

# Stem cells

When cultured, a stem cell has the ability to reproduce specialized cells (such as brain cells) for an indefinite period.

## Where do stem cells come from?

1. Stem cells can be isolated from a human embryo in early development. These are obtained with the consent of donor parents at in-vitro clinics.

2. Stem cells can be derived from fetal tissue obtained from terminated pregnancies with donor consent.

3. A normal egg cell has the nucleus removed and the cell is fused with any other body cell. These cells are not as versatile and healthy as ones obtained in the two processes above.

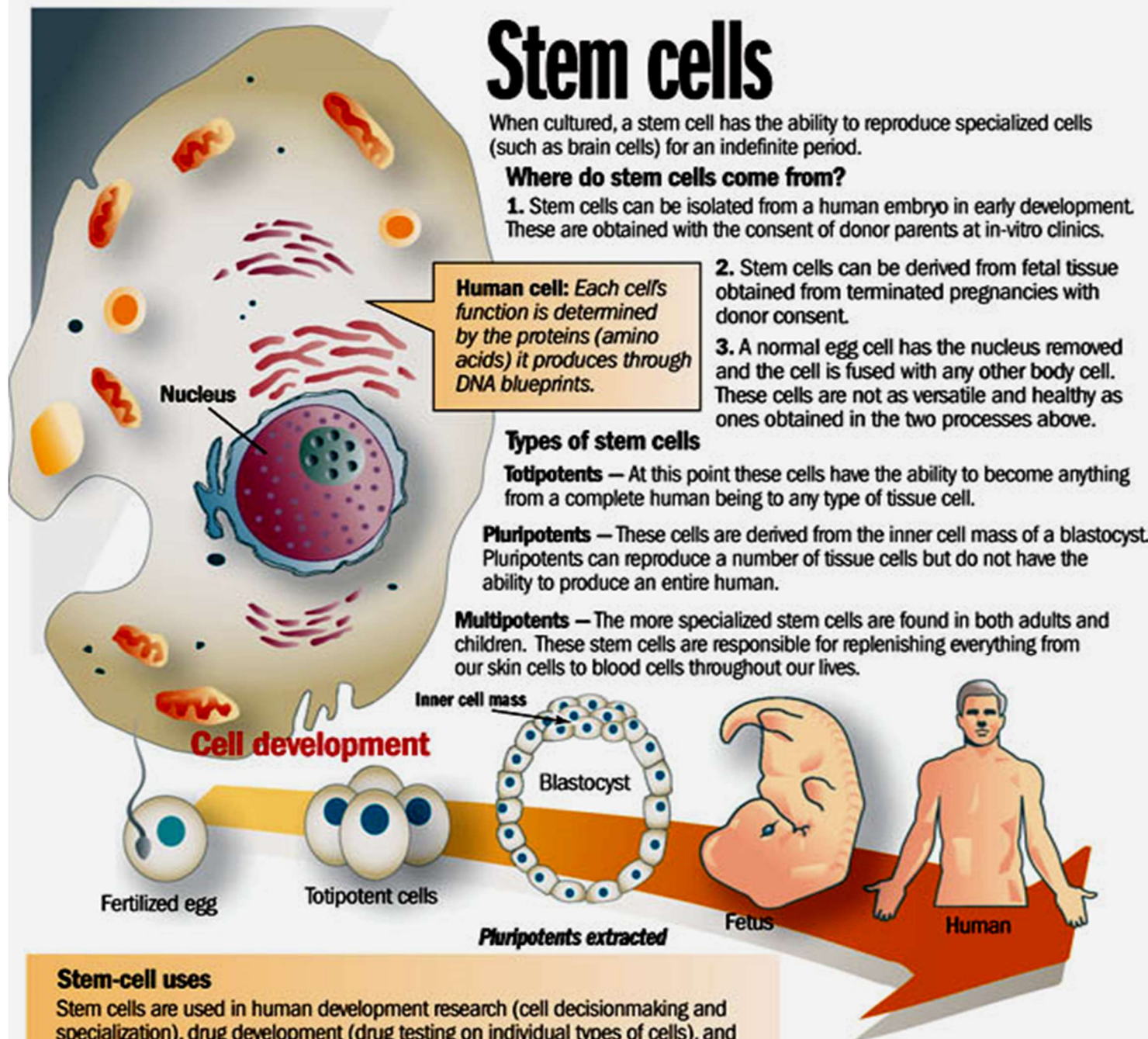
**Human cell:** Each cell's function is determined by the proteins (amino acids) it produces through DNA blueprints.

