

Opinion

Potentials of Stem Cell Research and the Implications of Legislation

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On August 9th, 2001 (exactly five years ago), American President George W. Bush, went on the National TV to announce that ‘embryonic stem cell research is the “leading edge of a series of moral hazards” and he would be banning Federal Funding for the research’. He also cautioned that the federal funds could only be used for research on “already existing stem cell lines” – about 60 of them. Recently, despite a 63-37 favourable voting in the Senate, President Bush used his VETO power for the *first time*, blocking the popular bill. European Union is also thinking on similar lines and considering such a move in the near future.

STEM CELLS are the hottest topic in Biotechnology today and the subject of National and International Research. It is an undeniable fact that the STEM CELL research will open gates to a revolution in Medical Science and hold answers to cell based therapies to treat diseases like Parkinson Disease, MND (motor neuron diseases), cancer, Alzheimer’s etc.

Most of the cells within the human body have definite life span (most cells can only divide and replace themselves between 30 and 50 times. After a cell has undergone

its 50 divisions, it can divide no further and enters cellular ageing process. Thus our organs have a definite life span, given that they are composed of cells whose function eventually declines. We all have our origin in the fertilized egg – a single cell. The egg divides to give rise to- eventually many billions of cells. At an early stage, there are only few hundred cells. Some of these cells are pluripotent – which means that they can give rise at later stages to any of the specialized cells of our body, such as skin, nerve, blood, muscle cells (that is the special ability of these cells – to grow in to any of the body tissue).

We have seen STEM CELLS are cells that have capacity for renewal as well the capacity to give rise to specialized cells- such as nerve, muscle and *blood cells*. Implementation of STEM CELL Therapy is not new. It has been practiced for the past 40 years with good results. We have in our body, a number of STEM CELLS that are present in very small numbers in certain tissues. For example,

1) There are STEM CELLS at the base of our skin, which are present in very small number in certain tissues. These “divide” and one of the ‘daughter’ cells can “differentiate” (multiply) to replace the skin cell that we lose daily, **WHILE THE OTHER REMAINS A**

STEM CELL.

2) There is a continual loss of cells in our gut. These are replaced by dividing STEM CELLS, one of whose daughters, differentiate in to functioning gut cells.

3) In our bone marrow, there are STEM CELLS that give rise to blood cells. These STEM CELLS multiply and replace lost cells through out our lives. (It is the bone marrow STEM CELLS that replace our blood cells continuously).

Adult STEM CELLS such as blood forming stem cells in the bone marrow (called hematopoietic Stem Cells or HSCs) were known to be the only type of STEM CELLS commonly used to treat human diseases. Doctors have been transferring HSCs in bone marrow transplants for over 40 years. More advanced techniques of collecting or 'harvesting' HSCs, are now used in order to treat Lymphoma, Leukemia and several inherited blood disorders. The clinical potential of Adult STEM CELLS, have also been demonstrated in the treatment of other human diseases that include diabetes and advanced kidney cancer. However, these newer uses have involved studies with a very limited number of trial patients.

Adult stem cells, which have greater potential, than previously thought, are no match for embryonic stem cells in their versatility – in their ability to become any kind of human cell. Stem cells derived from early embryo have much greater potential.

There are three classes of stem cells.

1) TOTIPOTENT - A fertilized egg is considered 'totipotent'- meaning its potential is total: it gives rise to all the different types of cells in the body.

2) MULTIPOTENT - STEM CELLS that can give to small number of different cell types are generally called 'multipotent'

3) PLURIPOTENT - Pluripotent' STEM CELLS can give rise to any type of cell in the body- *EXCEPT THOSE NEEDED TO DEVELOP A FOETUS*. Some of the pluripotent cells can give rise at a later date to any of the specialized cells of our body.

