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Neural stem cells

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ABSTRACT

The revelation of neural stem cells was established in exemplary investigation of haematopoiesis and of invertebrate neural events, which enlivened assessment of single neural progenitor cells (they are all types of undeveloped, proliferating cells). Neural stem cells are part of progenitor cells in nervous system which can renew it self and have potential to generate glia and neurons. The early examination drove to the disconnection of stem-like ells from the early stage of mammalian Central Nervous System (CNS) and the Peripheral Nervous System (PNS). From that point forward, stem cells have been segregated from numerous parts of the early embryonic nervous system. There are two types of stem cells embryonic stem cells which play role in embryonic development and present in inner cell mass and then, adult stem cells which are present in bone marrow. Advantage of adult stem cell is that it helps in treatment of leukaemia and other disorders. Through axis formation neural cells receives positional information. Stem cells can also be used in Multiple Sclerosis, Parkinson Disease, Alzheimer's disease, etc. This review provides an overview of the types and developmental aspects of neural stem cells. Furthermore, aging and development, future studies are discussed.

Keywords: Neural stem cells, Aging and development, Treatment

INTRODUCTION

Neural Stem Cells (NSCs) are self-renewing cells they generate the neurons of the nervous system that is why they are multipotent cells and capable of reforming through mitotic division. During embryonic development of animals' neural stem cells start to develop (Beattie et al., 2017). In adult vertebrate brain some neural stem cells produce neuron throughout life. They have capacity to differentiate into multiple cell types (Clarke et al., J 2002). They go into cell division to form two daughter cells. Two modes of stem cells are: both daughter cells are stem cells or one daughter is stem cell and other is specialized cell (Gilbert et al., 2014). They differentiate into neurons, astrocytes and oligodendrocytes.

HISTORY

The first proof that neurogenesis happens in quite a while of the grown up mammalian cerebrum came from (3H)-thymidine marking examines led by Altman and Das in 1965 which showed post pregnancy hippocampal neurogenesis in youthful rodents (Altman et al., 1965). In the region of subventricular zone (SVZ) of the mouse brain, Sally Temple, in 1989, described stem cells and self-renewing progenitor cells which are multipotent in nature (Temple et al., 1989). Then Brent A. Reynolds and Samuel Weiss in 1992 isolated neural progenitor and stem cells from the adult striated tissue which containing SVZ (neurogenic area) of adult mice (Reynolds et al., 1992).

Around the same time the group of Constance Cepko and Evan Y. Snyder were earliest to segregate multipotent cells from the mouse cerebellum and steadily transfected them with the oncogene v-myc (Cepko et al., 1992). This particle is one of the qualities generally utilized now to reinvent grown up non immature microorganisms into pluripotent undifferentiated organisms. From that point forward, neural ancestor and immature microorganisms have been disengaged from different spaces of the grown up focal sensory system, including non-neurogenic regions, like the spinal string, and from different species including humans (Juan Raymond et al., 2002).

TYPES

There are two types of stem cells:

Embryonic Stem Cells

They are derived from embryo. During early stage of embryo from inner cell mass of blastocyst stem cells are taken. Around 4 to 5 days are taken to reach the blastocyst which contains 30 to 50 cells. Two main features of embryonic stem cells are: They have self-renewal capacity and these cells can differentiate into all types of cells in ectodermal, endodermal and mesodermal. This is known as pluripotent nature (Persons DA) Due to these two qualities embryonic cells can be used for regeneration or replacement of destroyed tissues. Lot of research is going on regarding stem cells to explore more uses of these cells and curing disorders like diabetes be replacing the cells. But, due to ethical issues this is not done because embryo has to be destroyed so that stems cells are collected (Curr

Opin Mol Ther, 2003).

Stem cells from umbilical cord blood: These are collected from the placenta or umbilical cord. Use of stem cells from umbilical cord or placenta does not create any ethical issue because it is not harming the life of fetus or infant. They are easily available so they are becoming potent way for transplant therapies. Nowadays, around 70 diseases treatment stem cells are used worldwide.

