# Self-Destructive Behavior

**Peter Nesper**
Department of Biology
Lake Forest College
Lake Forest, IL 60045

"Inflammation! Ready yourselves glial brothers, the T-cells are coming!" The message is loud and clear. I now sit in shock and despair, looking back on the long and prosperous life that I have shared with my fellow cells here in the optic division. I try to feel grateful for the life I have been given. As I sift through it all, I feel blessed to have such a highly specific job as an insulator. I know that the task of speeding up messages between neurons is highly regarded and respected, at least among other glial cells. I am also thankful for the close connections between family and friends that this lifestyle affords me. But all the praise in the world will not release me from this growing fear that has clenched hold of me. Since the last attack, I have been plagued by the idea of losing my lifelong friend, co-worker, and fellow glial, Gilbert. Gilbert and I have been running mates since our origin, and to see him in such a degraded and eroded state has drawn a dark cloud of resentment and fear over my being. If only there was more I could do to terminate these invasions.

"Brace yourselves! The auto-reactive immunes have penetrated the blood-brain barrier. They are drawing near!"
Let me back up a bit and start from the beginning. For starters, I am a cell in the central nervous system of woman who stars in the hit television series "Real Housewives of Washington D.C." That's right! I am one of the billions of other lucky nervous system cells that can call Michaele Salahi our home. My story, along with the other glia and the neurons, began through the self-renewing process of neural stem cell division into a progenitor cell. So began my childhood, my gleogenesis. This progenitor cell divided until it eventually differentiated into a premature version of me, a glioblast. This particular glioblast developed into a young oligodendroglia named Ollie. I am not a neuron, but a glial cell. Glial cells are the support cells of the nervous system. We help neurons transmit information by binding them together and providing them with support, nutrients, and protection. As an oligodendroglia cell on Michaele's optic nerve, my main function is to insulate part of the axon that carries visual information from the retina of the eye to the primary visual nuclei.

For insulation, I use a special coating called myelin that surrounds the axons. It prevents short-circuiting and allows the neurons to send information much faster to one another. My close cousins, the Schwann cells, also myelinate, but they stick to the nerve fibers and neurons outside the brain and spinal cord in the peripheral nervous system. Without the aid of glial cells, neurons would be in rough shape! We outnumber neurons by at least 15:1. Myelination is a gradual process of reinforcing neural pathways. The entire myelinating process does not come to completion till around ages 25-30. Normal adult function in humans is not attained until myelination is complete, so it can actually be used as a general index for the maturation of the brain.

The different cells of the body are fated to become specific cell types, with the corresponding forms and functions, from a signal that influences its gene expression. These signals are thought to be chemical messages from the cell's unique environment and can explain the differentiation of progenitor cells into various neuron and glial cell types. The chemical signals trying to reroute me to another destination, but Gilbert kept me in line and told me to have faith. What he said about having faith was admirable, and from that point on I knew there was something special about that kid.

Thanks to Gilbert, we stuck to the path and arrived at our destination on the optic nerve. We were both so excited and nervous to get started, but in a process they called cell maturation we were given all the necessary tools and training to become successful oligodendroglia. They equipped us with the formula for creating extensions of our plasma membranes to produce myelin sheaths to coat nerve axons. Gilbert and I gradually became masters of our craft. We actually ended up next door neighbors, separated only by a tiny gap in our myelin called a Node of Ranvier. We grew to be great friends over the next 34 years.

Everything had been running quite smoothly in the CNS of Michaele, and from early development and well into adulthood the organism as a whole seemed perfectly functional and healthy. Then, while driving home after a photo shoot for Glamour Magazine, Michaele's vision in her left eye became cloudy. She tried rubbing her eye, but it didn't seem to help. She thought maybe it had something to do with the lights on the cameras, but the cells constituting her optic nerve knew that this was not the case. A few hours earlier, we began to see an unannounced increase in immune system cells in our area. At first, we saw T-cells breaching the blood-brain barrier. And if that wasn't peculiar enough, they started secreting some weird chemicals and calling in more immune cells. It wasn't until there was a massive army of T-cells, B-cells, antigen-presenting cells, macrophages, and microglial cells that we realized these cells actually meant to harm us! They were waging an all-out chemical warfare on us! Their weapons of choice were a harmful variety of chemicals called cytokines, which got into our myelin and started to break it down. A toxic substance called glutamate caused the same harmful symptoms.

