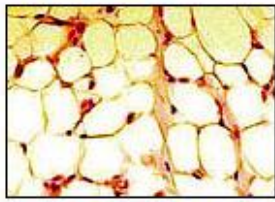
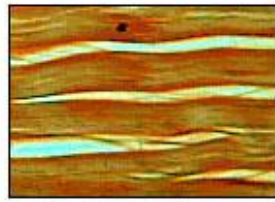


Areolar connective tissue



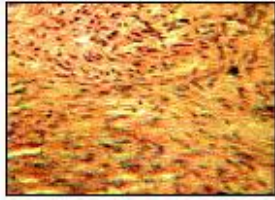
Adipose tissue



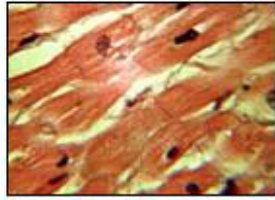
Fibrous connective tissue



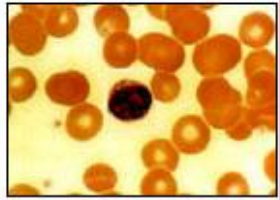
Skeletal muscle



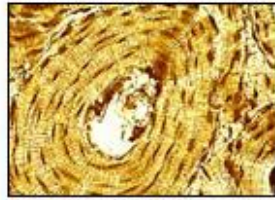
Smooth muscle



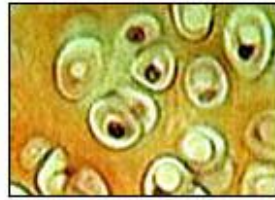
Cardiac muscle



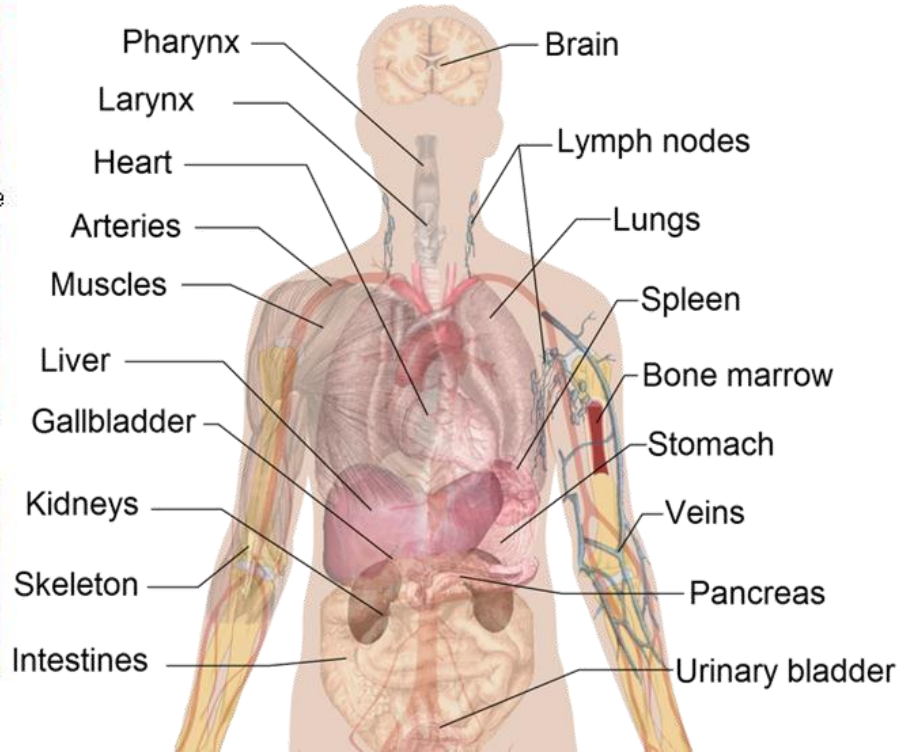
Blood



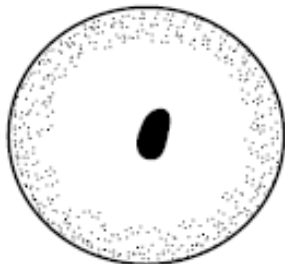
Osseous tissue



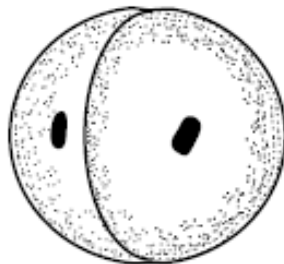
Hyaline cartilage



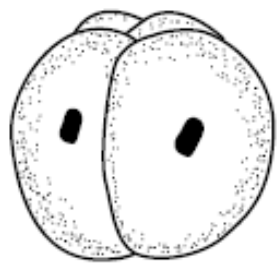
# Cellular Differentiation



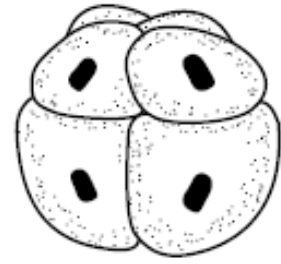
Fertilized egg  
(zygote)



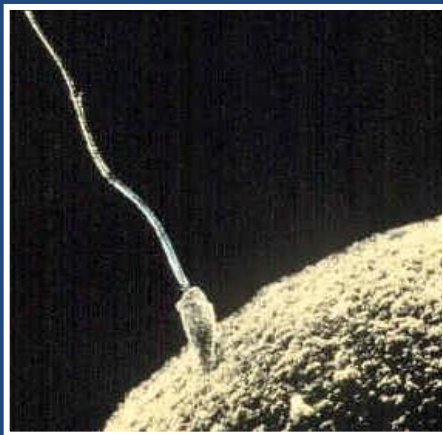
First cleavage  
(2 cells)



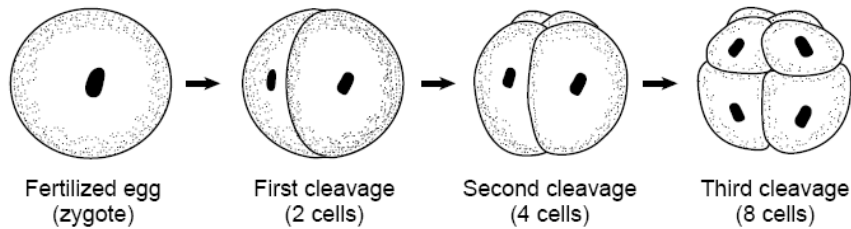
Second cleavage  
(4 cells)