## Types of stem cells

**Totipotents** — At this point these cells have the ability to become anything from a complete human being to any type of tissue cell.

**Pluripotents** — These cells are derived from the inner cell mass of a blastocyst. Pluripotents can reproduce a number of tissue cells but do not have the ability to produce an entire human.

**Multipotents** — The more specialized stem cells are found in both adults and children. These stem cells are responsible for replenishing everything from our skin cells to blood cells throughout our lives.



## Stem-cell uses

Stem cells are used in human development research (cell decisionmaking and specialization), drug development (drug testing on individual types of cells), and cell therapy (regeneration of damaged tissue with stem cells).

SOURCE: National Institutes of Health, May 2000

# Potency of a Stem Cell

**Potency** specifies the differentiation potential (the potential to differentiate into different cell types) of the stem cell.

**Totipotent:** (omnipotent): can differentiate into embryonic and extraembryonic cell types; can construct a complete, viable, organism; are produced from the fusion of an egg and sperm cell.

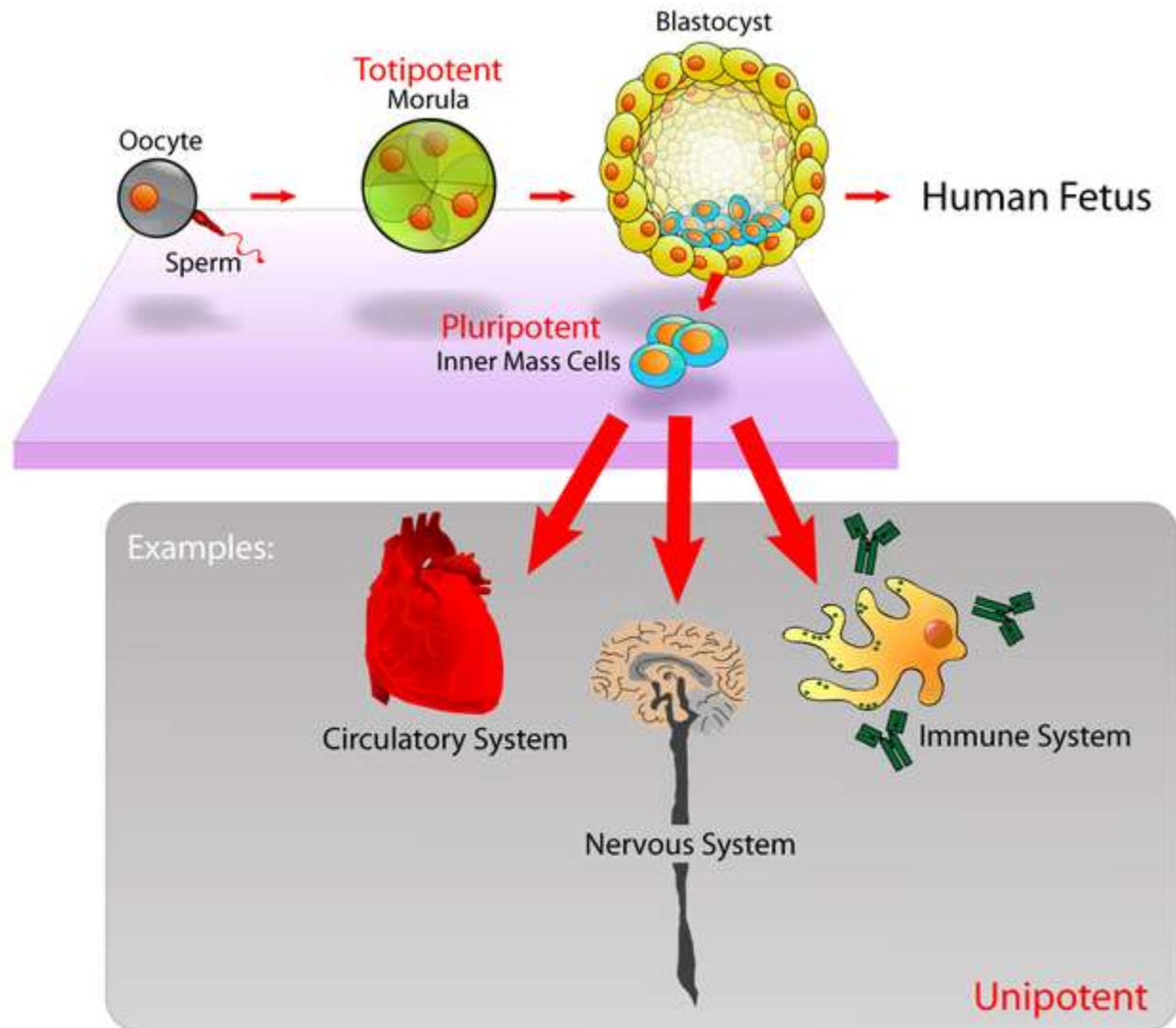
**Pluripotent:** are the descendants of totipotent cells and can differentiate into nearly all cells, i.e. cells derived from any of the three germ layers.