Adult Stem Cells

Embryonic stem cells (ESCs) do not disappear after birth. They remain in body and known as adult stem cells and play vital role in repair of damage tissue. There number becomes less. They are in undifferentiated multipotent progenitor cells forms which are found in growing children and adults. These cells are also known as somatic stem cells and present in everywhere in body. They are capable of dividing and repairing the dead cells and they regenerate the damaged tissues. Adult stem cells are present in bone marrow (Pietrangelo A, 2004)

Two types of stem cells are present in bone marrow: hemopoietic stem cells, they give rise to blood cells and bone marrow stromal cells; they can differentiate into cardiac and skeletal cells.

Advantages of stem cells: Adult stem cells are taken from bone marrow and used further in bone marrow transplant to treat leukaemia and other disorders. It is known that stem cells can develop into nerve cells, liver cells, skeletal muscles cells etc. (Tefferi A, 2003).

According to recent discoveries the stem cells are present in several tissues also which blood, blood vessels, muscles, liver, skin and brain. Recently it is found that they are capable of differentiating into multiple cell types. Nowadays, cell based therapy may be possible to treat many diseases which are neuronal or chronic in nature like Alzheimer's disease, injury to spinal cord, rheumatoid arthritis etc. (Trigg ME, 2004).

AGING AND DEVELOPMENT

In vivo origin

ESCs (Embryonic Stem Cells) are less specialized as compare to neural stem cells because they only generate the neural cells (Beattie et al., 2017). Neural stem cells of the central nervous system are known as radial glial cells which reside in ventricular zone (VZ) during embryonic development (Gilbert et al., 2017). Neural stem cells divide into new neurons in sub ventricular zone (SVZ).

In vitro origin

In mouse striatum adult NSCs we first isolated in early 1990's. When they were cultured in vitro it was seen that they were capable of forming multipotent neurospheres (Habeeb et al., 2011) Cells which can regenerate and divide to form specialized cells are called neurospheres (Calegar 2012). When they divide, they form particular neurons, glial cells, and oligodendrocytes.

Aging

Neural stem cell is regulated by FOXO proteins (Wolpert et al., 1994). To protect neural stem cells FOXO proteins have been used by inhibiting Wnt signaling (Altmann et al., 2001)

MODE OF INFORMATION ACQUIRE

Neural stem cells receive positional information

Through signaling systems formations of body axis take place that will differentiate specific information. For example, some of molecule's signals can particularly specify a group of progenitor cells if the cells response varies in providing intensity of the signal. In the nervous system, the first formation in pattern form occurs in anterior–posterior and dorsal–ventral axes (Kirschstein et al., 2001).

Neural stem cells receive temporal information

In temporal order neural cell types arise differently from a specific region and species. Generally, neurons of CNS and PNS arise first and there is particular type of each and every cell with specific birthdates. 'Temporal information' has positional information and is seen as important change in progenitor cells stage (Betarbet et al., 1996)

THERAPEUTIC USES OF STEM CELLS

Stem cells are still under active research for neuronal cell therapy to treat major neuronal disease (Fischer et al., 2001).

Parkinson's disease

Produce cells that will release dopamine for going on specific target that is the dopamine depleted striatum is most important. It is still not known that these cells also be mature enough in projecting neurons with synaptic host connections. To be effective therapy, process need average effects of embryonic nigral grafts (Anderson et al., 2001).

Spinal cord injury

Stem cells may be able to occupy the area of injury, main site of cell must be provided for axon growth over the whole transection, with primary embryonic cells this effect has been found but it is under process.

Multiple sclerosis

Oligodendrocyte's area is much better than neuron area. The main problem in multiple sclerosis is that stimulation of cells from myelinated site to demyelinated site (which is occurred due to disease) is still to be resolved.

All these main points can be solved but it will require more energy to transfer stem cells into more realistic clinical plan for cells to be repair and replaced.

DISCUSSION

Neural stem cells maybe an essential in developing the signals; it will change gene expression, morphology and behaviour. They still self-renew if the main feature of stem cells is different and are taken out from non-identical regions at separate times. Main point is to know that how signals (spatial and temporal) are changed in neural stem cells. Comparison between embryo and adult gene expression can be done with the help of markers which are for neural stem cells so that it will allow different stages selection to observe their potential. This will help in identifying genes that specify production of non-identical types of progenies. Research to identify highly flexible stem cells in adults for therapeutic use

is still going on (Wagers et al., 2004).

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DECLARATION OF CONFLICTING INTERESTS

The authors declared no potential conflicts of interest for the research, authorship, and/or publication of this article.

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