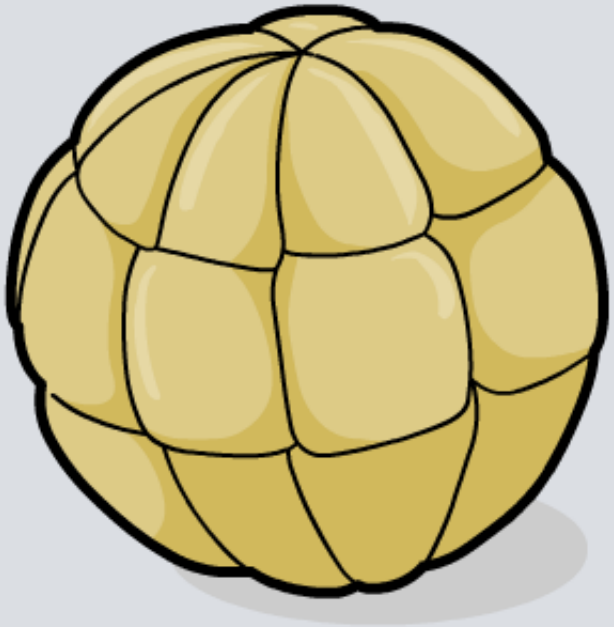
# Cell Differentiation



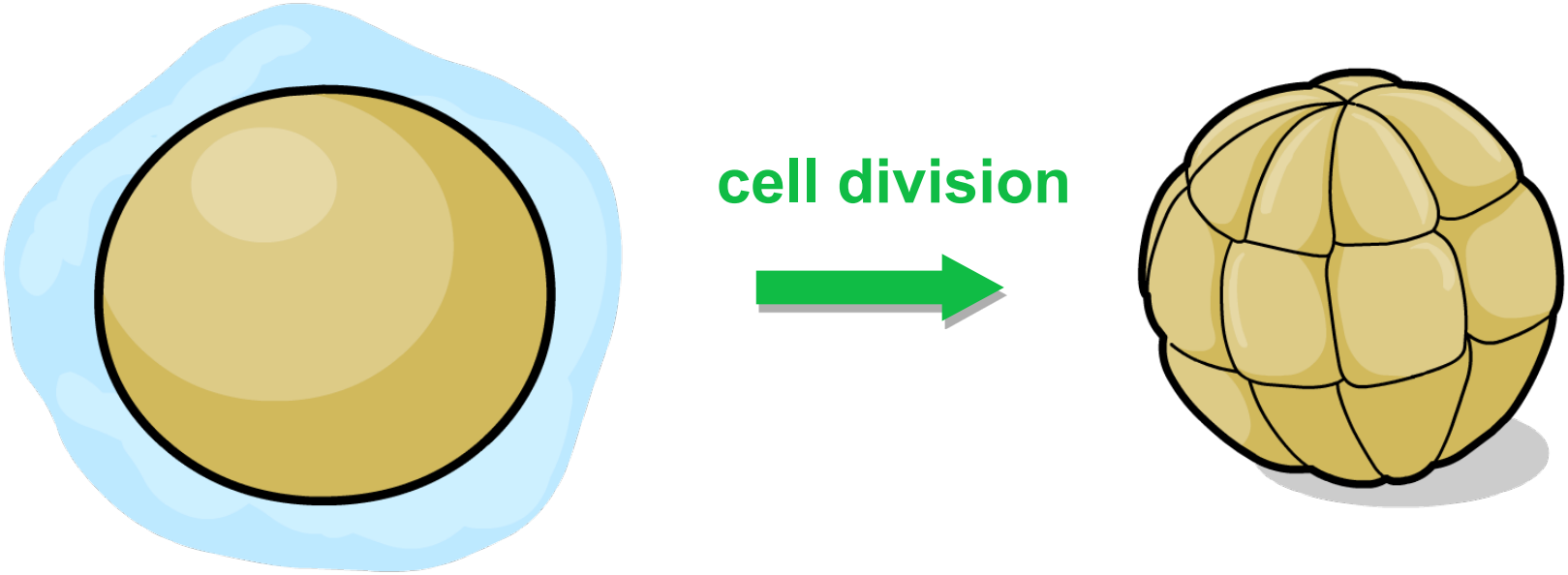
# How did you get like this?