**Multipotent:** can differentiate into a number of cells, but only those of a closely related family of cells.

**Oligopotent:** can differentiate into only a few cells, such as lymphoid or myeloid stem cells.

**Unipotent:** can produce only one cell type, their own, but have the property of self-renewal which distinguishes them from non-stem cells (e.g. muscle stem cells).

# How are Embryonic Stem Cells produced



# Basic concept of Embryonic Stem Cells

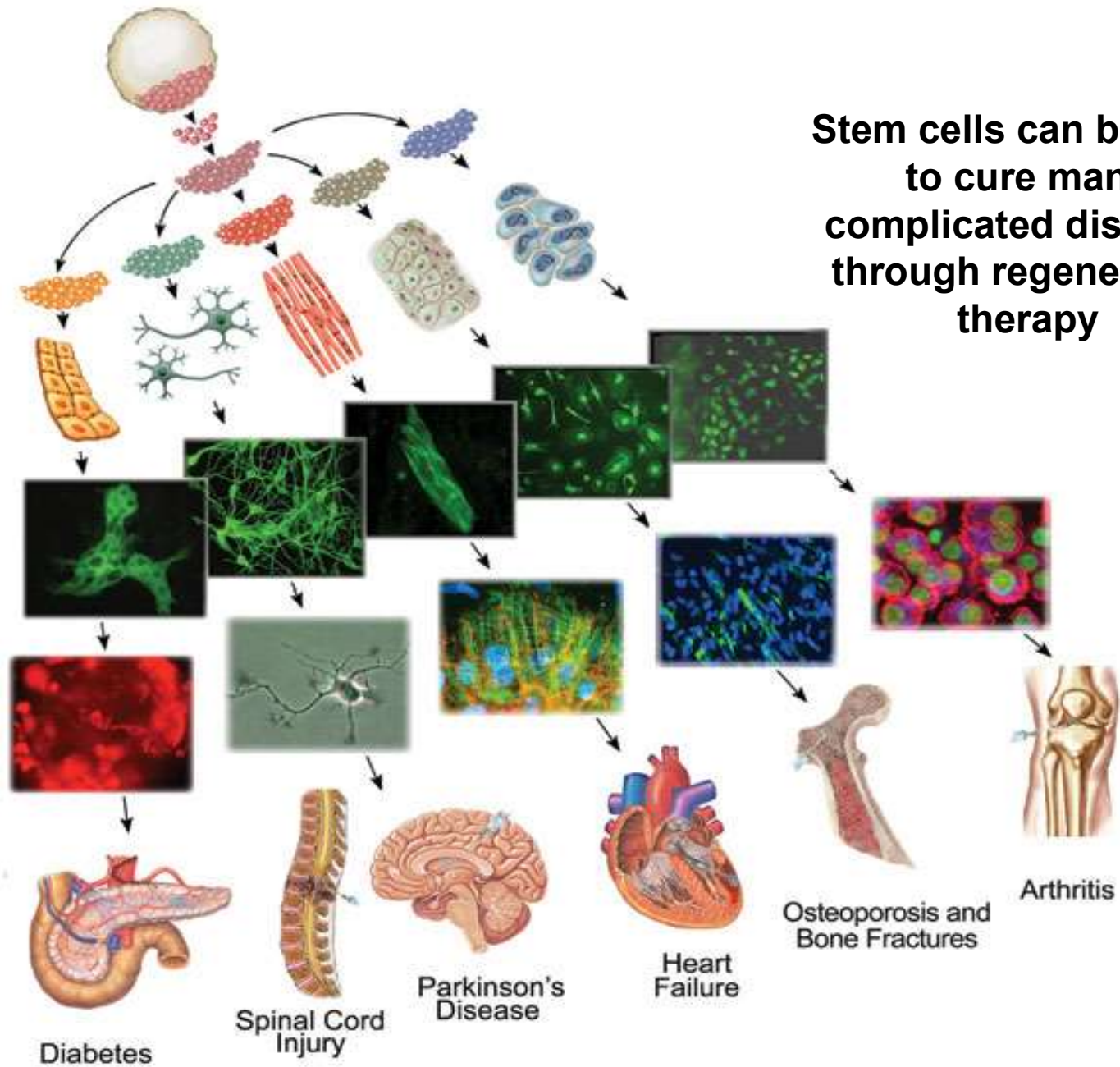
**Stem cells** are cells found in all multicellular organisms. They are characterized by the ability to renew themselves through mitotic cell division and differentiate into a diverse range of specialized cell types.

