

# Could Mast Cells Partially Explain Female Prevalence of Autoimmune Disorders? A Closer Look at the Importance of Mast Cells in Multiple Sclerosis

**Sam Curry**

Lake Forest College  
Lake Forest, Illinois 60045

The immune system is one of nature's most remarkable inventions. Without it, humans would be unable to survive any type of infection. Although the immune system is built to fight off infections from invading microorganisms, it can malfunction and attack the host organism. Diseases of this class are autoimmune diseases. They affect approximately eight percent of the population and seventy eight percent of these affected individuals happen to be women.

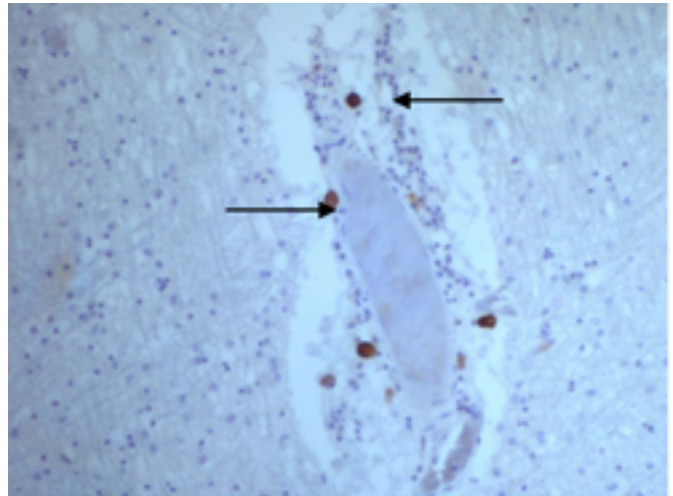
One of the most debilitating autoimmune disorders is Multiple Sclerosis (MS), a disease that affects the nervous system, destroying the myelin sheath that surrounds axons. Myelin, the fatty white substance surrounding the axons of nerve cells, functions to increase the speed of an action potential, increasing the speed of neural communication between cells. When myelin is destroyed, the nervous system is unable to communicate effectively, resulting in a variety of both physical and cognitive disturbances. Common symptoms of MS are pain, fatigue, spasticity, ataxia, weakness, tingling sensations, blurred vision, and depression. Additionally, MS affects approximately 2.3 million people worldwide, and most people are diagnosed between the ages of 20 and 50. Interestingly, MS disproportionately affects females, affecting approximately two to three times more women than men.

Mast cells, the first line responders of the immune system, have an important role in MS as well as many other autoimmune diseases, such as Rheumatoid arthritis and Type 1 Diabetes. These cells reside in many different tissues, but predominantly in areas of the body near the external environment such as the skin. Upon activation, mast cells release various cytokines and chemical mediators that induce the inflammatory response. For example, histamine, an inflammatory molecule released by mast cells, creates more permeability between the endothelial cells lining blood vessels; as a result, inflammatory cells, such as neutrophils, T-cells, B-cells, and macrophages, squeeze through the gaps between the endothelial cells into the interstitial fluid towards the site of infection. In the case of MS, mast cells in the central nervous system (CNS) may become activated, making the blood-brain barrier more permeable to inflammatory cells and various cytokines. Once the inflammatory cells cross the blood-brain barrier, they can then mediate the destruction of the myelin sheath and oligodendrocytes, cells that specifically create myelin in the CNS. This leads to brain lesions (also known as plaques) that are part of the characteristic pathology of MS. Although this is a simplified explanation of the complex pathophysiology of MS, this example makes it clear as to how mast cells are intimately tied to the disease.

Many scientists have confirmed in the past that mast cells are present in the border zones of MS plaques (Figure 1). Scientists define a border zone as the "area within a 1 mm distance of the actual plaques" (Krüger, Mork, 2012). In the present study conducted by Krüger and Mork (2012), the researchers wanted to examine the concentration of mast cells in these plaque-border zone regions in 11 females and 8 males. All brain samples were from patients that had been diagnosed with MS 4-8 years before they died of bronchopneumonia. The researchers used immunostaining to detect tryptase, an enzyme produced by mast cells, that would allow them to determine the number of mast cells in a variety of distances from MS plaques. The scientists discovered that the average number of mast cells was 2.34 mm<sup>2</sup> in males and 4.77 mm<sup>2</sup> for females. This difference between males and females was also statistically significant ( $p < 0.005$ ). The researchers were not certain why women have a greater number of mast cells in MS plaque-border zone regions, but this research finding was particularly interesting to the investigators of the study since females, as described earlier, have a greater susceptibility toward developing MS than males.

Although there is clearly much more for scientists to discover, based on the knowledge that mast cells have a key-role in the

pathophysiology of MS, a possible treatment for MS could be in the works, such as mast cell blockers that prevent the demyelization process from occurring as extensively. Future research should attempt to understand the significance of women having more mast cells in MS plaque-border zone regions and whether this finding can explain their greater susceptibility toward developing autoimmune disorders. In addition, scientists should continue to gain a deeper understanding of what causes the immune system to turn against the host organism that it is designed to protect.



**Figure 1:** 100x Mast cells (arrows) in plaque border-zones of MS (Krüger, Mork, 2012)

*Note: Eukaryon is published by students at Lake Forest College, who are solely responsible for its content. The views expressed in Eukaryon do not necessarily reflect those of the College.*

## References

- Krüger, P., & Mork, S. (2012). Mast cells and multiple sclerosis in females and males. *World Journal of Neuroscience*, 2, 145-149. Retrieved from [https://file.scirp.org/pdf/WJNS20120300001\\_79236042.pdf](https://file.scirp.org/pdf/WJNS20120300001_79236042.pdf)
- Conti, P., & Kempuraj, D. (2016). Important role of mast cells in multiple sclerosis. *Multiple Sclerosis and Related Disorders*, 5, 77-80. Retrieved from [http://www.academia.edu/22590211/Important\\_role\\_of\\_mast\\_cells\\_in\\_multiple\\_sclerosis](http://www.academia.edu/22590211/Important_role_of_mast_cells_in_multiple_sclerosis)
- Walker, M. E., Hatfield, J. K., & Brown, M. A. (2012). New Insights into the Role of Mast Cells in Autoimmunity: Evidence for a Common Mechanism of Action? *Biochimica et Biophysica Acta*, 1822(1), 57-65. <http://doi.org/10.1016/j.bbadis.2011.02.009>
- Fairweather, D., & Rose, N. R. (2004). Women and Autoimmune Diseases. *Emerging Infectious Diseases*, 10(11), 2005-2011. <http://doi.org/10.3201/eid1011.040367>
- Da Silva, E. Z. M., Jamur, M. C., & Oliver, C. (2014). Mast Cell Function: A New Vision of an Old Cell. *Journal of Histochemistry and Cytochemistry*, 62(10), 698-738. <http://doi.org/10.1369/0022155414545334>
- Davis, C. Early Multiple Sclerosis (MS) Signs and Symptoms. Retrieved from <http://www.easybib.com/guides/citation-guides/apa-format/how-to-cite-a-website-apa/>
- Who get's MS? (Epidemiology). Retrieved from <http://www.nationalmssociety.org/What-is-MS/Who-Gets-MS>