indication that steroids may be more appropriate for people with movement, rather than sensory, symptoms. (Mayo Clinic) While steroids do not affect the course of MS over time, they can reduce the duration and severity of attacks in some patients. The mechanism behind this effect is not known; one study suggests the medications work by restoring the effectiveness of the blood/brain barrier. “ Because steroids can produce numerous adverse side effects (acne, weight gain, seizures, psychosis), they are not recommended for long-term use.

” (Bernard) One of the most promising MS research areas involves naturally occurring antiviral proteins known as interferons. Two forms of beta interferon (Avonex and Betaseron) have now been approved by the Food and Drug Administration for treatment of relapsing-remitting MS.

A third form (Rebif) is marketed in Europe. Beta interferon has been shown to reduce the number of exacerbations and may slow the progression of physical disability. When attacks do occur, they tend to be shorter and less severe.

In addition, MRI scans suggest that beta interferon can decrease myelin destruction. (Mayo Clinic) Investigators speculate that the effects of beta interferon may be due to the drug’s ability to correct an MS-related deficiency of certain white blood cells that suppress the immune system and/or its ability to inhibit gamma interferon, a substance believed to be involved in MS attacks. Alpha interferon is also being studied as a possible treatment for MS. (Mayo Clinic) “ Common side effects of interferons include fever, chills, sweating, muscle aches, fatigue, depression, and injection site reactions.

” (Health Central) Scientists continue their extensive efforts to create new and better therapies for MS.

Goals of therapy are threefold: to improve recovery from attacks, to prevent or lessen the number of relapses, and to halt disease progression. In conclusion, MS is a disease that is well known but poorly understood by the medical and nursing community as well as the general public. It has no

known cure and the genes that are accountable for it have yet been pin pointed.

The United States is capable of finding a cure for this disease; over the years, medical researchers have found cures for many diseases that were thought incurable. Not only time and money are needed to find a cure for this disease, but faith and heart are needed to realize the importance Glossary antibodies — proteins made by the immune system that bind to structures (antigens) they recognize as foreign to the body. antigen — a structure foreign to the body, such as a virus.

The body usually responds to antigens by producing antibodies.

ataxia — a condition in which the muscles fail to function in a coordinated manner. autoimmune disease — a disease in which the body’s defense system malfunctions and attacks a part of the body itself rather than foreign matter. blood/brain barrier — a membrane that controls the passage of substances from the blood into the central nervous system. cerebrospinal fluid — the colorless liquid, consisting partially of substances filtered from blood and partially by secretions released by brain cells, that circulates around and through the cavities of the brain and spinal cord.

Physicians use a variety of tests–electrophoresis, isoelectric focusing, capillary isotachophoresis, and radioimmunoassay–to study cerebrospinal fluid for abnormalities often associated with MS. cytokines — powerful chemical substances secreted by T cells. Cytokines are an important factor in the production of inflammation and show promise as treatments for MS.

demyelination — damage caused to myelin by recurrent attacks of inflammation.

Demyelination ultimately results in nervous system scars, called plaques, which interrupt communications between the nerves and the rest of the body. experimental allergic encephalomyelitis (EAE) — a chronic brain and spinal cord disease similar to MS which is induced by injecting myelin basic protein into laboratory animals.

fatigue — tiredness that may accompany activity or may persist even without exertion. gadolinium — a chemical compound given during MRI scans that helps distinguish new lesions from old. human leukocyte antigens (HLAs) — antigens, tolerated by the body, that correspond to genes that govern immune responses. Also known as major histocompatibility complex. immunoglobulin G (IgG) — an antibody-containing substance produced by human plasma cells in diseased central nervous system plaques.

Levels of IgG are increased in the cerebrospinal fluid of most MS patients. immunosuppression — suppression of immune system functions.

Many medications under investigation for the treatment of MS are immunosuppressants. interferons — cytokines belonging to a family of antiviral proteins that occur naturally in the body. Gamma interferon is produced by immune system cells, enhances T-cell recognition of antigens, and causes worsening of MS symptoms.

Alpha and beta interferon probably exert a suppressive effect on the immune system and may be beneficial in the treatment of MS. lesion — an abnormal

change in the structure of an organ due to disease or injury. magnetic resonance imaging (MRI) — a non-invasive scanning technique that enables investigators to see and track MS lesions as they evolve. myelin — a fatty covering insulating nerve cell fibers in the brain and spinal cord, myelin facilitates the smooth, high-speed transmission of electrochemical messages between these components of the central nervous system and the rest of the body. In MS, myelin is damaged through a process known as demyelination, which results in distorted or blocked signals. myelin basic protein (MBP) — a major component of myelin.

When myelin breakdown occurs (as in MS), MBP can often be found in abnormally high levels in the patient’s cerebrospinal fluid. When injected into laboratory animals, MBP induces experimental allergic encephalomyelitis, a chronic brain and spinal cord disease similar to MS. oligodendrocytes — cells that make and maintain myelin. optic neuritis — an inflammatory disorder of the optic nerve that usually occurs in only one eye and causes visual loss and sometimes blindness. It is generally temporary.

paresthesias — abnormal sensations such as numbness, prickling, or “ pins and needles.” plaques — patchy areas of inflammation and demyelination typical of MS, plaques disrupt or block nerve signals that would normally pass through the regions affected by the plaques. receptor — a protein on a cell’s surface that allows the cell to identify antigens. retrobulbar neuritis — an inflammatory disorder of the optic nerve that is usually temporary.

It causes rapid loss of vision and may cause pain upon moving the eye. spasticity — involuntary muscle contractions leading to spasms and stiffness or rigidity. In MS, this condition primarily affects the lower limbs.

T cells — immune system cells that develop in the thymus gland.

Findings suggest that T cells are implicated in myelin destruction. transverse myelitis — an acute spinal cord disorder causing sudden low back pain and muscle weakness and abnormal sensory sensations in the lower extremities. Transverse myelitis often remits spontaneously; however, severe or long-lasting cases may lead to permanent disability. white matter — nerve fibers that are the site of MS lesions and underlie the gray matter of the brain and spinal cord.

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