

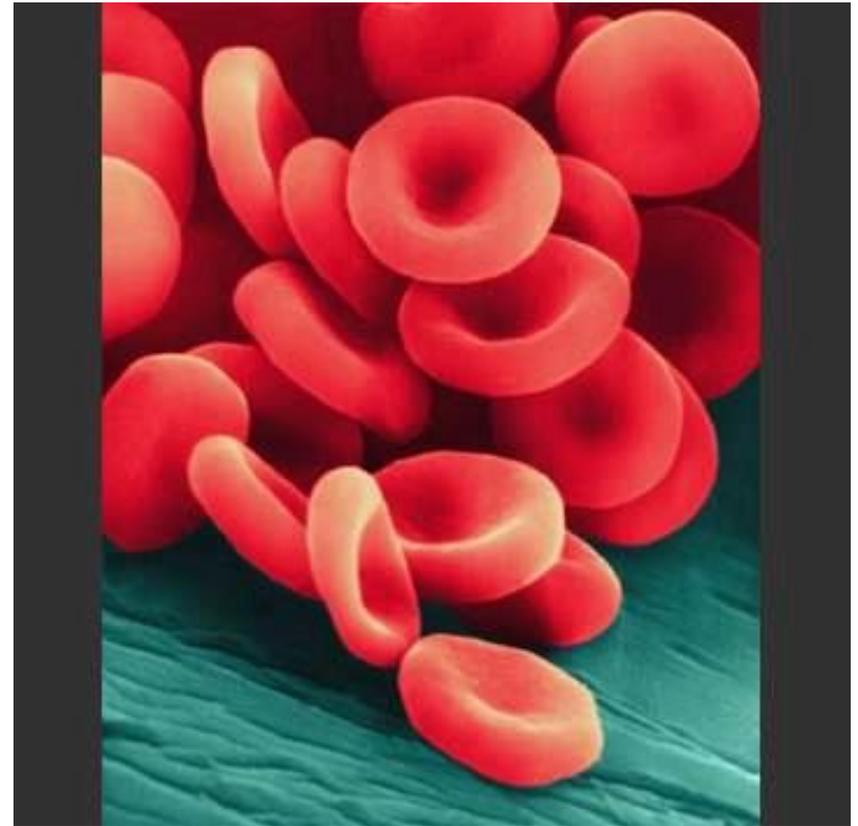
# **SPECIALIZATION IN ANIMAL AND PLANT CELLS**

# SPECIALIZED CELLS

- A cell that can perform a specific function
- Have physical and chemical differences that allow them to perform **one** job very well
- Look different from one another

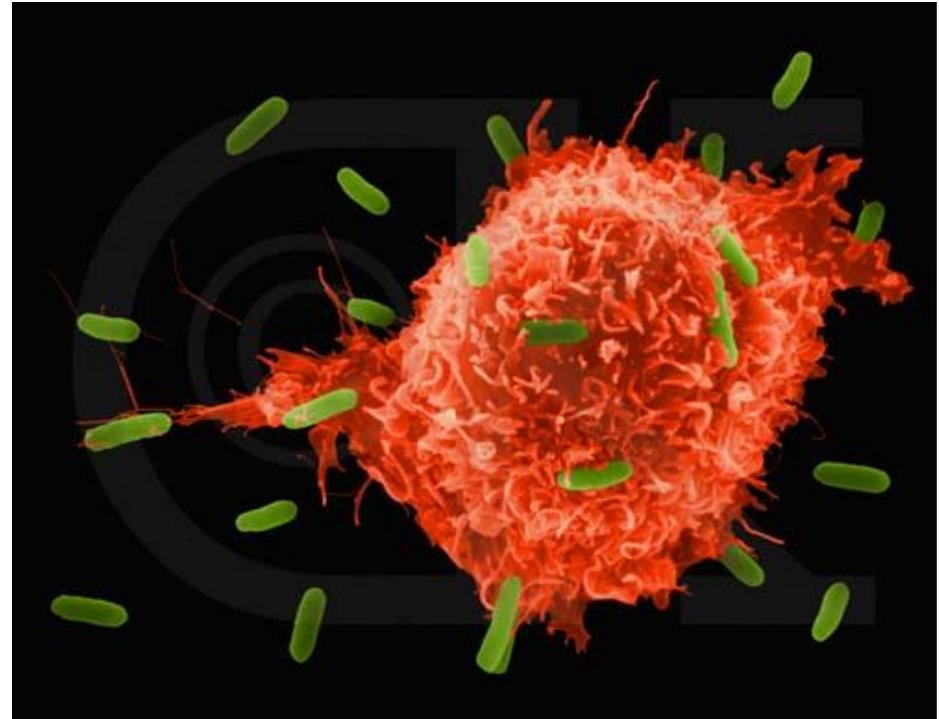
# SPECIALIZATION IN ANIMAL CELLS

- Red blood cells
  - Contains hemoglobin that carries oxygen
  - