Lipid Profiles of Differentiating Neural Cells

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More than one half of the mass of vertebrate central nervous system (CNS) consists of lipid. Neural cells, as well as their subcellular organelles are surrounded by a semi-permeable membrane, which is essential for creating the chemical and electrical gradients needed for cellular functions. These membranes are extremely complex structures, consisting of a great variety of proteins and thousands of different lipid molecules, (phospholipids, sphingolipids and sterols). The concentrations of these lipids are maintained within narrow limits, which shows how crucial lipid homeostasis is for cell survival. Membrane lipids participate in cell recognition, signalling events, protein traffic, domain assembly (rafts) and modulation of protein function. Recent developments in mass spectrometry, especially electrospray-ionization technique (ESI-MS) have made lipidomics a promising area of biomedical research, with a variety of applications in biomarker and drug development. However, these tools have not yet been applied to study neural stem cell lipidomes or changes of the profiles during differentiation process of the cells. We have isolated progenitor cells from rat spinal cord, differentiated neural cell types and recorded their lipidomes with characteristic differences by ESI-MS. Our goal is to provide more accurate validation of the quality of stem cells. Stem cells of choice for regenerative treatments of neural tissues consist of diverse, heterogenous populations, and often their identity and stage of differentiation remains unclear. Proper characterization of these cells is a necessity for controlled systematic CNS regeneration experiments with animals and extremely important for validated human transplantations and patient safety.