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Review Article

An Incredible Discovery to Extend Life - Stem Cell

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A B S T R A C T

Stem cell technology is a stream line which connects many other prominent fields like Biotechnology, Tissue Engineering and Medical Science which has a remarkable potential to develop many cell types, tissues and organs. Stem cells have really created a prominent place for itself in medical science. They serve as a repair mechanism which is very much effectual and promising boon in recent days. Earlier stages only had embryonic stem cells which are isolated from the embryos and nowadays Somatic or adult stem cells are also employed in treatment techniques. They are used to treat multilateral diseases. The clinical research environment in India underwent a tremendous flux with severe criticism from the press and public. This review is projected to underline the significance of stem cells especially in India and its scale.

Keywords

Stem cell, Tissue Engineering, Medical Science, embryonic stem cells.

Introduction

Biotechnology is the fusion of biology and technology or application of biological techniques employed in research and development intended to ameliorate the quality of human life. Stem cell therapy is an emerging field of science that deals with the growth of organs of the body through a single cell giving hopes to many fatal medical conditions. The technology and Medical Science have been working for the elevation of better human life since 1980s.

Researches and early scientists have always dreamt of repair damage mechanism using tissue or creating new organs. The persistent research and experiments led to the discovery of the new discipline 'STEM CELLS'.

The potential of this new discovery took the field of medicine and technology to a huge boost.

The launch of stem cells was done in 1981 when Martin Evans, University of Cambridge identified embryonic stem cells in mice. Following that the first animal clone 'DOLLY- THE SHEEP' by Ian Wilmut and his colleagues were discovered. This discovery was based on surrogacy yet it was the eye opener for further research in hybrid and human stem cell therapies. And there in 1998, James Thomson, University of Wisconsim and John Hopkins, University of Baltimore respectively isolated Embryonic Human Stem Cells and grow

them in laboratory. This was the first human embryonic stem cell [1]. This later encouraged and grew the interest towards the stem cells.

Milestones in History

The controversies and ethical issues were seen against research in stem cell therapy. In 2001 US President George W. Bush limited the federal funding to the research in human embryonic stem cells stating that embryo is destroyed in the research process. Stem cells discovery found difficult to catch a prominent place in the field of science [2]. Woo Suk Hwang of Seoul National University, South Korea, during 2005 reported that his team created a human embryo stem cell genetically matching to specific people. Later the same year it was proved false. A new Chapter of stem cells research was started in 2006 when Shinya Yamanaka of Kyoto University, Japan introduced induced pluripotent stem cells isolated from adults shutting the controversies of destroying embryos for the sake of embryonic stem cell research. The world officially welcomed the new stream line by awarding Nobel Prize for medicine to Evans for his discovery in 1981. In 2009 US President Obama lifted the 2001 restrictions leading to further research. From 2010 stem cell therapy was employed in treating people suffering from several incurable diseases around the globe. In 2010 a spinal injury case was treated with stem cell therapy in California. It was conducted by Geron of Menlo Park, California a pioneering company for human embryonic stem cell therapy.

Later in 2012 blindness was treated using stem cell therapy by transplanting limbal stem cells. Later in the same year Yamanaka received a Noble Prize for his discovery of induced pluripotent cells. He shared the Noble Prize with John Gurdon, University of Cambridge. In 2013 National Primate Research center in Beaverton produced human embryonic stem cells from fetal cells using therapeutic cloning a breakthrough falsely claimed in 2005 by Woo Suk Hwang. In 2014 Charles Vacanti, Harvard Medical School and Haruko Obokata, Japan announced that any cell can potentially be rewound to pre-embryonic state by dipping adult cells in an acid for less than an hour. "Reprogramming adult cells by exposing them to acid for half an hour is an incredible discovery" Says Vacanti. Personalized stem cells will be cheap and easy to make. It will take weeks rather than months and at the same time effective too. If the procedure would apply for humans then it would change almost everything. In 2014 therapeutic cloning with adult cells in human is experimented with the insulin producing beta cells. Several trials in human were also conducted. In 2015 the research line gave many solutions to numerous serious medical conditions. Bone marrow transplant using stem cells in human is one of the most remarkable milestones achieved in 2015.