Third cleavage  
(8 cells)

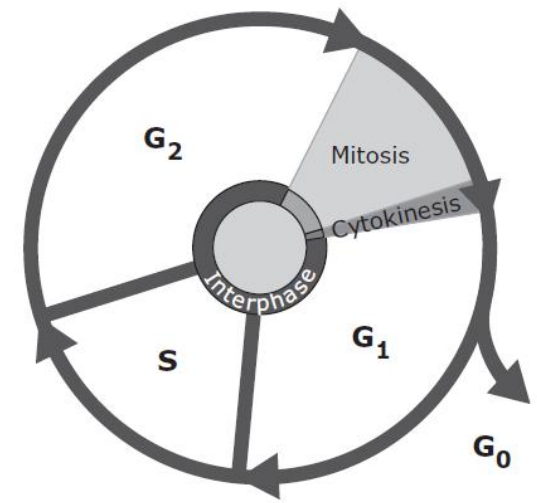
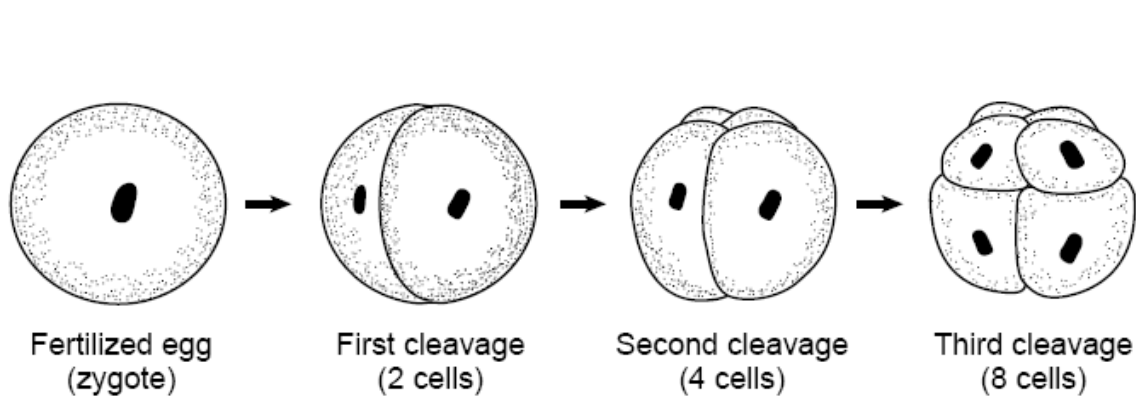


Humans begin as a single fertilized cell called a zygote.



*We GROW as our cells divide through the process of mitosis.*

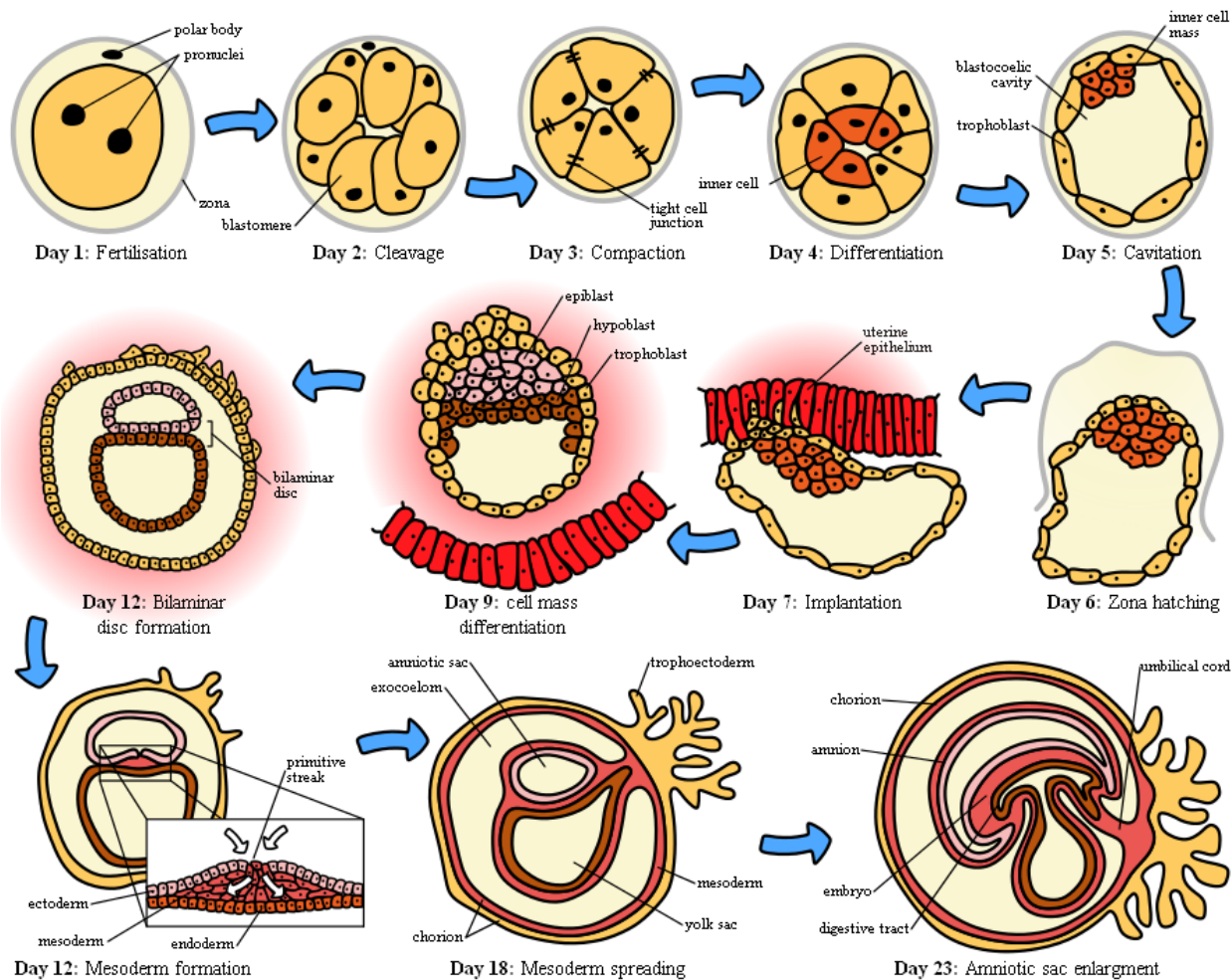
**Mitosis** is very important because it makes every cell in an organism genetically identical.