Pluripotent STEM CELLS are isolated from human embryos that are a few days old. Cells from these embryos can be used to create pluripotent stem cell 'LINES' – cell cultures that can be grown indefinitely in the Laboratory. Pluripotent stem cells have *comes moral implications*. (To quote United Nations General Assembly also been developed from fetal tissue older than 8 weeks of development... *and here* (UNGA), who in their declaration found it necessary, "to prohibit all forms of human cloning in as much as they are incompatible with human dignity and the protection of human life"?).

It is possible to separate cells at this stage and place them in a culture dish where they are happy, grow and multiply. When the embryo is still smaller than a pinhead, researchers extract STEM CELLS that have the potential to grow in to any cell type in the body and *THIS IS THE CRUX – THE ABILITY OF THESE CELLS TO GROW INTO ANY BODY TISSUE*.

Under specific conditions, these cells can be made to differentiate – that is change into cells of a variety of different types such as muscle, nerve or skin. Since these come from early embryos they are called embryonic stem cells.

[An interesting observation while we are in the subject of "STEMCELL Research". A custom prevails in most of Southern Indian States,(may be true in other parts of India and South East Asia), the dried and clipped umbilical cord, is given by the hospital to the young mother .A small bit of this umbilical cord, is kept inside a talisman, sealed and tied round the waist of the child for a year or two. After that, the family, with identification, safely preserves the Talisman with the umbilical cord inside. This practice has been carried out for centuries and generations.

The point is, when DNA was not even heard of, what is the purpose of this 'stem cell

banking’? What purpose was it expected to serve? As modern Science is now realizing, none of these customs and habits were without significance. Did they know about banking and the use of stem cells? Has the technology been lost somewhere in the last century? I wish to take up this search in my spare time.]

WHY ARE DOCTORS and SCIENTISTS SO EXCITED ABOUT human EMBRYONIC STEM CELLS (hHSCs)?

Stem cells have potential in many different areas of health and medical research. To start with, studying stem cells will help us understand how they transform in to a dazzling array of specialized cells that make us *what we are*. Some of the most serious medical conditions such as Cancer, birth defects etc are due to the problem that occur *somewhere* in this process. A better understanding of normal cell development will allow us to understand and PERHAPS correct the errors that cause these medical conditions.

Another potential application of stem cell is making cells and tissues for medical therapies. Today, donated organs and tissues are used to replace those that are diseased or destroyed. Unfortunately, people needing a transplant, far exceed the organs available for transplantation at any given time.

Pluripotent stem cells offer the possibility of a renewable source of replacement cells and tissues to treat a myriad of diseases, conditions and disabilities including

- 1) Parkinson’s
- 2) Spinal cord Injury
- 3) Burns
- 4) Heart and Kidney diseases

AND HERE LIES ANOTHER HUMAN WEAKNESS.

Every one wants rejuvenated youth and those who can afford would definitely try. SCIENCE can be used or misused- misused like the use of aborted fetus, forcibly buying off and transplanting a kidney (for example) with the help of a minority of unscrupulous middlemen with or with out the knowledge of professionals. {This has unfortunately

happened in many parts of India and the world.}

The 3R policy of cell research
REFINE...REDUCE...REPLACE.

Only where necessary may only be followed in the breach. To counter this, to some extent, many of the fertility clinics normally discard eggs or dead embryos. These could be (and are being) used. But in no state, policing can be so perfect, especially in high level of scientific areas, where even an highly educated scientist is not aware of another’s project. It is the moral standards attached by the individual or group of scientists and self-policing, which will control misuse. We have seen some of the dangers of stem cell research earlier. Professor Brian Eyre – Chair of the Royal Society Committee on scientific aspects of international security, warned the Society, “to be alert for a tangible link between the out come of research and the possible use in some sort of harmful device”.

Clearly, no office holder in high places, want their name to be referred to as promoter of Scientific research that could destroy mankind. PERHAPS, ALFRED NOBEL HAD THAT IN MIND WHEN HE INSTITUTED THE NOBEL PRIZE.

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