

## Stem Cells 101

### What Are Stem Cells?

Stem cells are essentially the parent cells for all tissues and organs of the body. They exist mainly to maintain and repair cells in the areas of the body where they are found – such as in the blood, bone marrow, skin, muscle, and organs like the brain and liver. Scientists at Cincinnati Children's work with different kinds of stem cells: animal and human, embryonic stem cells, adult stem cells, and induced pluripotent stem cells.

### Embryonic Stem Cells

Embryonic stem cells come from an egg that is fertilized in a Petri dish. After the fertilized egg divides about six times, this microscopic ball of cells can be coaxed into becoming an embryonic stem cell line that grows indefinitely in a Petri dish. The biological equivalent of a blank sheet of paper, they can form cells and tissues from any part of the human body, including brain and spinal cord neurons, cells for blood, bone skin, heart, and so on. They are more versatile than adult stem cells. For research purposes, eggs must be donated by fully informed donors who no longer desire additional children. If not used for research, the eggs would be destroyed and discarded. For research, the eggs are fertilized in a laboratory setting, not in a woman's body.

### Umbilical Cord Blood and Placental Stem Cells

These blood-forming stem cells are present in umbilical cord blood and the placenta. At birth, these cells can be extracted from the discarded tissue and preserved for the benefit of children and adults who suffer from bone marrow and blood diseases and some genetic conditions. There is no harm to the mother or child.

### Adult Stem Cells

Researchers receive adult stem cells from people who donate bone marrow, cord blood, or tissue biopsies for research. A disadvantage of most adult stem cells is that they have already started to specialize into the type of cell they will eventually become – blood stem cells make only blood, muscle stem cells make only muscle, and so on.

### Induced Pluripotent Stem Cells

This relatively new technology allows research to genetically reprogram ordinary skin cells to create induced pluripotent stem cells (iPSCs), which can form cells of most kinds of tissue. An important potential advantage of using iPSCs to treat disease is that it may be possible to use patient's own cells for treatment. Risks would be reduced because patients' bodies do not reject their own cells.

### Stem Cell Treatments

Some stem cell therapies already exist, mostly those involving bone marrow or cord blood transplantation for treatment of some cancers. Doctors hope to one day use stem cells to treat people suffering from a wide range of genetic diseases, tissue injuries, and degenerative diseases, including spinal cord injury, Parkinson's disease, stroke, heart disease, muscular dystrophy and many others.