A Multifacited Stem Cell Therapy

The predominant field biotechnology extends its branches towards stem cell therapy by developing tools and therapeutics methodologies through modification and engineering. It helps in transplanting immature microorganisms or giving medications. Stem cell therapy can cure more than 15 deadly medical conditions. Bone marrow transplant is the cured form of stem cell therapy that has been used for many years without any controversies till now. Even the field of Bio informatics has a role in stem cell therapy. It helps by giving the computational methods to explore the molecular mechanism of cells.

Stem cell technology is important in regenerative medicine. Regenerative pharmaceuticals have the capacity to repair or help in recovery of tissues and organs. These drugs can restore cells and tissues, with the rapid technological advantages in health care and its promising results. It is estimated that the use of this stem cell technique in medical science as therapeutics will increase and the market is expected to have double growth in the forecast period of 2015-2025. BCC research projects, the global stem cell will reach $10.6 billion in 2018.

Stem Cell Therapy in India

The establishment of stem cell therapy indeed created stir in India. The clinical research environment in India underwent a tremendous flux with severe criticism from the press and public. Indian council of Medical Research (ICMR) drafted guidelines[Fig.1] on stem cell research which includes aims, scopes, ethical consideration, classification, categories, mechanism, public participation and many more under 17 topics and sub topics. They have attached a protocol which makes it a complete guide for stem cell therapy [3].

IC-SCRT – Institutional committee – Stem cell research and therapy. IEC – Institutional Ethics committee. DCGI - Drug Controller General India

The cultural intricacies, stigmas and taboos surrounding infertility in Indian culture seem more likely to promote a self protective silence on the moral status of the human embryo rather than an open discussion. Many research scientists and doctors worked behind the erasure of the taboo regarding stem cell therapy in India. Finally after a long hesitations and ethics, India is welcoming the idea of stem cell therapy. Table 1 listed out the stem cell therapy centers in India [Table1]. The stem cell controversy is linked to the source of cells in embryonic stem cell therapy. As the name suggests they are isolated from fertilized blastocysts (Known as the inner cell mass). This raises a religious and ethical debate around the use of these cells. Unless like Embryonic stem cell the new methodology induced pluripotent stem cells have less limitation in the view of ethics as they are directly isolated from the adults. Even then they are emerging as a successful method they have some drawbacks.

Cells would have genetic defect.[4,5]

One of the pluripotency gene is a cancer gene.[5,6,7]

Virus might be inserted in genes (Mutation) [11,12,13]

Stem Cells – A Ray of Hope for Incurable Medical Conditions

The discovery of stem cells takes us through a path of new life. Many diseases which are labeled as Incurable are getting cured by the stem cell therapeutic methods. Stem cells give another chance to those who do not respond to any drugs further. The discovery of stem cells simply elevates the technological and medical field tremendously that leads to many new discoveries, learning skills and research line. Yet the system of working and methods are not known to all people around the world it surely works perfect with people who are aware of it and their comment on stem cell therapy is ‘miraculous’. It has been reported that more than 20 patients had done bone transplant using their own stem cells. It rebuilds destroyed immune system by one self’s blood. From the recent report it is known that scientists are working on