By the time you finish growing, you will have an estimated 50 trillion cells. That's **50,000,000,000,000**!

You started out as a single cell. How did one cell turn into 50 trillion?

# A slow start

For the first week, humans don't actually grow – the fertilized egg cell (**zygote**) splits in two every day to make a bundle of smaller cells.

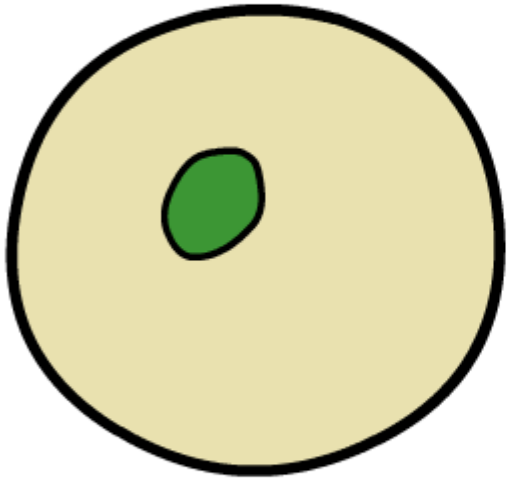



After about 1 week, the zygote is called an **embryo**.

## What is exponential growth?

In the first week of development, stem cells keep dividing in two. This results in the **exponential growth** of cell numbers.

Click the cell or "**play**" to see this type of growth.

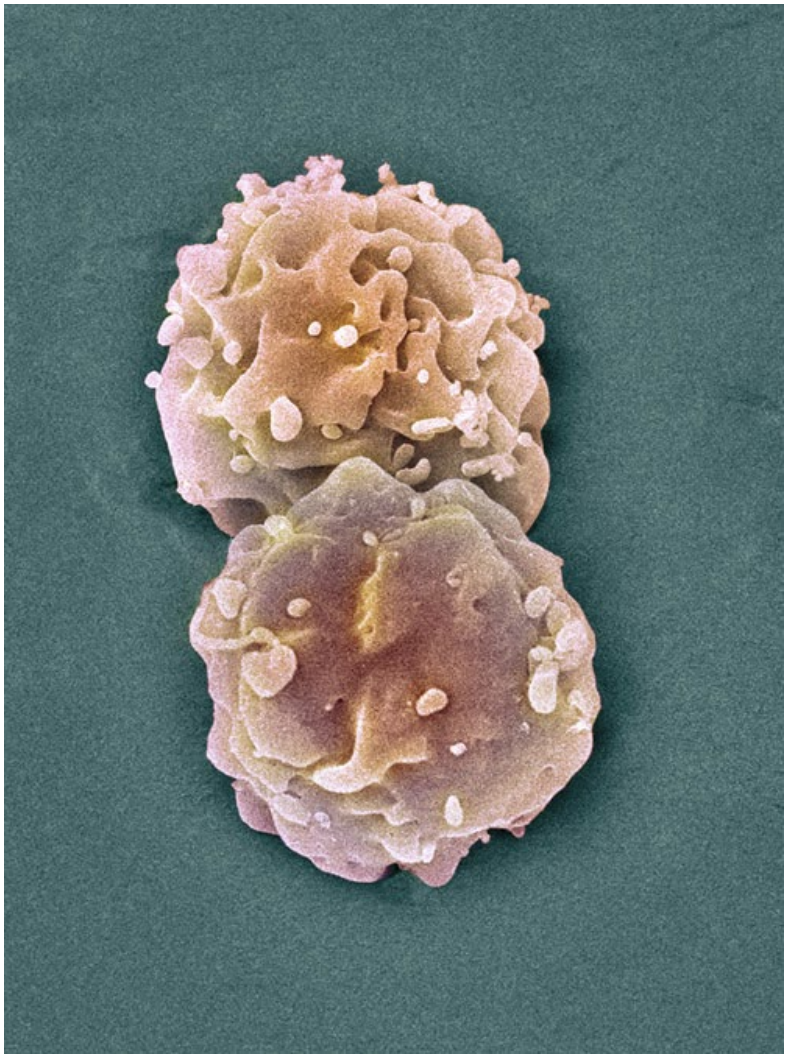


# What are stem cells?

The first cells are **stem cells**. These are unspecialized cells capable of developing into many different types of cell.