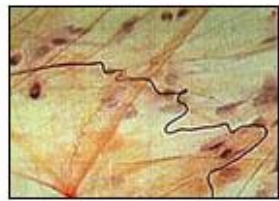


This means that every cell in your body contains the EXACT SAME DNA!

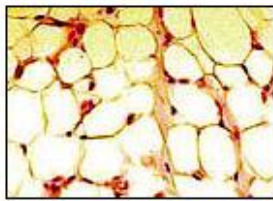
# In the beginning, cells are not specialized.

Unspecialized cells are known as **stem cells**.

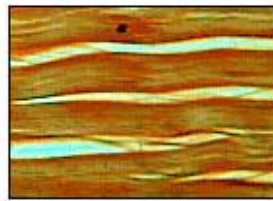




Areolar connective tissue



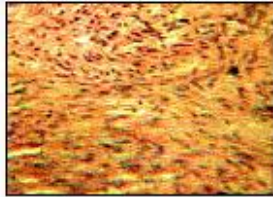
Adipose tissue



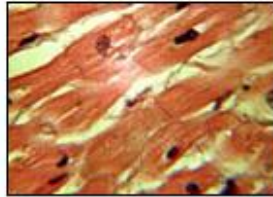
Fibrous connective tissue



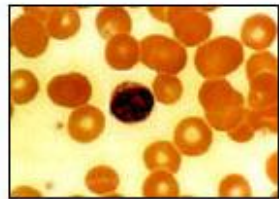
Skeletal muscle



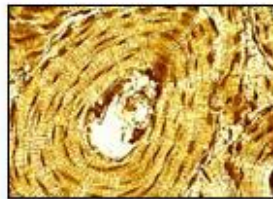
Smooth muscle



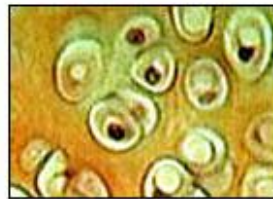
Cardiac muscle



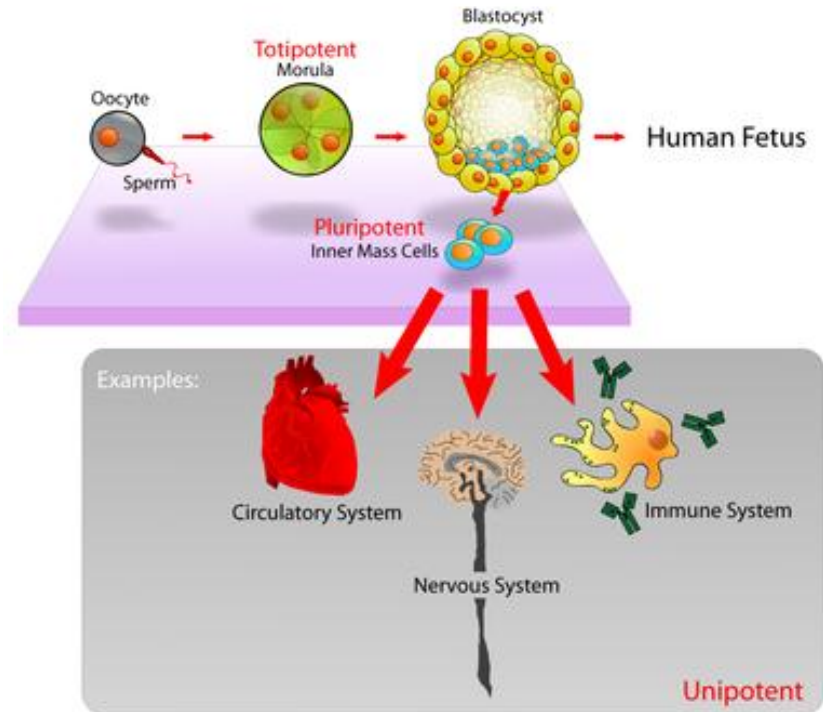
Blood



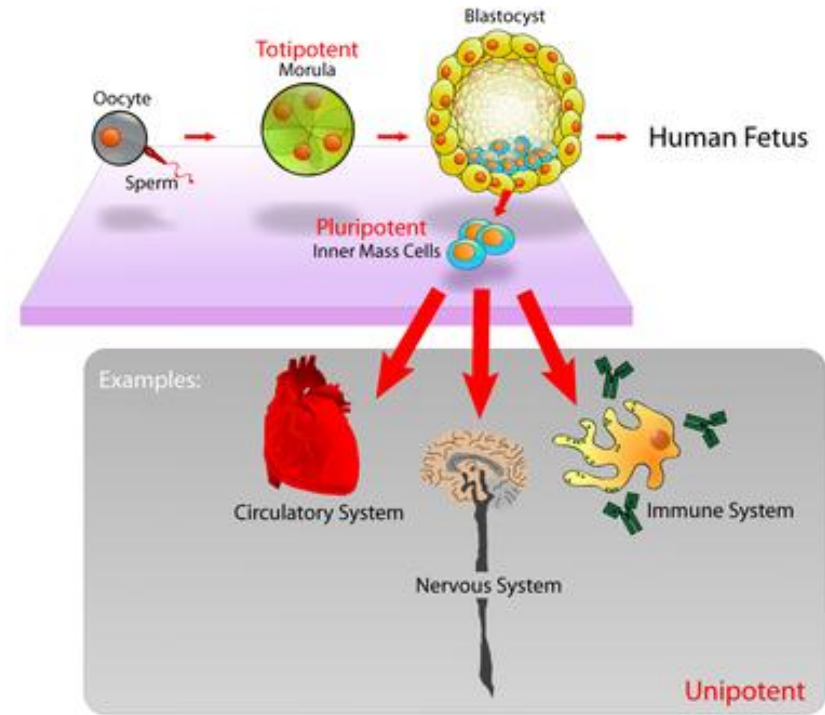
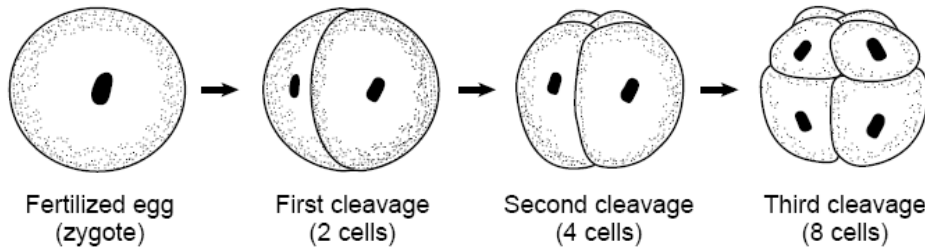
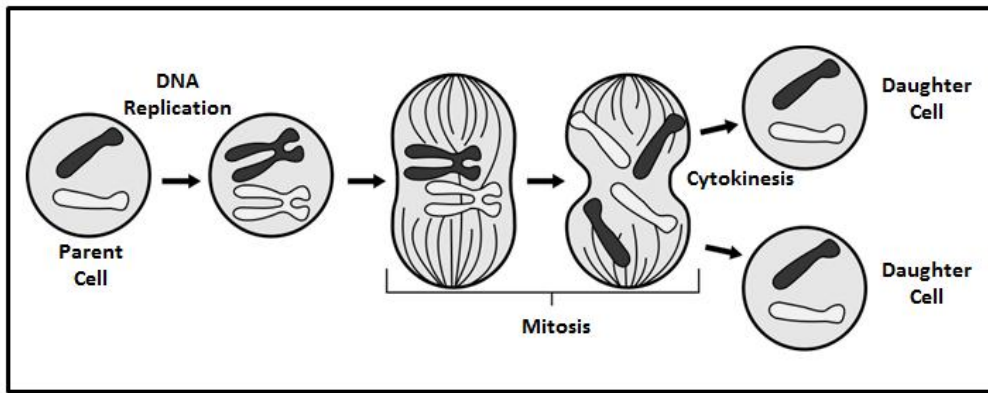
Osseous tissue



