

# What Are Stem Cells?

*Scott R. Moyer "Selected Essays" 2010*

Stem cells are biological cells with unique regenerative abilities. Stem cells serve as an internal repair system to replace worn out or damaged tissues. When a stem cell divides, each new cell has the potential either to remain a stem cell or become another type of cell with a more specialized function, such as a heart cell, a blood cell, or a skin cell.

In 2005, it was discovered that 4 types of pluripotent stem cells originate in the placental and umbilical cord tissue of mammals: Amniotic Epithelial Stem Cells (AESC), Mesenchymal Stem Cells (MSCs), Umbilical Vein Endothelial Cells (UVECs), and Umbilical Cord Matrix Cells (UCMCs).

## Stem Cells: Amniotic vs. Embryonic

While placental and umbilical tissue derived stem cells share many similarities with embryonic stem cells, there are important differences to note:

- Like embryonic stem cells, placental and umbilical cord tissue cells express many of the same surface markers and transcription factors normally present on embryonic stem and germ cells, which identifies them as true stem cells.
- Like embryonic stem cells, placental and umbilical cord tissue cells are also pluripotent, which means they can differentiate into any type of cell in the body. This means there are no cells in the body they cannot repair or replace.
- Unlike embryonic stem cells, placental and umbilical cord tissue cells are harvested ethically. There is no controversy regarding their use, because they are derived from the post-birth, delivered placenta of healthy sheep raised at medicinal farms.
- Unlike embryonic cells, placental and umbilical cord tissue stem cells are NOT associated with teratomas and other types of neoplasms. Placental and umbilical cord tissue derived cells are considered to be nonallergenic and safe.

In addition, placental and umbilical cord tissue stem cells express the stem cell specific transcription factors octamer-binding protein 4 (Oct-4), and the "immortality" gene Nanog. The gene Nanog, found in stem cells, appears to be the "master gene", coordinating other genes to allow stem cells to multiply limitlessly, while still retaining their ability to differentiate. (It was christened Nanog after the land in Celtic myth called Tir nan Og, whose inhabitants remained forever young.)

## Lyophilization Preserves Stem Cells

Around the time placental and umbilical cord tissue stem cells were discovered (2005), lyophilization technology made a giant leap forward. Lyophilization, or freeze drying, is the preeminent process for preserving sensitive biological substances. Given that stem cells are smaller in size and structure than regular mammalian cells, they easily survive this process. Lyophilization provides the greatest possible preservation of the stem cells' vitality.