Stem cells found in embryos are called **embryonic stem cells** and develop into all the different types of cell in the body.

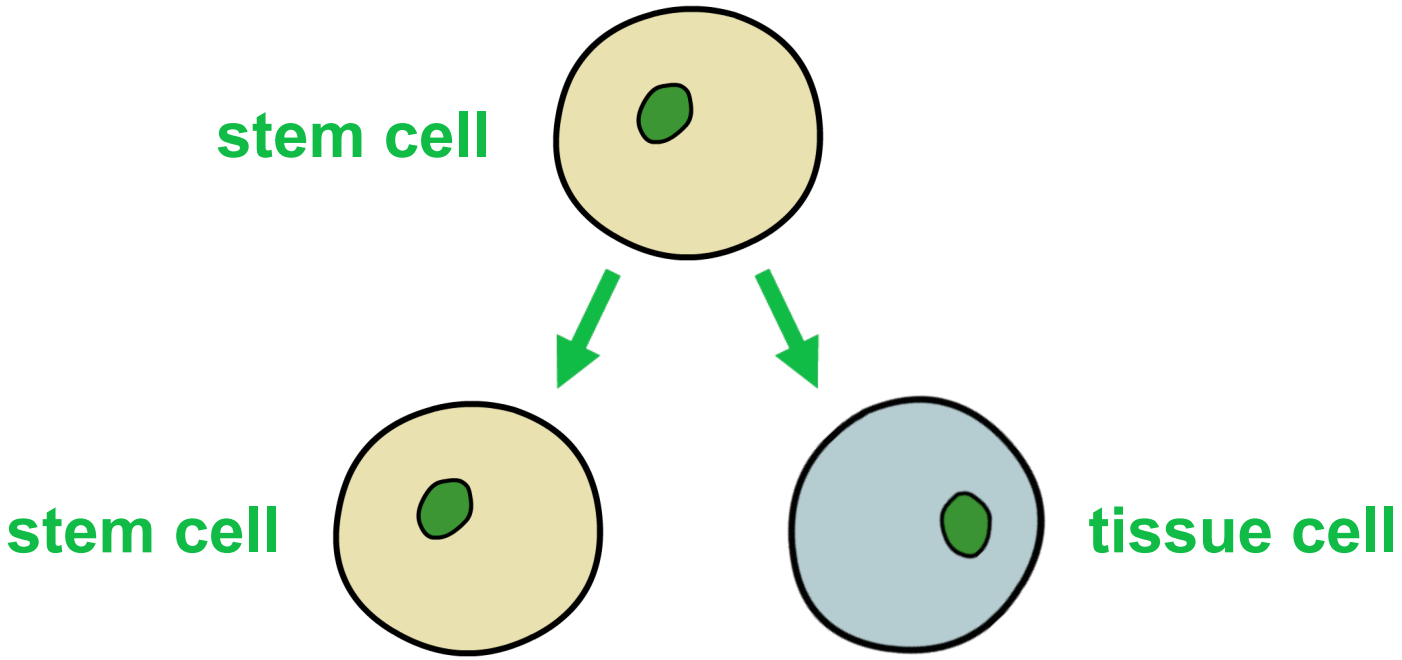
If stem cells continued to divide as they were, humans would end up as a large jelly-like blob!



# Changing cells

When the embryo contains about 500 cells, the cells stop being the same and they stop getting smaller with each division. They start to **differentiate** into different types of cell.

