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Editorial OMICS International

# Stem Cells Therapy for Neurological Diseases

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## Editorial

The adult tissues in the body usually have their own mechanisms to maintain homeostasis and in cases of damage to regenerate. These abilities are very limited concerning brain tissue and the ability of "self-healing" is very limited within this tissue. The damaged tissue and neural-tissue degeneration might be a result of inflammatory, degenerative or cardiovascular conditions. In the last two decades the application of stem cells as a tool for regenerative medicine was widely studied. Several types of stem cells were identified varying from pluripotent embryonic stem cells to tissue-specific adult stem cells. Human ES cells are unique in the universe since they can self-renew infinitely in culture and also have a remarkable potential to develop into all cells and tissues of the human body. Despite all of the great potential of ES, the use of these cells holds a lot of technical and ethical difficulties and controversies. In the last few years, a highly motivated research is being carried field of Induced Pluripotent Stem Cells (iPS) which are type of stem cells generated from somatic adult cells reprogramed genetically to imitate embryonic stem cells in the biological features. Despite being limited in the differentiation potential and to a large extent have tissue-specific differentiation potential, adult stem cells (from various tissues) were found to have immunomodulatory properties (which may be useful in inflammatory diseases) as well as neuroprotective and neurotropic effects within the milieu they exist in. Neural stem cells (NSCs) have the advantage of being naturally "neuralized" and they are already committed to give rise to brain-tissue cells.

However, as in the case of ES, transplantation of NSCs into adult brain tissue is coaxed with scientific, technical and ethical difficulties. Long-term culturing of NSCs leads to a bias towards a glial differentiation pattern, at the expense of neuronal differentiation, which may significantly reduce the therapeutic potential of NSCs in diseases where neurodegeneration dominates and neuronal replacement is essential. The possibility of clinical application of NSCs in neurological diseases hold the difficulty in their isolation (source of the cells), the difficulty to produce large-scale production of NSCs in cultures and the possible risk for rejection/engrafted cell death, upon transplantation. Bone marrow considered one of the large pools of adult stem cells which were extensively studied in the context of neurological diseases and other diseases. The BM compartment contains mainly the hematopoietic stem cells, which constantly renew all the blood cells (which are clinically used in several blood cancer diseases). An additional stem cell population residing in the adult BM is that of Mesenchymal Stem Cells (MSC). MSCs were shown to carry the ability to promote neuronal repair, to protect damaged neuronal tissues and to down regulate the immune responses (immunomodulation) both *in vitro* and *in vivo*. The therapeutic effects of stem cells mainly adult stem cells focusing on bone-marrow derived stem cells were extensively investigated in several preclinical models of different diseases such as multiple sclerosis, amyotrophic lateral sclerosis, Huntington's disease, stroke and others. Upon all of the encouraging results obtained from preclinical studies, clinical studies were also conducted for different conditions of brain diseases. In the last few years several controlled and registered clinical trials focusing of multiple sclerosis and amyotrophic lateral sclerosis (including in our center) were conducted utilizing Mesenchymal stem cells. Some of these trials were resulted in very encouraging results, regarding feasibility, safety and to some extent efficacy. Unfortunately, in addition to these registered trials, there are numerous private stem cell 'centers' and companies that offer, upon payment of high fees, so-called 'stem cell treatments' (especially with MSC, which are easily obtained and expanded) in various neurological conditions. This is especially prominent in the developed countries (but not only, and you can find it also in USA and Europe) where such medical procedures are almost entirely uncontrolled.

In conclusion, intensive worldwide preclinical and clinical research has definitely enhanced our understanding of the role and feasibility and safety of stem cells as a therapeutic tool in neurological diseases; however, a lot of studies still needed to normalize these therapeutic approaches in technical and development stages of cell production or in the medical application (dose, application route, number of injections and etc.).