

At the XVI European Glia Meeting, I had the amazing opportunity to hear from worldwide known scientists on their current work aiming to investigate glial cells in health and disease and learn topics outside of my research field, which gave me a broader understanding of the importance and role of glia for brain homeostasis.

The conference started with an exciting workshop on novel technologies for glial engineering and gliotechnologies. Some personal highlights were learning about using graphene-based materials to achieve high-resolution spatial and temporal recordings of astrocytes' calcium signaling or using DREADDs to increase astrocytes' calcium signaling as a therapy for major depressive disorder. In addition, the use of nanomaterials such as Alginate to mimic the extracellular matrix and recapitulate the cellular environment to improve oligodendrocyte precursor cells (OPCs) differentiation, as well as computational-based methods to reconstruct human genome-wide studies to distinguish cell, region, and gender-specific gene expression in Alzheimer's disease. This workshop revealed innovative tools to further investigate glial cells to develop therapeutic approaches for neurological disorders.

I was looking forward to the lectures of all the plenary speakers, such as Freda Miller and Michael Wegner, who gave great presentations on how growth factors important in CNS development can be used to boost regeneration in demyelination disorders, namely by inducing proliferation and differentiation of OPCs. In addition, Marc Freeman also showed how vital glial cells are for neuronal remodeling, focusing on pruning and cell death. Furthermore, how neurons signal to glial cells for synapse elimination and how astrocytes can also eliminate synapses in *Drosophila*'s CNS through phagocytosis, which depends on turtle/borderless signaling.

The presentation I found the most exciting was by Shane Liddelow, his lab focuses on investigating novel sub-types of reactive astrocytes, and he has previously identified a neurotoxic subtype of astrocytes that is activated by microglia following generalized infection. These neurotoxic astrocytes have now been detected in models of neurodegeneration and traumatic brain injuries, such as the one I use in my research work (i.e., stab-wound injury), and shown to be human-conserved. In addition, he showed that this subtype secretes a neurotoxic composed of lipids that induce neuronal lipoptosis and that blocking a signaling pathway involved in the elongation of fatty acids improves neuronal survival. This finding was fascinating because the modulation of this mechanism may yield higher efficiency of neuroregenerative approaches. Furthermore, Liddelow's lab has also developed a transcriptome analysis pipeline and released a public database to help subclassify reactive astrocytes in different disease models, which will be a great tool for my Ph.D. research. I also had the opportunity to meet him, ask more about his work, and even discuss my project, and his feedback was incredibly helpful.

My project aims to investigate the interactions between induced neurons and their surrounding cells, including endogenous neurons and glial cells. Thus, I found it particularly interesting to learn more about glia-to-neuron and glia-to-glia interactions, namely, how astrocytes communicate through gap junctions using connexin proteins and how the depletion of connexin 3 prevents glucose transport and accelerates neurodegeneration in a glaucoma model, furthermore, how techniques such as ribotag and spatial transcriptomics (e.g., RNAscope) can be used to tackle these interactions.

Furthermore, on neuroinflammation and regeneration, Yvonne Dombrowski showed that a coordinated response between the innate and adaptive immune processes may be required to achieve myelin regeneration. Namely, immune mechanisms can impact OPCs

proliferation and differentiation. For example, the secretion of pro-inflammatory factors by T-cells (e.g., Treg, CD4/3) was shown to promote OPCs proliferation and differentiation. In contrast, Christopher Heinrich showed his lab's progress in targeting reactive glia for in vivo glia-to-neuron conversion toward neuronal regeneration in a mouse model of epilepsy. Specifically, the forced expression of the reprogramming factors *Ascl1* and *Dlx2* in hippocampal reactive glia gave rise to functional induced neurons exhibiting hallmarks of GABAergic interneurons. Furthermore, he also showed a reduction of hippocampal seizures following neuronal reprogramming, highlighting how promising this approach is for therapeutical translation.

Lastly, at this conference, I also had the opportunity to present my Ph.D. work progress as a poster and had the most interactive and gainful scientific discussions. From principal investigators to undergraduate students, everyone was accessible, interested, and enthusiastic to share ideas and give constructive feedback. It was, overall, a great atmosphere to network with researchers, appreciate "first-hand" their current work, and learn how and towards where the field is advancing.