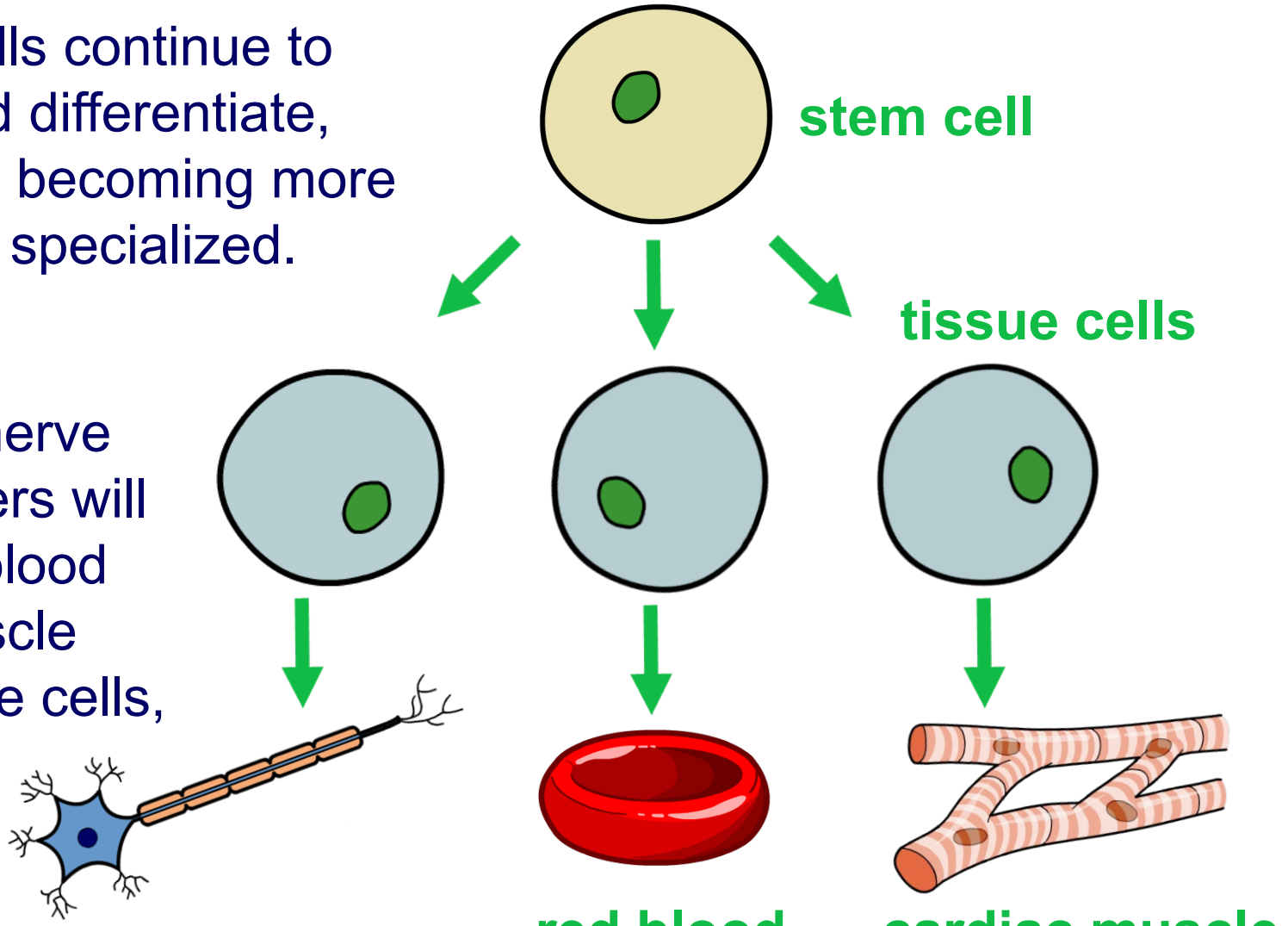
At this point, stem cells no longer form two new stem cells when they divide. Instead, one of the two daughter cells becomes a **progeny** or **tissue** cell.



# Becoming specialized

Tissue cells continue to divide and differentiate, each time becoming more and more specialized.

Some will become nerve cells, others will become blood cells, muscle cells, bone cells, etc.



# How many divisions?

Stem cells are special because they can carry on replicating indefinitely. However, cells that are fully differentiated (tissue cells) only replicate a certain number of times before dying.

This number of divisions is the **Hayflick limit** and, in humans, it is about 50. Bacterial cells have no Hayflick limit.

**Cancer cells** are tissue cells that have retained the ability to divide indefinitely and have no Hayflick limit. These cells grow exponentially, producing a tumor.