What are stem cells?

Embryonic stem cells

Stem cells are found in the embryo, day 5 after fertilisation (embryonic stem cells) these cells with the right cues can turn into any of the 200 types of cell in the body, eg skin, nerves, heart muscle or blood.

Tissue or adult stem cells

In the adult (and children) tissue-specific stem cells, sometimes called adult stem cells are found in most tissues in the body including bone marrow, fat, heart, teeth and the umbilical cord. These tissue stem cells **cannot** turn into any cell type, they are more restricted in terms of what they can turn into. Thus stem cells in heart can make new heart muscle, but not nerves or blood, while stem cells found in baby teeth can make new teeth, but not heart muscles or nerves.

- http://www.eurostemcell.org/films/a-stem-cell-story/English
- http://www.eurostemcell.org/stem-cells
- http://www.stemcellnetwork.ca/index.php?page=what-are-stem-cells&hl=eng
- http://www.umich.edu/news/stemcells/022706_Intro.html

Time line of major stem cell scientific discoveries

- http://www.stemcellnetwork.ca/index.php?page=stem-cell-timeline

Use of stem cells from bone marrow or umbilical cord for bone marrow transplants

Stem cells in the bone marrow and umbilical cord can make all the components of blood (white cells, red cells and platelets) but could not turn into nerve cells or heart muscle. Stem cells in bone marrow and umbilical cord are used to replace the bone marrow in patients with leukemia or with a genetic blood disorders, this is called a bone marrow transplant. In the past bone marrow transplants were carried out giving bone marrow stem cells from a donor to a sick patient. In recent years it has been found that stem cells from umbilical cords can be used instead of bone marrow. The major advantage of cord blood stem cells is that because they are frozen they are available for use off the shelf (just like a frozen ready meal) and as such patients that are ill can be given a transplant immediately (it can take up to 6 months to find and organise a donor for a bone marrow transplant). One limitation is that there are not enough stem cells in an umbilical cord to treat an adult, thus cord blood stem cells can only be used for treatment of children up to the age of 8 years old.

The Bone Marrow Registry and Stem cell banks

We currently have a small cord blood stem cell bank in the UK (NHS and Anthony Nolan Trust) as such the majority of bone marrow transplants rely on donors on the adult bone marrow registry. It has been found that ~200 people a year die in the UK as they cannot find a match for a bone marrow transplant. The loss disproportionately affects black and minority ethnic (BME) patients because of the particular challenges in identifying suitable donors for members of these communities. Thus while 90% of North European Caucasian patients may typically find a match, the matching rates for BME patients may be 40% or lower, especially for patients of mixed genetic heritage.

Cord blood banks

The UK strategic stem cell forum recently recommended (Dec 2010) that-

The UK should increase its inventory of banked cord blood units to 50,000 over the next 10 years, with 30-50% of donations from BME women. This would satisfy 85% of current unmet Caucasian need (~150 patients per year) and ~50% of unmet BME need (~50 patients per year).

This would cost ~£50 million.

Cord blood donations are at a significantly lower cost per unit (£16,000) than the current cost of an adult donation (£36,000) or imported cord blood donation (£25,000).

Read the full report
http://www.nhsbt.nhs.uk/current_issues/uk_stem_cell_strategic_forum.html

Find out how you could donate your umbilical cord blood in the UK

http://www.anthonynolan.org/What-you-can-do/Donate-your-umbilical-cord.aspx

Why have a National cord blood stem cell bank?

To increase the chance of children in the UK getting a match for a bone marrow transplant.

To reduce the time it takes to get a transplant, because stem cells would be frozen and therefore could be used immediately off the shelf.

Only ~ half of all umbilical cords contain enough stem cells to be clinically useful. Thus on average of 2 cord bloods collected only one will contain enough stem cells to be frozen and banked for future use.

It is envisaged that if National cord blood bank is established then cord blood units that do not contain enough stem cells to treat patients could be used for medical research.

It is anticipated that the success rate of a bone marrow transplants using cord blood stem cells will be improved due to

- The reduced time to transplant

- Increased quality of stem cells (because there will be more time for quality control)
- Increased numbers of stem cells transplanted (because only cords with high numbers of stem cells will be selected for banking)

Thinking about having Stem cell therapy? – Get the facts direct from the International Society for Stem Cell Research

http://www.closerlookatstemcells.org//AM/Template.cfm?Section=Home1

The Ethics of Stem Cell Research and Therapies

- http://www.bbsrc.ac.uk/stemcellsresource/
- http://www.eurostemcell.org/films/conversations/ESC_conversations_

Stem Cell Scientists – hear about some of the current research

- http://www.stemcellfoundation.ca/