There are two types of stem cells that can be retrieved from the Umbilical Cord Blood and Cord Tissue at birth. They are:

**Haematopoietic Stem Cells** - Contained in the umbilical cord blood.

**Mesenchymal Stem Cells** - Contained in the umbilical cord tissue.

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**HAEMATOPOIETIC STEM CELLS**

- **Umbilical cord blood** is rich in haematopoietic stem cells. “Haematopoietic” means “blood forming” and these stem cells are destined (“programmed”) to differentiate into the 3 types of blood cells: red blood cells, white blood cells, and platelets. In our bodies, bone marrow is the source of all blood cells. Haematopoietic stem cells are contained in the bone marrow and they continuously make new blood cells to replace old ones. If bone marrow is damaged by disease or drugs, it cannot make these essential blood cells, leading to fatal consequences. Therefore, haematopoietic stem cells must be replaced as part of the treatment. This is done via whole bone marrow transplant or stem cell transplant:

  The below lists diseases for which haematopoietic stem cells are a standard treatment. For some diseases they are the only therapy and for others, they are employed when front-line therapies have failed or the disease is very aggressive:

- **Leukemia** – Acute and Chronic (Leukemia is a cancer of the blood immune system, whose cells are called leukocytes or white blood cells)

- **Myelodysplastic Syndromes** [Myelodysplasia is sometimes called pre-leukemia]

- **Lymphomas** [Lymphoma is a cancer of the white blood cells that circulate in the blood and lymph vessels]

- **Anaemia** [Anaemia’s are deficiencies or malformations of red blood cells that are inherited or acquired diseases]
  - Severe Aplastic Anemia
  - Sickle cell anemia
  - Thalassemia
  - Fanconi’s Anemia [Note: the first cord blood transplant in 1988 was for this disease]
  - Paroxysmal Nocturnal Hemoglobinuria (PNH)
  - Pancytopenia

- **Inherited Platelet Abnormalities** [Platelets are small blood cells needed for clotting]
  - Amegakaryocytosis / Congenital Thrombocytopenia

- **Myeloproliferative Disorders**
  - Acute Myelofibrosis
  - Polycythemia Vera
  - Essential Thrombocythemia

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**Inherited Immune System Disorders**

- Severe Combined Immunodeficiency (SCID)

**Metabolic Disorders**

- Adrenoleukodystrophy
- Gaucher’s disease
- Krabbe disease [globoid cell leukodystrophy]
- Gunther disease
- Hurler syndrome
- Hunter syndrome
- Neiman-Pick Syndrome
- Tay-Sachs disease

**Cancers in the bone marrow** (Plasma Cell disorders)

- Multiple Myeloma
- Waldenstrom’s Macroglobulinemia

**Other cancers** [Not originating in the bone marrow or blood system]

- Neuroblastoma
- Retinoblastoma
- Nephroblastoma
Mesenchymal stem cells are found in abundance in umbilical cord tissue, although a small amount is found in the cord blood as well. These cells form the various connective tissues of the body: bone, cartilage, tendons, muscle and nerves. They are found in nearly all the organs of the body but are difficult to harvest from most sites. Apart from the umbilical cord tissue, mesenchymal stem cells can be harvested from the bone marrow and adult adipose (fat tissue). These cells can be easily multiplied and stored for future use. Their applications are far reaching and are currently being researched, tested and used in experimental clinical applications for:

- Wound healing
- Skin regeneration
- Cartilage and bone repair
- Heart muscle repair
- Nerve repair

Allogeneic transplantation
This type of transplant is a transplant between two genetically non-identical individuals. These individuals may be related family members or completely unrelated. Allogeneic transplants (allograft) may be used in the treatment of inherited and non-inherited disorders. Before doing an allograft, the recipient needs to find a matching donor.

HLA matching necessary for transplants
Prior to allogeneic stem cell transplantation, HLA – type matching needs to take place. Human leukocyte antigens (HLA) are proteins on the surface of cells that determines the tissue type of a person. The immune system uses the HLA’s to differentiate its own cells from that of other (non-self) cells. To successfully receive tissue from another person, the tissue type has to be the same otherwise the recipients system will see it as foreign and it will reject the donated tissue. A major advantage of cord blood and cord tissue is that it does not have to be a 100% match for transplant, opening the door to many more useable donors.

HLA typing is done by analysing a sample of blood from the donor and one from the recipient.

STORAGE OF STEM CELLS

If you can get Haematopoietic stem cells and Mesenchymal stem cells from adults, why store at birth?

The stem cells that are collected from a new born baby are at the beginning stages of their life span. Stem cells start showing age related changes as they get older: they start to divide slower and their reparative function starts to decrease. These changes are precipitated by the shortening of the telomeres (strands) of the chromosomes with each division of the cells. Therefore, umbilical cord stem cells have a “youthful” phenotype that is able to be expanded easily and retain the properties of stem cells. It is postulated that better treatment results are achieved with stem cells collected at birth. Additionally, stem cells are much easier to collect at birth (painless and more cost effective).

Why should you store both Cord Blood and Cord Tissue Stem Cells?

- Cord blood and cord tissue are used for different things and they are not interchangeable.
- Cord blood is needed for bone marrow transplants.
- Cord tissue regenerates connective tissue. Although there are no standard clinical applications at the moment, they have the potential to be extremely useful.