Searching for "Smart-and-Sex" Genes — Evolutionary Driver for Neuron and Germ Cell Development in Primates

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Evolution has shaped primates to develop two key advanced traits in comparison with lower mammalian species: first higher intelligence with increased brain size and cortical complexity and second a more enhanced reproductive system. Furthermore the brain and testis, among all the organs of the human body, exhibit the most similar gene expression pattern. This study explores if there exist any “smart-and-sex” genes that drive the evolution of these advanced traits. First bioinformatics analysis performed upon existing human brain and testis transcriptomic database identified a group of candidate “smart-and-sex” genes that emerged after the primate-rodent split during evolution and exhibit a significantly higher expression in neural progenitor cells at the peak of human brain development (0-1 year newborn) as well as in male testicular progenitor cells (age 13 and beyond).Then in vitro model of cortical neurogenesis and 3D mouse testicular germ cell proliferation experiments were conducted to test the impact of these genes. Experiments results showed that expression of some of these genes in neural progenitor cells leads to larger clone size and potentially, a higher number of neurons to be generated. In parallel, expression of the same genes in mouse testicular progenitor cells gave rise to much more enhanced 3D clonal formation ability, indicating a clear upgradation of the mouse reproductive system. In summary, these findings support the hypothesis that there exist primate-specific “smart-and-sex” genes that could be the evolutionary driver for neuron and germ cell development in primates, with great therapeutic potential in treating neurodegenerative and reproductive diseases.

Awards Won:
Second Award of $2,400