Hyaline cartilage



But as the embryo grows, cells begin to **specialize** so that they can perform different functions. The process of stem cells becoming different types of cells is called **cell differentiation**.

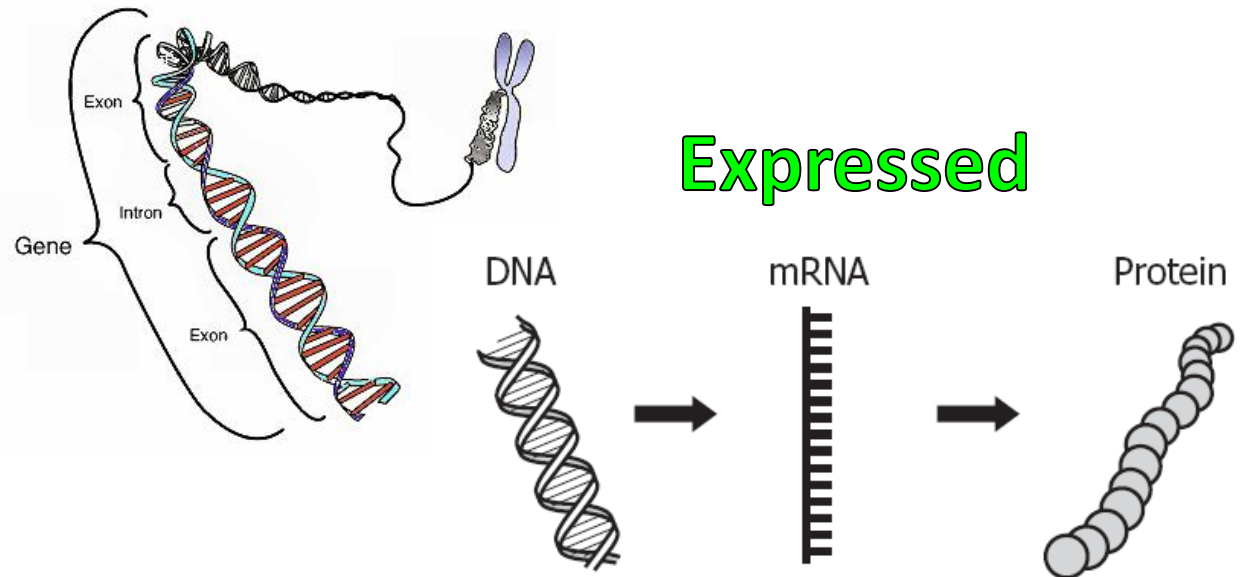


If every cell in an organism has the same DNA, how can they act so differently?

All of the cells have the same DNA, but they are not *expressing* the same genes.

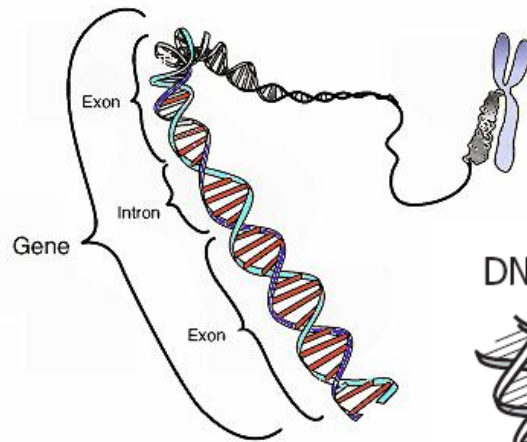
# Gene Expression

Remember that cells can turn genes **ON** and **OFF** so that only certain genes in the cell are *expressed, or made into a protein*. Even though every gene is present, *only certain genes are turned ON*.



# Gene Expression

Remember that cells can turn genes **ON** and **OFF** so that only certain genes in the cell are *expressed*. Even though every gene is present, *only certain genes are turned ON*.



