Regeneration of Neurons via in-vivo Reprogramming of Neural Stem Cells (NSCs)

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Abstract: Regeneration of Neurons via in-vivo Reprogramming of Neural Stem Cells (NSCs)

Purpose: An illustration of an organ that does not regenerate is the adult mammalian central nervous system (CNS), particularly that of adult humans. However, there has been a growing interest in the creation of novel therapeutic approaches that make use of recent strides in stem cell and neuroscience research in order to restore damaged CNS tissue. In fact, a key tactic for CNS regeneration is the recapitulation of normal neuronal development. Early progenitors have a wide range of multipotency, while late progenitors are unable to create the earlier fates, according to groundbreaking heterochronic transplantation experiments. This discovery gave rise to the fundamental notion that the potential of CNS stem cells is gradually, temporally constrained.

Method: This is a conceptual study that has been combined with a literature review of various research studies to explore the role of Neural Stem Cells (NSCs) in Neural Regeneration in CNS.

Result: The creation of techniques to capture lengthy time-lapse movies of CNS germinal cells ex vivo has produced a wealth of knowledge. The lineage trees of isolated murine CNS progenitor cells were strikingly similar to those of invertebrates, as seen in movies of isolated cortical clones growing in 2D cultures. Even more astounding, individual cells were programmed to replicate the timing of various progeny seen in vivo, including their gradual restriction in potency (Shen et al., 2006). Slice culture with retroviral tagging allowed researchers to view cortical progenitor cells in a system that mostly preserved the typical 3D niche architecture. This method demonstrated that the basic progenitor cells for neurons and subsequent glia were radial glial cells (RGCs), which extend from their soma in the ventricular zone (VZ) to the surface of Pia. This discovery, together with in vitro research employing transgenic RGC reporters, supported the hypothesis that embryonic multipotent CNS NSCs constituted a subgroup of RGCs.

Contribution of the research: There should be fewer negative effects from direct in vivo reprogramming of internal proliferative cells than from in vitro cell culture and transplanting. While there are many obstacles to overcome before in vivo reprogramming may be used in clinical therapies, none of them are insurmountable, and the majority of the obstacles will also be encountered by other techniques, such as stem cell therapy. Before initiating any human therapeutic trials, it is necessary to show that neuronal circuits may be rebuilt following in vivo reprogramming and to achieve functional recovery in animal models. However, as a proof of concept, we have already shown that NeuroD1 expression or small compounds can directly reprogram cultured human astrocytes into functioning neurons, indicating that astrocyte-to-neuron conversion is potentially relevant in human patients.

Keywords: Neural Stem Cells, CNS, Neurons, Embryonic neural progenitor cells (NPCs), Radial Glial Cells (RGCs)

What will audience learn from your presentation?

- Learn about the potential cells that can be used in neural regeneration
- This research will be helpful for the medical and the research fraternity in order to help the patients with

neurodegenerative disorders, major brain injuries to recover from the neuron damage and rehabilitation thereafter and thus, help in controlling the cognitive decline. This is just a literature review but based on this, numerous clinical studies can be conducted on this concept.

Biography of presenting author

Ms. Prerna Dash has graduated in Human Development and Childhood studies University of Delhi in 2022. Throughout her undergraduate, she has had the opportunity to present her research at the Trends in Psychology Summit, Harvard University, Shaheed Bhagat Singh Evening College (DU), and the National Association of Psychology convention in association with IIT Bombay and EBRAINS Summit, as well as she is the recipient of Cognitive Neuroscience Society Fellowship (JoCN Travel Fellowship), San Francisco. She has published research paper in the International Youth Neuroscience Association Journal March 2022 titled 'A Neurological Study on Frontal Brain Asymmetry in Major Depressive Disorder'.

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