**Embryonic stem cells (ES cells)** are pluripotent stem cells derived from the inner cell mass of the blastocyst, an early-stage embryo.

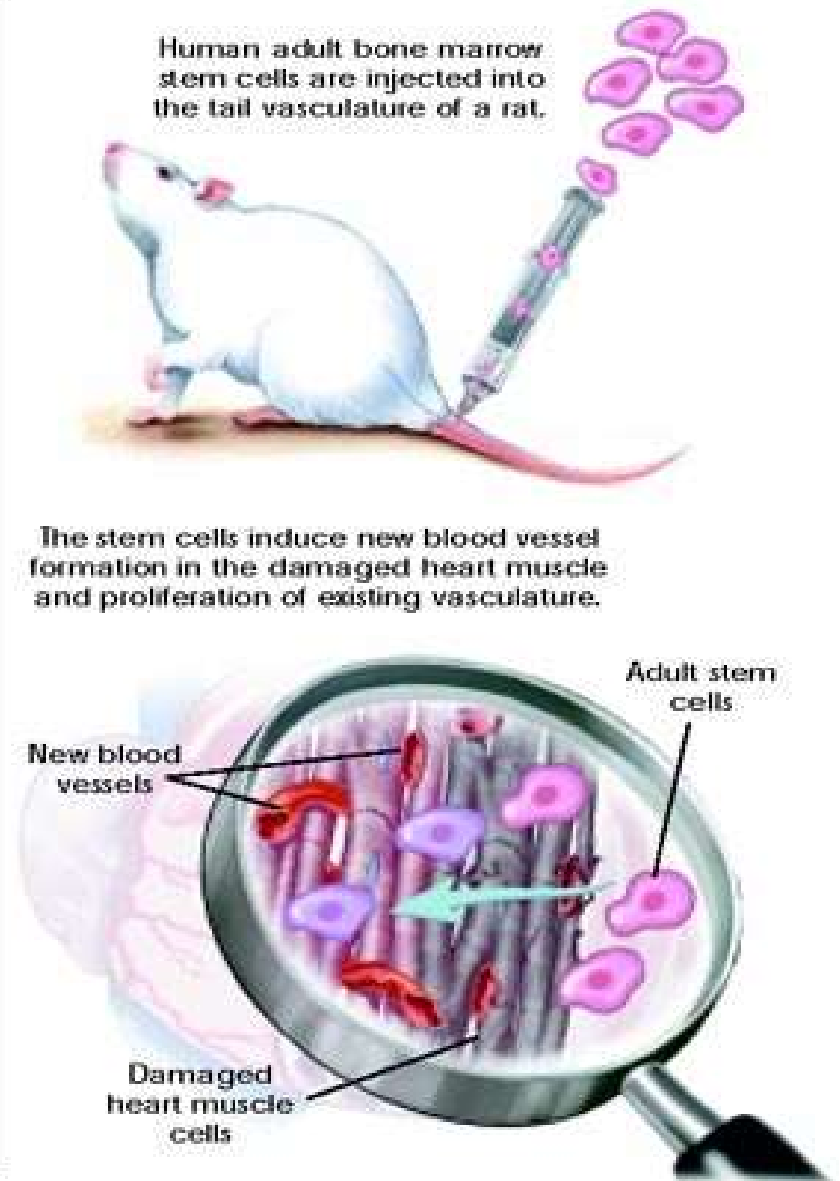