DNA



**Unexpressed**

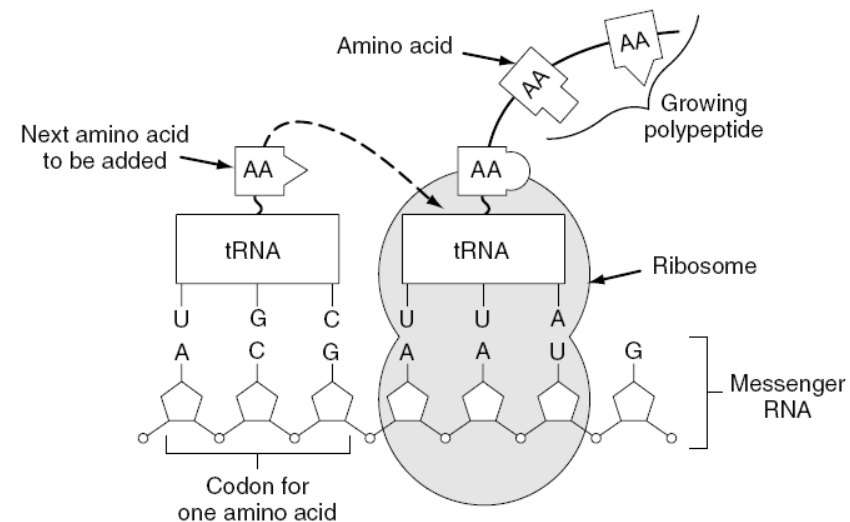
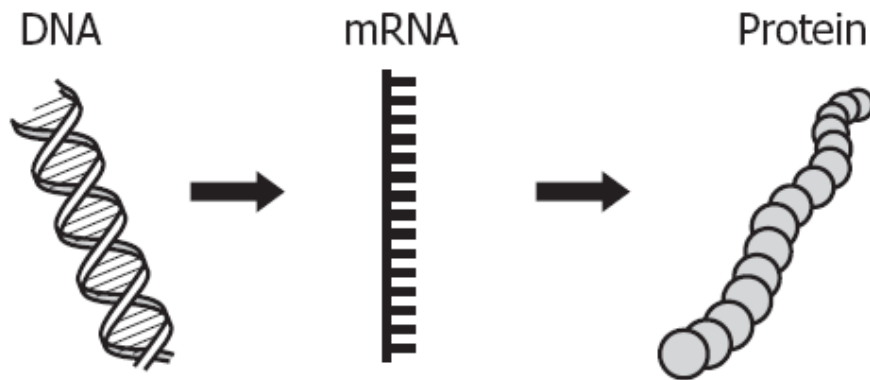


**No Proteins**  
**Made!**



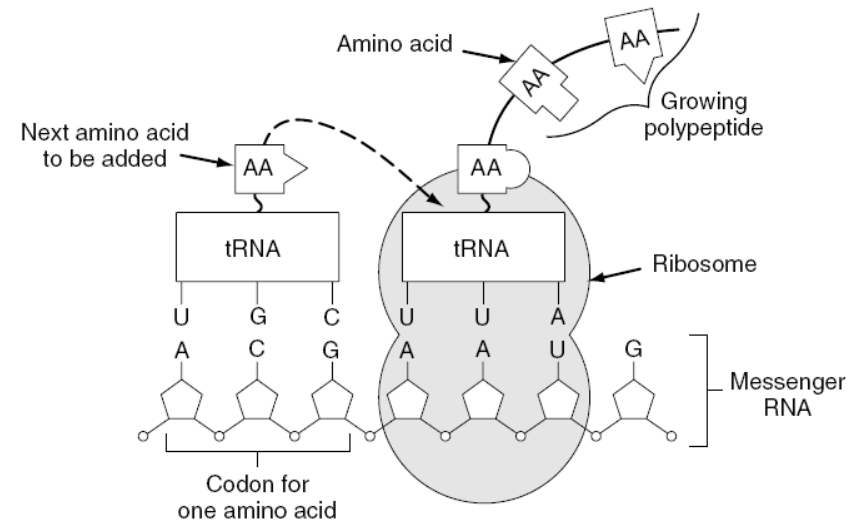
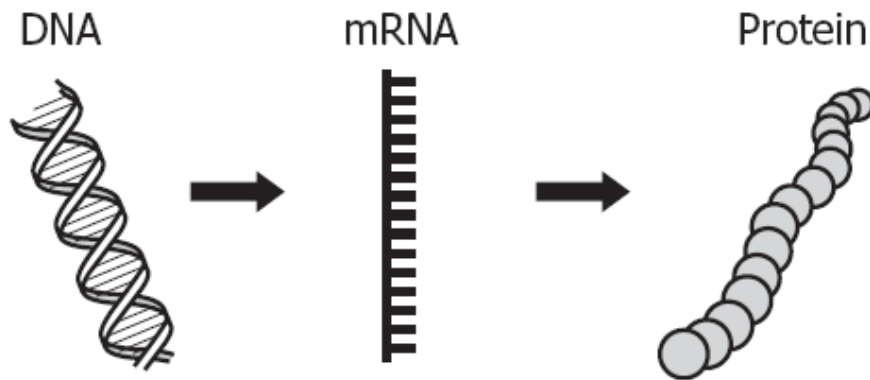
# Gene Expression

While every cell in a multicellular organism will have the same set of DNA, they will **NOT** all have the same set of mRNA molecules. As different genes are expressed, different mRNA molecules will be produced.



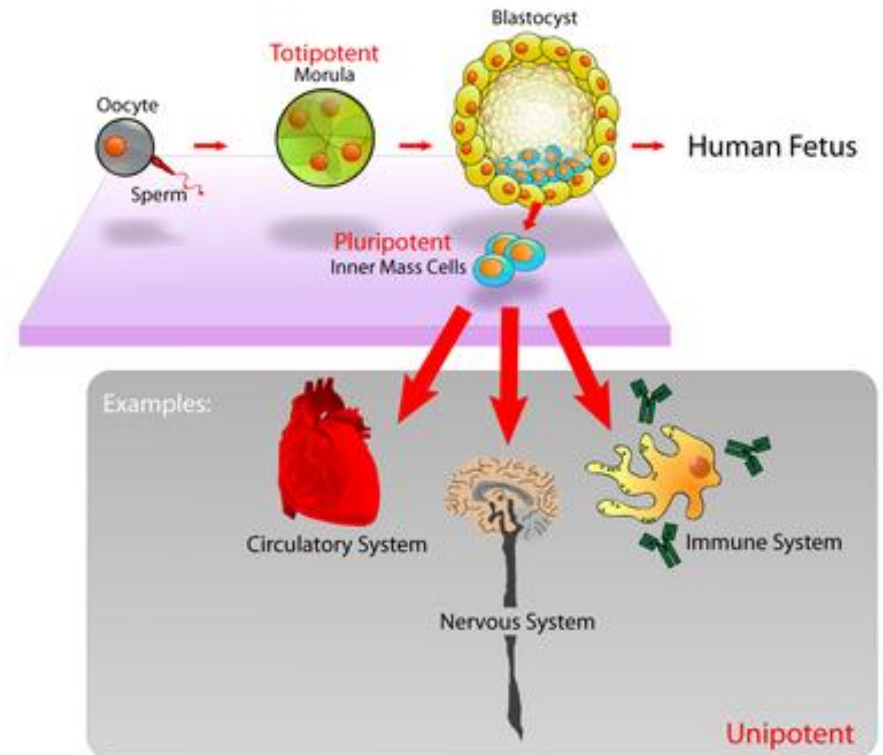
# Gene Expression

Having a different set of mRNA molecules will cause the cell to make **different proteins**. These proteins will cause the cell to have the specific structure and function it needs.

