Characterization of Astrocyte Polarity with Regards to the Primary Cilium

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Cell polarity is the intrinsic asymmetry present in almost all eukaryotic cells shown in the organization of various subcellular components. Proper polarity is critical to cell division, migration, and differentiation. In the central nervous system (CNS), astrocytes are a glial cell without obvious polarization. However, research suggests glial fibrillary acidic protein (GFAP), a major protein of the astrocytic cytoskeleton that plays a role in cell communication and the development of the blood-brain barrier, is polarized while a comprehensive study of the nature of its polarity does not exist. Through immunohistochemical staining of Aldh1L1 transgenic reporter mice, I characterized the nature of GFAP polarity in astrocytes with regard to age and brain region and found that GFAP is highly polarized with respect to regional planes of alignment throughout the adult mouse brain while polarization in younger mice with respect to alignment was significantly less. Furthermore, I found that GFAP polarity is influenced by the primary cilium through analysis of Tg737orpk knockout mice who have characteristically deficient primary cilium. Polarization of GFAP in wild-type mice was localized around the primary cilia while polarization in cilia-deficient mice seemed random. Evidence indicates the primary cilium has the ability to control cell behavior and influences cell migratory ability. Taken together, this indicates that the primary cilium influences the correct polarization of GFAP in astrocytes and in turn, affect migratory ability, which may help in explaining traits such as cerebellar hypoplasia characteristic of patients with ciliopathies.

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