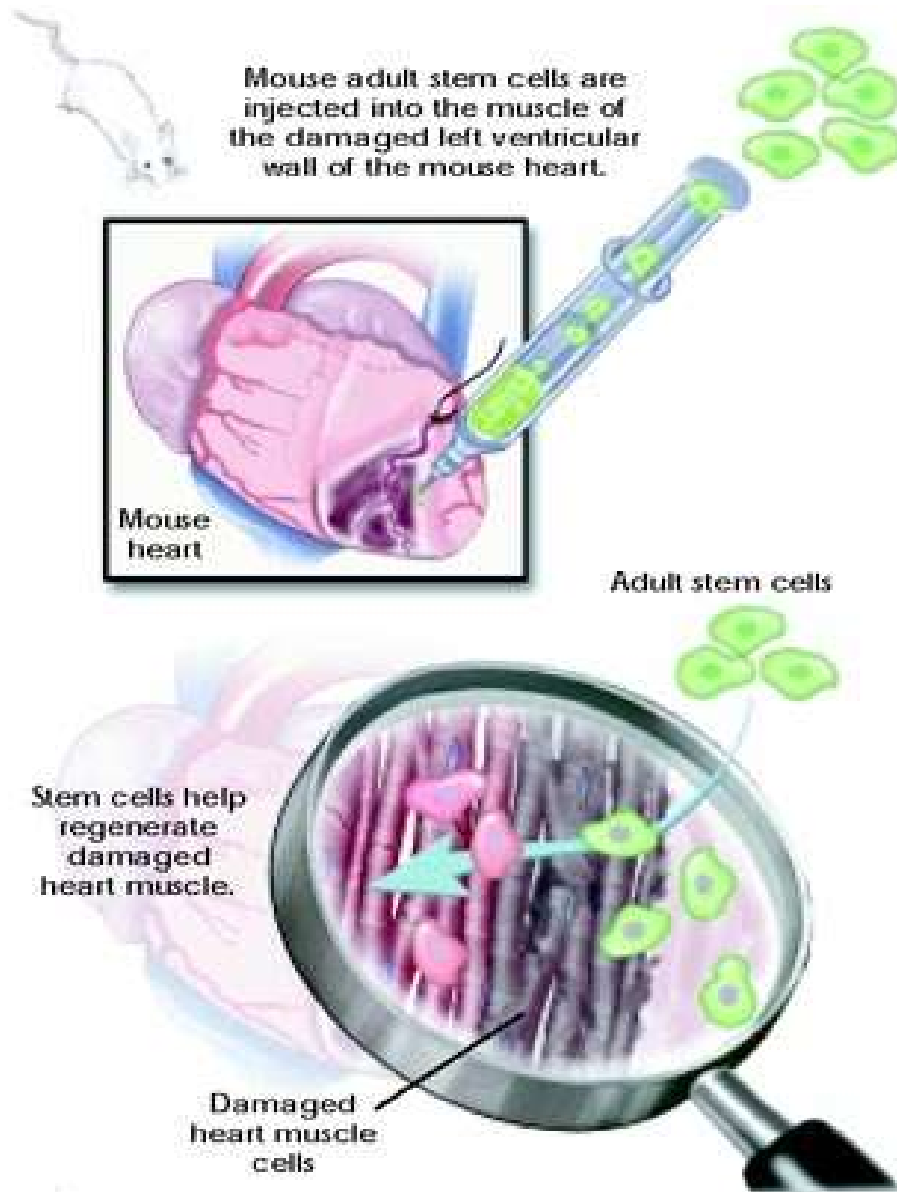
Human embryos reach the blastocyst stage 4-5 days post fertilization, at which time they consist of 50-150 cells.