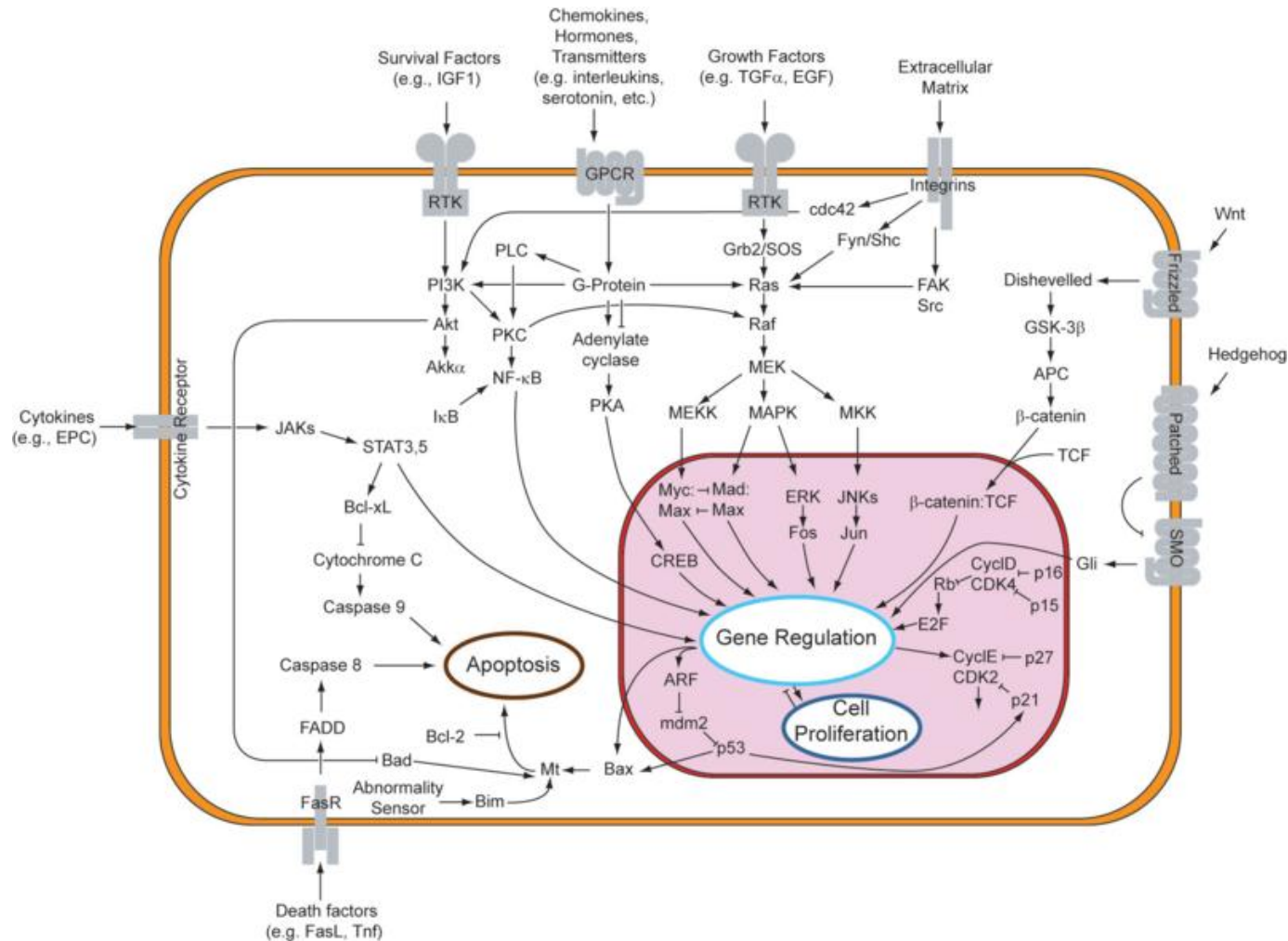


# Cell Differentiation

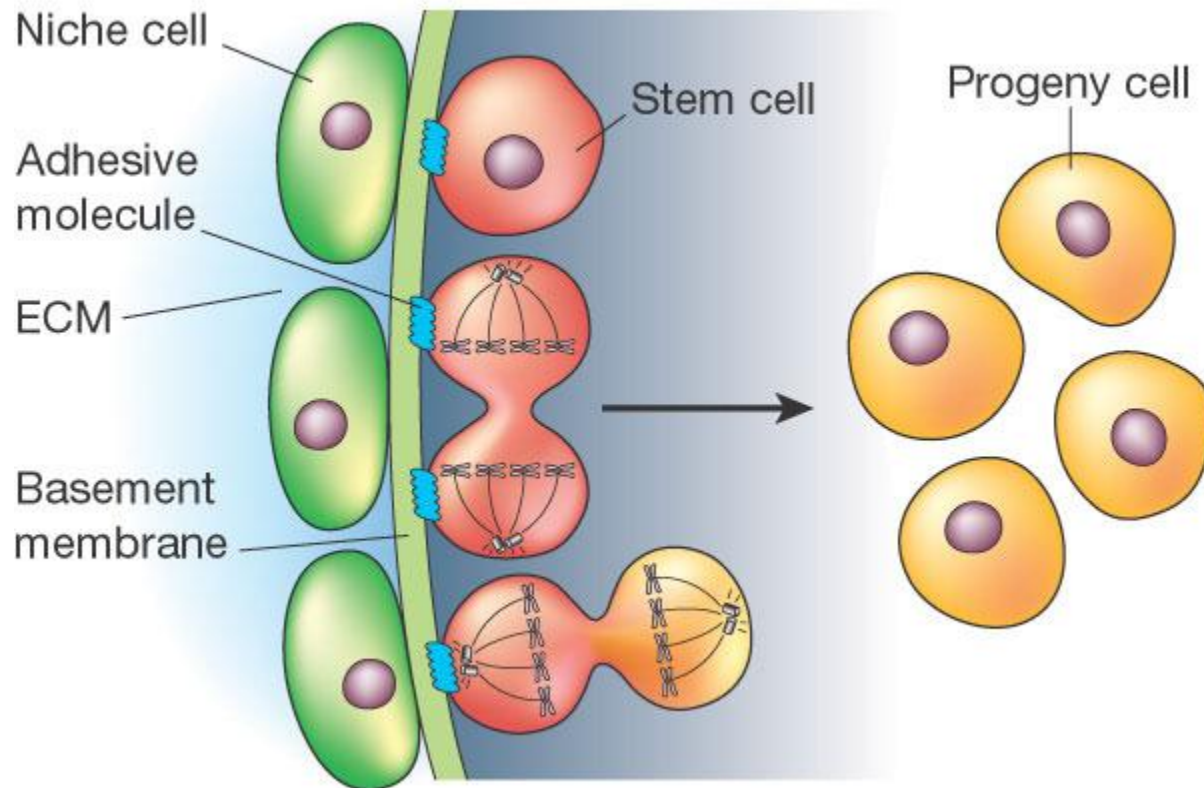
By controlling **gene expression**, cells with the *same set of DNA* can become a wide variety of different cells with **unique structures and functions.**



