Project 1.6 Interlaminar astrocytes in primates – from molecular signature to functions in-vivo

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Background:

How the human brain evolved to provide complex cognitive functions is one of the most fundamental and fascinating questions in biology. Recent data indicates that the evolution of neurons and supporting cells including astrocytes led to changes in the activity of hundreds of genes. These results suggest that the enhancement of higher brain function in humans is in part determined by changes in astrocyte biology.

Astrocytes not only ensure proper brain homeostasis, but also warrant proper functioning of synapses. Learning and memory therefore require the presence and activity of astrocytes. Astrocytes are heterogeneous in form and function. Morphological analysis allows to distinguish protoplasmic, radial, fibrous and interlaminar astrocytes. Remarkably, interlaminar astrocytes (ILA) are found only in primate brains. Although the function of ILA is unclear, their cytoarchitecture and localization suggest an influence on higher-level brain functions.

Virtually all neurological disorders are characterized by astrocyte dysfunction ranging from hyperactivity to atrophy. The brains of patients with Down's syndrome or Alzheimer's disease (AD) show profoundly altered ILAs, in the most extreme cases of ADs, ILAs disappear altogether. Our project hypothesizes that by identifying the genes that define AMW biology in primates, we will provide fundamentally new insights into the mechanisms that ensure proper brain function and shed new light on the mechanisms of brain evolution.

Aim:

The far reaching aim our work is to understand ILAs function in primates. For this purpose, the successful candidate will take advantage of stem cell models to obtain human, chimpanzee and macaques ILAs. The candidate will implement single cell technologies to define genes active in ILAs and uncover essential genes related to their evolution. Using genome editing techniques, the PhD student will test the involvement of the identified genes in ILAs function. The data generated by this project will shed new light on the genetic basis of brain evolution and possibly provide new insights into the genetic basis of neurological disorders, including Alzheimer's disease.

Requirements:

- Master's degree in cell biology, biotechnology, genetics, or neurobiology;
- experience in laboratory work,
- capacity to think synthetically and excellent organization skills.