Isolating the embryoblast or inner cell mass (ICM) results in destruction of the fertilized human embryo, which raises ethical issues.





# Examples of REGENERATIVE THERAPY



# THE CURE

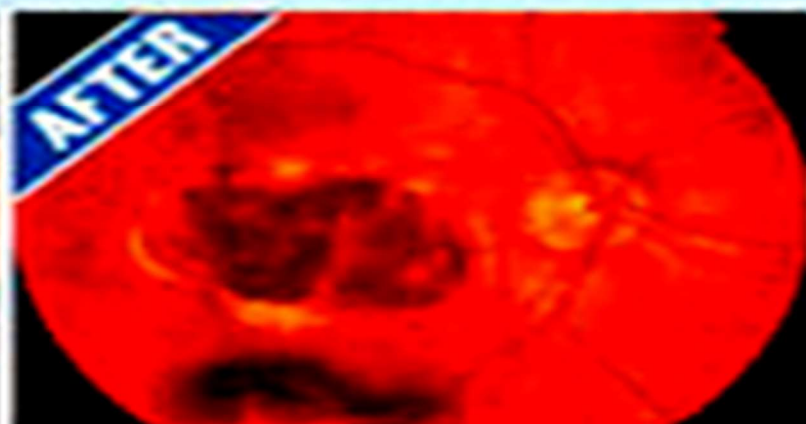
Stem cells



**1** Scientists coax stem cells into multiplying, and turn them into a 'carpet' of retinal pigment epithelial cells.

**2** Small oval patches of cells, measuring 4mm by 6mm, are placed into a syringe and injected into the retina

Damaged area



**3** After two to three weeks, the patient's sight begins to improve.

Pictures: The Macular Disease Society/TN Wire



## Many companies offer to store umbilical cord blood for future regenerative therapy of the child



### CORD BLOOD COLLECTION

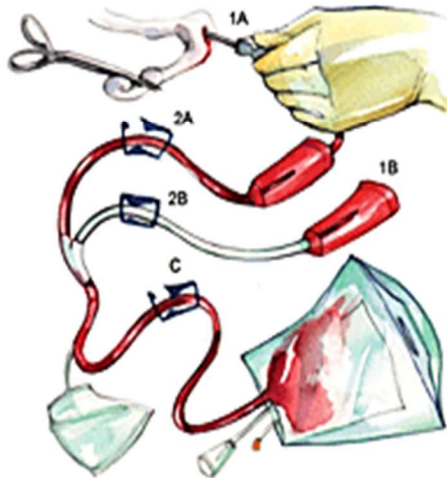
The collection of blood from the umbilical cord can be done immediately after birth without any distress or upset to the mother or the new-born child; in fact neither will even be aware it is taking place. Your gynaecologist or obstetrician will be able to collect the blood using Nanog's proprietary kit.

If for any reason they feel uncomfortable with the procedure, Nanog is able to provide a trained medical technician who will perform the simple procedure of draining a portion of the umbilical cord blood into the collection bag and sealing it.

1



2



3





The main difference between normal cells and stem cells is that the later contains many unique **TRANSCRIPTION FACTORS** that suppress certain genes and activate others resulting in differentiation during cell division

Transcription factors are a type of proteins that actively participate in Transcription and translation process