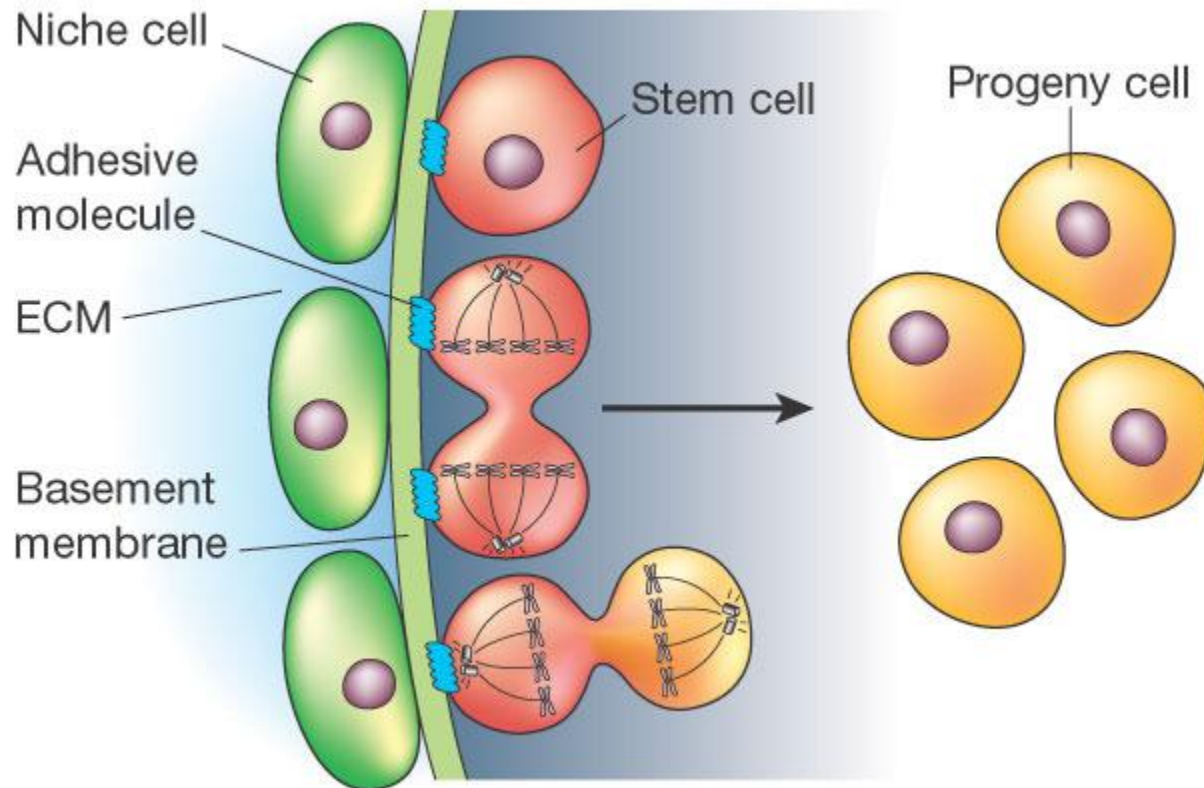
# Signals from the environment that stem cells receive affect how they divide and differentiate.

