Cellular Differentiation

You started as a fertilized egg and now you are huge.

Your cells divided

- You started as a zygote and that cell divided into two. Those two cells then divided into four and then those four divided and so on…
- After about 4 days since conception, you started to form embryonic stem cells
  - Embryonic stem cells are called pluripotent stem cells
  - Pluripotent Stem Cells can turn into ANY cell in your body
  - When a stem cell divides, one of the two daughter cells will become Specialized (This is called differentiation)
  - Notice the stem cell will also create another stem cell
  - A differentiated cell usually performs one specialized function
    - Ex. Cardiac cells → heart; Nerve cells → brain
- Adult Stem Cells
  - Right now your body still has stem cells, just not pluripotent stem cells
  - Your adult stem cells are usually multipotent = they can create many different types of cells (but not all types)
    - Ex. Hematopoeitic (Blood) Stem Cells can give rise to all the different kinds of blood cells
- Stem cells and their intermediate cells are usually the only cells in the body that divide (can do mitosis)
- Specialized cells are stuck in G_0 phase because they can't pass the (G1) restriction checkpoint

Stem Cell Therapy

- Can be used for:
  - Therapeutic Cloning = using stem cells to create specialized cells of choice and insert into an organism to treat a disorder
    - May be used for treating diabetes, spinal cord injuries, etc.
  - Reproductive (Fertility) Cloning = create babies for *in vitro* fertilization

- Used to have to rely on Embryonic Stem Cells (ES) = cells from fertilized embryos
  - obviously there were ethical concerns
- Now use Induced Pluripotent Stem Cells (iPS) = skin or other body cells that are genetically treated to induce the cells back into their pluripotent state
  - Treating patients with their own stem cells eliminates the chances of rejection of tissues by the immune system