When we started noticing that signals from the retina were becoming abnormal, we realized this was not a just a local event, since the breakdown or loss of myelin limits a nerve's ability to communicate and conduct signals effectively. This must have been when Michaele first began noticing changes in her vision. If it was affecting other parts of the optic nerve, then where else might these immune cells be attacking? We just didn't understand why they were attacking us. Gilbert and I concluded that they must have been controlled, or maybe possessed, by some entity to start attacking healthy, harmless cells of the same body. This brutal attack lasted about four weeks before tapering off, leaving many wounded oligodendroglia in its wake. One of these was Gilbert, who suffered a significant amount of myelin breakdown. As glial cells of the central nervous system, we have very limited healing abilities and most damage is irreversible. Oligodendroglia are able to remyelinate some of what is lost, but such heavy warfare left scars of myelin which could not be recovered. It was really tough to see my best friend all beat up like that, but after a short period his wounds turned into scars (or more like hard plaque-like build up) and he began to feel better.

Once the attack was over, we did our best to repair and tried to move on with our lives. Michaele had gone to the hospital where doctors told her she had optic neuritis and that she should be aware that this could be a warning flag for some disease. Yet, when Michaele got her vision back, she left it behind her entirely and forgot the doctor's warnings. The next twelve years were happy times for Gilbert and I. We still had full

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compounds that signal cells are called neurotropic factors.
Oligodendroglia cells are the last cell type to be generated in the central nervous system, but because the first areas that need myelination in the brain are areas controlling simple movements and sensory analysis, I was shipped off relatively early. I first met Gilbert in the early stages of our cell migration and differentiation. Apparently, we had both been predisposed to going to the ventricular region, where we were formed to migrate to an axon on the optic nerve. And of fate was to aid in the transmission of visual signals from the retina of the eye toward the brain. As for the migration, we were told to just be brave and to follow a specific path made by radial glial cells. I was very skeptical about wandering off in the dark. There were a number of times along the way where I was nearly overcome by chemical attacking steadily and with more fire-power than before. Gilbert's health was getting worse and his myelin was so disintegrated in some spots that parts of the axon started becoming visible. It seemed like Gilbert was slowing being converted from a highly functional glial cell to a hard, dead, plaque-like scar. I didn't know what to do.

Michaele went in and described symptoms of tingling and numbness in her hand, difficulty swallowing, extreme fatigue, muscle spasms, cloudy vision, and some depression to her doctors. After seeing that her MRI revealed cerebral scar tissue, they diagnosed Michaele with Multiple Sclerosis (MS). MS is a neurodegenerative, inflammatory, and possibly autoimmune disease affecting the central nervous system. They said that the mechanisms through which the disease works are known, but the actual cause is still a mystery, and a cure is yet to be found. They explained that symptoms usually appear in gradual episodes with periods of remission. Also, depending on the type, relapse-remitting or secondary progressive, she may or may not experience another remission. Michaele began therapy, which was supposed to ease some of her symptoms, and she started taking a commonly prescribed drug. The drug is supposed to relieve the stress put on us by mimicking a protein of ours, the myelin basic protein, and acting as a decoy for the immune cells' target.

So here I am, a helpless glial cell under attack by my host body's own immune system for reasons unknown. My best friend is on the verge of death. I, myself, am experiencing the deadly blows of the chemicals being used against us first hand. But as Gilbert once taught me: one must always have faith. There's a chance this drug will work and the symptoms will reside. If the drug can buy us some time, doctors and scientists might discover the root of this disease and stop it once and for all. No matter how bad things get, how small the chances are, or how limited the options seem, there is still one choice. Hope. I choose hope.



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