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Astrocytes and cannabinoids

Reaching for the stars

Science is filled with rat stories. Okay, more accurately, rodent tales. That's because rodents work so well in the lab replicating the research model. Scientists can take the same kind of rodent, rerun the same experiment, and be able to get the same results. They also often find major differences between species.

The CNS is a tightly regulated area of the body by design. Its functions are so crucial to life that a strong barrier exists to keep trespassers out. Cannabinoids are one of the few substances allowed into this exclusive VIP area. Nature created the ECS as a support system to intervene in signaling problems – such as *demyelination* and *apoptosis,* or "cellucide."

The familiar parts of the CNS are the brain and spinal cord. Only ten percent of the cells in the CNS are neurons – the other ninety percent are "glial," the Greek word for "glue." The most abundant glial cells in the CNS are star-shaped "**astrocytes**." These special glial cells help us keep it all together. They provide nutrients to nerves, are involved in cell impulse signaling, repair and induce scarring after inflammatory conditions, and support cells which form the blood-brain barrier.

A 2006 study found that human astrocytes are more advanced than rodents. Rat astrocytes protect and monitor approximately 100,000 synapses. Human astrocytes embrace "up to 2,000,000" synapses. This 20-times greater complexity led the researchers to identify human astrocytes as one of the "distinguishing cells" that separates us from rats.

Astrocytes play an essential role in the bodily process called "myelination." Our nerve axons are covered with myelin, an electrically insulating material which protects them. Myelin formation starts during fetal development and continues through adulthood. Research has established a working relationship between synaptic activity, astrocytes and myelination. Science also shows that the ECS supports astrocytes in building and repairing myelin. For example, astrocytes must produce proteins to initiate scarring as inflammation begins. Research from as long ago as 1998 found that cannabinoids potentiate astrocytes to produce the proteins needed to remedy the inflammation.

A 2008 study looked at how astrocytes and the ECS work together in another way. They found that hippocampal astrocytes have CB1 receptors on them that activate, stimulate and increase cellular processes. The research showed the existence of an "endocannabinoid-glutamate signaling pathway." In this pathway, astrocytes are a bridge for chemical (nonsynaptic) neuronal communication. Recall that each star cell is

performing these tasks while simultaneously communicating with about two million other cells.

In 2010, the rat race research continued – this time with mice and the CB2 receptor. Activation of mice CB2 receptors was shown to prevent thermal pain, alleviate "allodynia," meaning abnormal pain, and facilitate the proliferation of anti-inflammatory glial signaling. Scientists used a synthetic cannabinoid called "NESS400" to investigate chronic pain thresholds. They looked at the CB2 and found that repeated treatment with NESS400 "significantly alleviated" nerve pain.

While astrocytes are repairing damaged nerve tissue, they are protected by the ECS. If astrocytes are not protected they will be unable to repair myelin. They also can't help with apoptosis, or cellucide. While most cells die a natural death, apoptosis is initiated, regulated and executed by the cell itself. In this case, astrocytes instruct cells not to kill themselves.

Surprise! Sometimes apoptosis is good – like if you're fighting cancer. The goal of chemotherapy is cancer cell death. Researchers are coming to the conclusion that cancer cannot be cured without the aid of the ECS. A simple search of the National Institutes of Health website (PubMed.gov) yields a vast array of studies validating the ECS's anticancer power. An example from 2010 – research published in the journal of Cancer Investigation shows that THC "inhibited [cancer] cell proliferation, migration and invasion, and induced cell apoptosis." ***That means THC killed cancer.*** – Which isn't a surprise: science discovered the same thing in 1975. See the article, "*Antineoplastic [anticancer] activity of cannabinoids*," from the National Cancer Institute, if you want to read it for yourself.

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Search terms
Astrocytes, glial and cannabinoids; apoptosis and cannabinoids; myelin and cannabinoids; endocannabinoids and cannabinoids on PubMed.

Research and selected readings
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