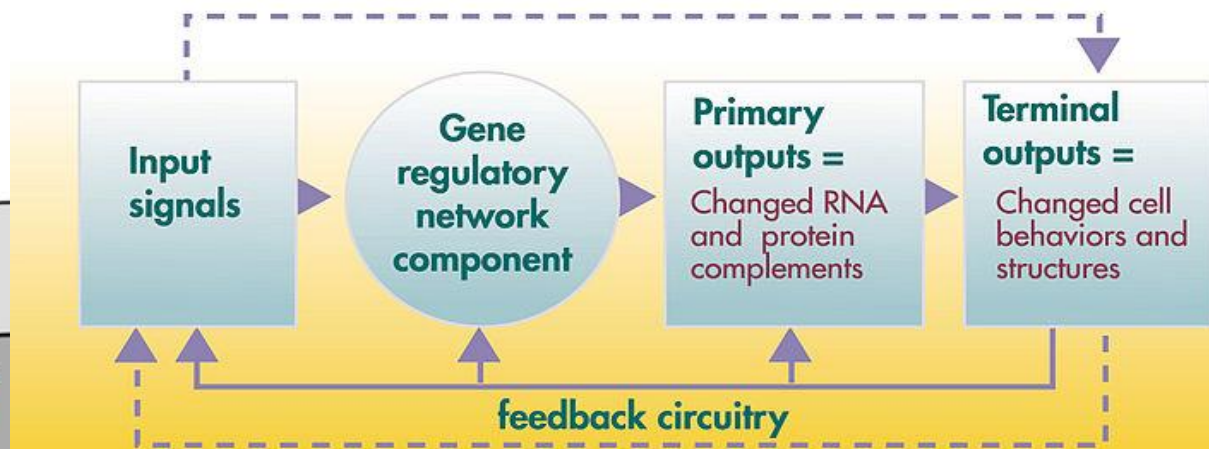
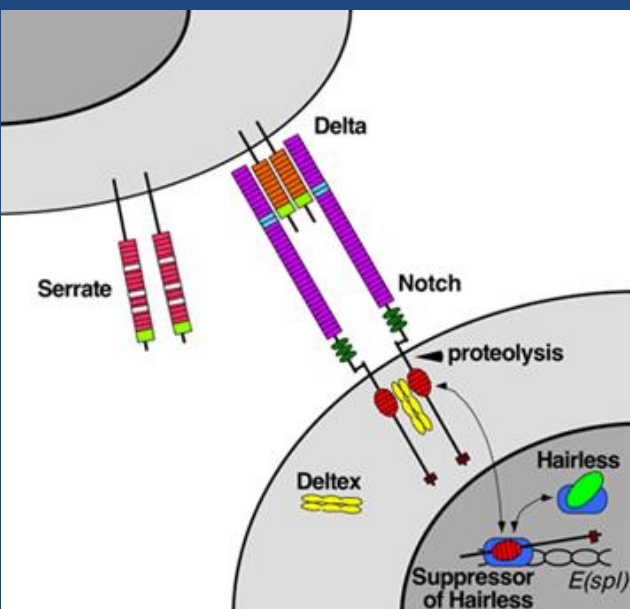


In the body, stem cells are kept inside microenvironments called stem cell niches. These cellular structures send signals to the stem cells to keep the stem cells from dividing or differentiating until they are needed.

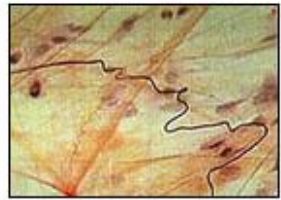


When new cells are needed to replenish or repair tissue, the niche cells help regulate the division of stem cells so that new cells can be created while stem cells are still kept inside the niche for later use.

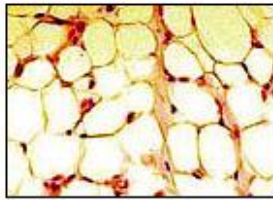




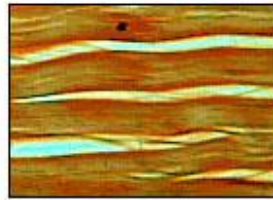
Undifferentiated cells communicate with each other through receptor proteins in their cell membranes. This allows cells to interact with each other and directs stem cells to become the type of specialized cell needed in the surrounding tissue.



Areolar connective tissue



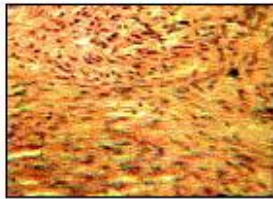
Adipose tissue



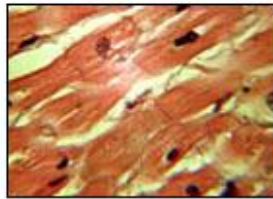
Fibrous connective tissue



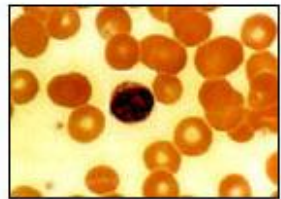
Skeletal muscle



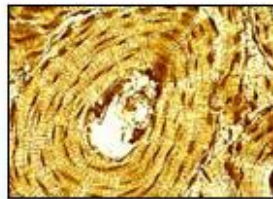
Smooth muscle



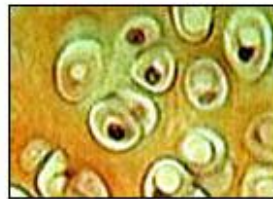
Cardiac muscle



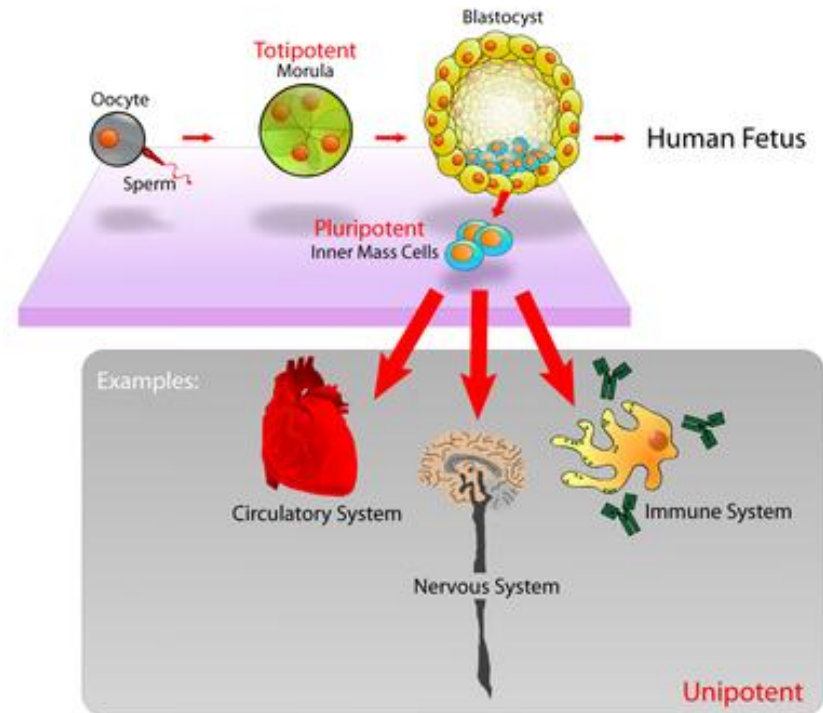
Blood



Osseous tissue



Hyaline cartilage



**Tissues** are what we call groups of specialized cells that perform the same function.



# Explore the interactive program on stem cells at Utah's Learn.Genetics site!

## Go, Go Stem Cells!

Stem cells can give rise to multiple cell types. In adults, stem cells hang out in niches around the body. They are poised to jump into action when they receive the proper signal.

Click on one of the niches to make the stem cells go, go go!

What is a Stem Cell Niche?



*Click on the image to go to the site!*