

# January 2020 Newsletter



## Who Says Being a Quitter is a Bad Thing?

It's a well-established fact that smoking increases the risk of lung cancer and heart disease. Several studies link smoking to [MS](#) and other autoimmune diseases, such as [rheumatoid arthritis](#), [Graves' disease](#) and [inflammatory bowel disease](#). In fact, [research](#) shows the risk of MS in smokers is 1.5 times higher compared to nonsmokers and the more cigarettes an individual smokes the higher the risk. A link between smoking and other MS risk factors has also been established. For example, a [study](#) from Denmark found that smoking is associated with the Epstein-Barr virus. [Investigators](#) at Harvard found individuals with MS who smoke also appear to have a much greater chance of experiencing a more rapid progression of their disease. Data suggest the risk of progressing from relapsing remitting to secondary progressive MS (SPMS) is 3.6 times higher for current and past smokers compared to people who never smoked.



While these findings suggest a correlation between cigarette smoking and MS disease progression, the underlying mechanism for this effect isn't clear. Researchers are studying several different hypotheses. Most cigarettes have a glass fiber filter through which the smoke is inhaled. Tobacco smoke consists of [two phases](#): a particulate phase (the particles captured by the filter) and a gaseous phase (the portion of smoke that passes through the filter). A Swedish [study](#) compared the effects of tobacco smoking and smokeless tobacco on MS risk. Interestingly, their results showed smokeless tobacco was not associated with an elevated risk for MS. This suggests that the predisposition to MS may be caused by irritation in the lungs from the gaseous phase of tobacco smoke.



Cigarette smoke contains over 4,500 potentially toxic components, including tars, nicotine, carbon monoxide and other particles. Some components of cigarette smoke may have direct toxic effects on the central nervous system. Both the particulate and gaseous phases of tobacco smoke contain high concentrations of [free radicals](#), which may cause nerve degeneration. Free radicals are molecules that are highly reactive with other cells because they contain unpaired electrons. They can cause damage to parts of other cells by stealing their electrons through a process called oxidation. When free radicals oxidize important components of other cells, those components lose their ability to function normally, and the accumulation of such damage may cause the cells to die. Numerous [studies](#) indicate that increased exposure to free radicals causes or accelerates nerve cell injury and leads to neurodegenerative diseases (such as MS). [Research](#) shows serum concentrations of [cyanide](#), a component of cigarette smoke, and its main metabolite [thiocyanate](#) causes demyelination in the brain and spinal cord in animal models. Smokers are exposed to high levels of [nitrous oxide](#) (NO), also known as “laughing gas,” from two sources: first high amounts of inhaled NO in smoke and, second, endogenously released NO after uptake of nicotine in the brain. Exposure to NO has been [shown](#) to cause nerve degeneration or to block nerve conduction, especially in demyelinated axons. This suggests that NO may play a role MS disease activity and progression.

MS is considered to be an immune-mediated disease in which the body's immune system attacks the central nervous system, which causes nerve damage. Immune system activity results in the inflammation responsible for many MS symptoms. An inflammatory mediator is a messenger that acts to promote an inflammatory response. [Studies](#) show cigarette smoke stimulates the influx and activation of a several inflammatory mediators, such as [neutrophils](#), [monocytes](#) and [macrophages](#).



Various inflammatory markers are used to assess systemic inflammation. [Acute phase reactants](#) (APRs) are inflammation markers that increase or decrease in an individual's serum during times of acute tissue injury or inflammation. [Fibrinogen](#) is an APR, which means fibrinogen levels may rise sharply in any condition that causes inflammation or tissue damage (like MS). [Results](#) from the Framingham Heart Study indicate current and past smokers have higher fibrinogen levels than non-smokers, and these levels correlate with the number of cigarettes smoked per day. Peripheral blood leukocyte counts are routinely measured in clinical practice and are the only cellular marker of systemic inflammation. [Research](#) suggests cigarette smoke elevates peripheral blood leukocyte counts and is associated with other important markers of inflammation like the [C-reactive protein](#) and [interleukin-6](#) (IL-6).

Another hypothesis involves a direct effect of smoke components on the [blood-brain barrier](#) (BBB) which separates the brain from the circulatory system and protects the central nervous system from potentially harmful chemicals. In order for the immune system to launch an attack on the myelin sheath surrounding nerves in the brain and spinal cord, [T-cells](#) (a type of white blood cell) from the immune system must first cross the



BBB. Leakage of this barrier has been suggested as a factor in initiating the development of MS. Nicotine, a major component of cigarettes, has been [shown](#) to affect the integrity and function of the BBB. A [2010 study](#) also suggests the compounds contained in tobacco smoke may affect the viability of cells in the BBB and trigger an inflammatory response that, in turn, may further lead to the loss of its integrity.

As discussed in our [May 2018 newsletter](#), there is mounting evidence that estrogen (a female hormone), not only affects the reproductive system, but also impacts the nervous and immune systems. Many women find that their MS symptoms worsen just before and during their menstrual period. The decrease in estrogen levels leading up to menstruation may be a contributing factor. MS symptoms may also slightly worsen as women go through menopause. One possible reason for this is the decline in estrogen that occurs around this time of life. [Research](#) shows that women who smoke cigarettes are estrogen deficient. Women who are smokers undergo menopause earlier than non-smokers. This may play a role in the worsening of disease.

There is growing scientific evidence that smoking not only increases the risk of developing MS but also influences disease progression. The suggestion that components of smoke play a role in this is supported by a [recent finding](#) that even passive smoke exposure (second hand smoke) increases the MS risk. Further investigation with well-designed prospective studies is necessary in order to better understand the underlying mechanisms behind these effects. Understanding the role of smoking in the MS disease process may enable us to one day slow disease onset and, perhaps, also control disease progression in high risk individuals by stopping exposure. It may also facilitate the development of more effective MS treatments by identifying new therapeutic targets. ACP and iConquerMS are committed to facilitating research efforts like these, which have the potential to significantly improve the health and quality of life for those living with MS.

