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Special Issue

Neural Stem Cells

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The continuous generation of various types of neurons and glial cells from pluripotent embryonic stem cells during the development of central nervous system, as well as the formation and integration of adult neural stem cells in the mature brain represent two major processes in generating neural cells. Neural stem cells provide the in vitro model to study neural developmental stages, and offer the possibility in treating many neurological disorders, such as Parkinson's disease, spinal cord injury, multiple sclerosis, and others. The availability of human neural stem cells further promotes the cellular replacement therapy for focal as well as most degenerating diseases. Recent advances of induced pluripotent stem cells through genetic engineering of somatic cells or even diseased cells with defined transcription factors open the new avenue in disease-specifically treatments. Though many technical and ethical problems are yet to be solved, the enormous prospective of this area has formed more than several hotspots. To highlight recent progress in this field, the **Electronic Journal of Biology** organized a special issue "Neural Stem Cells", with a total of eight manuscripts ranging from the culture, molecular definition of neural stem cells, stem niches, to practices of transplantation, and the function of adult generated neurons inside the brain.

In This Volume:

Ivan Iourov [1] and colleagues from National Research Center of Mental Health, Russian Academy of Medical Sciences reviewed the molecular cytogenetics of neural stem cells, based on their studies detecting Aneuploid ((losses/gains of whole chromosomes in a cell) in neural stem cells in both adult and developing brains. They discussed the advantages and disadvantages molecular cytogenetic techniques when studying health or diseased brains. Their data can serve as the basis for future basic studies of neural stem cells biology.

One unsolved question in studying the biology of neural stem cells is the lack of definitive molecular markers for neural stem cells. ***Martin Maurer*** [2] from the SYGNIS Bioscience GmbH and Co. KG, Germany reviewed the functional definition of neural stem cells by their gene expression, responsiveness to extracellular stresses or growth factors, the recruitment of cell signaling pathways that are well indentified during development, and the control in producing progeny. The use of functional genomic and proteomic approaches offer the new ways in isolation and identification of different neural stem cells.

Hippocampus represents one of the most important centres controlling the learning and memory process, and evidences for adult generated neurons emerged half a century ago. ***Nagesh Shanbhag*** [3] from National Centre for Cell Science, University of Pune Campus, India reviewed the general functions of hippocampal neurogenesis, as well as changes of neurogenesis under injury and diseased conditions. Specifically, ***Francisco Nieto-Escámez*** [4] from the Department of Neuroscience and Health Sciences, Universidad de Almeria, Spain discussed the growing studies on learning influenced adult neurogenesis in the dentate gyrus (DG) of hippocampus. The manuscript critically evaluate evidences that link DG neurogenesis with learning process, and reviewed current hypotheses on the role of neurogenesis in learning.

Current knowledge suggest that adult neurogenesis in mammalian brain is restricted to two major areas, hippocampus and the subventricular zone (SVZ). ***Stefano Pluchino and Luca Bonfanti*** [5] from San Raffaele Scientific Institute and University of Turin, respectively, discussed the typical stem niches (such as hippocampus and SVZ) and the atypical neural stem cell niches that are formed during the homing interaction processes after transplantation into normal or diseased brains. Understanding of the mechanisms underlying how these neural stem cells or nonconventional stem cells will interact with

microenvironment can finally bring improved therapeutic activity of transplanted stem cells or neural progenitor cells.

One of the most important applications of neural stem cells is cell replacement therapy to different neurological diseases and trauma conditions. ***Nan Dai and Virginie Sottile*** [6] from Wolfson Centre for Stem Cells, University of Nottingham reviewed on the sources and cellular markers of neural stem cells in adult brain, as well as their potential application in treating brain disorders. ***Keiko Nakanishi and Atsuhiko Oohira*** [7] from Aichi Medical University further discussed the transplantation therapies combined with niche modification, specifically for neurodegenerative disorders. The submission of niche modulators and trophic factors that support the survival and integration of neural stem cells thus may greatly facilitate current practices in neural stem cell transplantation therapies.

In addition this special issue includes an original article from ***Yegorov*** [8] lab in Engelhardt Institute of Molecular Biology, Russian Academy of Science on human telomerase reverse transcriptase gene (hTERT) promoted proliferation of neural stem cells in culture. Their study suggests that telomerized cells can be a useful source for future research and clinical applications.

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