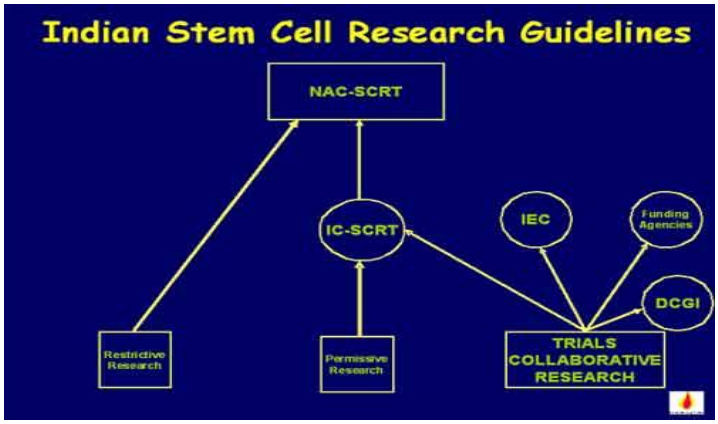
alignated bubble drugs that would carry insulin producing beta cells for treating diabetes [8,9].

Multiple Sclerosis society said that the treatment was life changing yet aggressive and many may not be effective for all MS patients. In Mumbai, India, 26th January 2016 a 24 yr old engineering student Sushant Chavan who was diagnosed as a patient of Multiple Sclerosis in 2011, recovered undergoing stem cell therapy [14]. He had lost his speech and was crippled. Dr.Mahajan who treated him stated that his condition was worse ad no medicine could help him. Then he treated him with stem cell therapy and miraculously he is walking again.

Table.1 Stem Cell Therapy Centers in India

Sl No.	Hospital Name	City
1	Nichi-In Centre for Regenerative Medicine	Chennai
2	Sanjay Gandhi PGIMS	Lucknow
3	Tata Memorial Hospital	Mumbai
4	Inlaks Budhrani Hospital	Pune
5	Armed Forces Medical College	Pune
6	Army R & R Hospital	Delhi
7	Christian Medical College	Vellore
8	Narayana Hrudayalaya Health City	Bangalore
9	Manipal Hospital	Bangalore
10	Trinity Hospital & Heart Foundation	Bangalore
11	Global Hospital	Hyderabad
12	NIMS Hospital	Hyderabad
13	TRICell Therapeutics Pvt. Ltd.	Chennai
14	Adyar Cancer Institute	Chennai
15	Apollo hospital	Gandhinagar

Fig.1 Indian Stem Cell Research Guidelines



Stem cell therapy not only helps in the state of being rejected of medical help but also extends the life time of those who are suffering from age factor. Old age people don't have the power to withstand any operation usually above 70 [15]. Stem cell therapy offers a new life yet after that age without an operation scar. In Chennai, India 2016, 77 Year old Manju was diagnosed of Arthritis of knee. Surgery was not applicable due to her age factor. She had a cartilage damage which causes constant pain. It was usually treated by removing the cartilage and replacing them through surgery [16]. Mesenchymal stem cell therapy, the innovative knee therapy helped her to recover health again. It can cure chronic arthritis, ligament tear and knee arthritis. It is mostly recommended and suitable for old age people who cannot go for a surgery [17, 18, 19].

In conclusion, the breakthrough started in late 20th century and researches, experiments are ongoing till date in many countries including India without a break. Stem cells have really created a prominent place for itself in medical science and technology. Stem cells even cure diseases related to neurology and cardiology. In recent days Automated Modular iPS machinery has been introduced. Almost all the internal organs and tissue related disease can be cured through this therapy. People stated that it is a life saver and it gives a hope of new life. Amidst the controversies and bans this therapeutic method is slowly proving itself. Government is funding more to do research in many countries. Stem cell treatment also relates with tissue engineering, tissue regeneration which are other effective branches of biotechnology. Ground works on growing new external organs entirely by using stem cells are under to be experienced. It has been tested and proved that stem cells can even grow a tooth and hair. There is a huge scope for stem cells and its studies in upcoming years. Just treating people with ailments but also it requires some more refining processes in the areas as follows.

To study how organs grow and develop over time.

To test drugs and chemicals.

To understand genetic machinery.

Potential to regenerate tissues.

Replace cells that cannot be renewed or heal themselves.

Cures fatal diseases.

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