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A potential role for programed cell death in the formation of an in vitro neural stem cell niche

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Stem cell therapies have the potential to help manage diseases that are currently untreatable, such as Batten Disease, a progressive neurodegenerative disease of childhood. One proposed therapeutic intervention is the transplant of stem cells into a patient to replace cells lost or to prevent future cell loss due to neurodegeneration. The use of donor cell systems capable of maintaining a microenvironment sufficient to support self-renewal and differentiation may increase the therapeutic value of current cell transplant methods. We predict that the transplantation of a stem cell niche (a unique structure found in adult tissues that houses adult stem cells) may enhance delivery and incorporation of donor stem cells into recipient tissue. We have developed a method of producing a neural stem cell niche in vitro from mouse embryonic stem cells. TUNEL staining has shown the presence of the apoptotic pathway (i.e., programmed cell death pathway) during the maturation of our in vitro niche. We hypothesize that the cells being lost within the niche to apoptosis are post-mitotic and cannot be sustained in the minimal culture conditions provided. Previously, simultaneous immunocytochemistry and TUNEL experiments have indicated the absence of cell death within the center of the niche, where the early stem cell marker, platelet derived growth factor receptor alpha, is found. Further investigation by western blot will show us a "timeline" for cell growth and death within our niche structure. A better understanding of the conditions necessary for the formation and maturation of our in vitro neural stem cell niche may lead to newer and better methods for cell-based therapies for a number of brain disorders. This method may then be used to provide a self-sustaining population of cell types to many patients suffering from many neurodegenerative disorders such as Batten Disease.