My Life as a Magnocellular Neuron

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Well, gosh, I guess I should start with an introduction. I'm Lucas. I am a magnocellular neuron from the first layer of the right lateral geniculate nucleus. It's a pretty nice neighborhood, I suppose. I don't know too many of the neighbors because I'm not really outgoing; I am afferent after all. Those other neurons are just too strange, especially those parvocellular guys in the sixth layer. But my job is really all I need to be content. My job is to transport information given to me by the guys working in the optic tract and to send it through the optic radiation to the boss, the primary visual cortex. This information comes from the rods of the eye. It usually consists of bits and pieces of visualized movement, depth, and sometimes the amount of light in the external world. I can never make any sense of the stuff, so I always just pass it on as I am told. From what I hear, my job is better than working in the optic tract. I hear those retinal ganglion cells can be real jerks sometimes. The main reason I like my job is because I am helping out the body that we live in to fulfill its purpose. We live in a small Hungarian boy (only one year old at the moment), but I am glad that what I do can help him see the external world. Just recently, though, there have been a few problems due to his Canavan disorder.

When I was born, there weren't really any problems that I was aware of. I developed from my parent stem cell into a dashing progenitor and grew quickly into a handsome neuroblast. Then, as I developed just as my genes ordered me to, I became more and more specialized into the magnocellular neuron I am today. Of course, my experiences in the environment shaped who I am as well. Finally, the time came for me to move out into the world on my own. I traveled along my route on the radial glial highway across the vast open fields of the cortex.

I arrived in my own place in the right lateral geniculate nucleus. I was anxious and frightened to begin my new life. I felt my dendrites growing and branching out as though I was embracing the world with my newfound independence. Then, suddenly I sensed a heavenly thing. Absolutely intoxicating tropic persuaded me to expand. The chemical was more inviting than anything I had ever felt before. At the tip of my axon, I felt my cell adhesion molecules at work. My growth cone stretched and guided my developing axon into the direction of the tropic molecules. As I expanded, I felt the repulsive tropic molecules other neurons were emitting. Nonetheless, I traveled swiftly and diligently into the realm of the inviting chemical. I knew that, if everything went as I had planned, I would be working at my dream job in no time.

If only I had known then what I know now. I wasn't going to be living the life that I had always dreamed as a perfectly functioning magnocellular neuron. I developed more and more, and I became close with neighboring neurons in order to begin the transportation of information. During the final stage of my maturation my myelin was just starting to form and help me be as efficient in the field of transportation as possible. In the distance, I saw a large open space, and I was perplexed as to what it could be. I was told by a couple of my shared oligodendroglial cells (who had their arms outstretched over many of the townspeople) that the large emptiness was actually filled with a strange fluid. Nobody knew what it was, but we were frightened. Where the fluid was, neurons and oligodendroglial cells had once been. I immediately knew that something was wrong.

I had received some interesting information from our human infant's external world. There were small patches of information that I had never been responsible for, now trying to pass through me. The neurotransmitters being released into my shared synapse amongst my dendrites and receptors from my pre-synaptic neighbor were not quite right. I knew it was my duty as a neuron to keep my action potential from reaching threshold so the message could not be passed along any further. This had never happened before. I was worried and confused, as I very well should have been.

The next morning, I woke to find the oligodendroglial cell near the middle of my axon, fighting with an evil-looking chemical. Throughout the next few days, every one of my other oligodendroglial cells was attacked. I was in a state of alarm. I did not know what to do. My friends were diminishing and degrading and all I could do was watch. I frantically scanned through my genetic code and searched for an answer. I found a mutation in the ASPA gene responsible for the production of the aspartoacylase enzyme. This enzyme breaks down the n-acetyl-asparate acid through hydrolysis. The gene mutation decreased the enzyme drastically, and now we are left with superfluous amounts of the n-acetyl-asparate toxin. Its main effect is dysmyelination. This disorder is known as Canavan disease. As I began to wonder if there was any hope left for me, I heard my neighboring neuron cry for help, as he too was attacked by this ravenous toxin. To my dismay, I realized that almost all the oligodendroglial cells in my layer were battling this toxin.

Three Years Later

The dreadful battles have lasted for what seems like ages now. Few have survived as long as I have. The Great War between n-acetyl-asparate and the oligodendroglial cells has been gruesome. The toxin is winning. Our human boy is four years old, I do not know how he is alive. From what I have heard, the boy cannot walk, speak, sit, or feed himself. His head is enlarged with fluid and dead cells. His legs are paralyzed and he has begun having frequent seizures. I do not know how much longer I will last. My myelin sheath has deteriorated completely, and I am becoming weaker as I attempt to continue performing my job. My sole purpose of existing has been hindered. I have extreme difficulties receiving, correctly reacting to, and conveying information. My axon terminal has begun to wither and degenerate. How much longer I have, I do not know. When I die, the boy will be blind. I have already impaired his vision enough as it is, but I must keep trying.

One Month Later

His skull is a bloody ruin, full of the corpses of my comrades and disfigured swollen astrocytes wandering hopelessly. A feeling that we have lost this battle is upon me. I can no longer communicate with my post-synaptic neuron. I have failed in my duty to provide this small dying child with sight. I have failed him, and now he must live his few remaining

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months in utter darkness. Now, I must die to obstruct the grief, the pain, the guilt.

Neurobiological Concepts

- The optic system
- Neurogenesis
- Cell migration
- Cell differentiation
- Cell maturation
- Myelogenesis
- Dysmyelination
- Spongy Degeneration
- Axon Degeneration
- Cell Death

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