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Stem cell incorporation and differentiation in organotypic rat and mouse brain slice cultures

Stem cells can be derived from a variety of sources and have three general properties. They can continuously divide for long periods of time; they are unspecialized and they can differentiate into specialized cell types. Many stem cell types are capable of migrating through brain tissue and can be used to deliver therapeutic agents to regions of injury or disease. Our lab is interested in determining which stem cell type has the highest survival and integration rate when introduced into mammalian tissue. Migration potential and ability to deliver therapeutics are also vital and will be assessed in the future. To study the stem cells in host mammalian tissue, we are using organotypic cultures of neonate rat and mouse brain slices that enable us to track the functional integration of donor cells for up to three weeks. Donor cell types include undifferentiated ES cells, neuralized ES cells and adult peripheral blood stem cells (provided by Dr. Elmer Price) all of which express green fluorescent protein that allows for visual tracking after transplantation. Functional integration is determined by the presence of unique neural morphologies, expression of neural markers and physiological function after integration into the host tissue. Preliminary results indicate that undifferentiated ES cells integrate well and differentiate into cells that display neural morphologies, though their survival rate is much lower than that of adult peripheral blood stem cells. Neuralized ES cells also integrate well and differentiate into cells displaying neural morphologies. These cells also form interesting structures that span injurious gaps in rat brain slices. Unfortunately, neuralized ES cells have extremely low survival rates when compared to the other two cell types. Peripheral blood stem cells show the highest frequency of integration, differentiation and long-term survival within the host tissue.

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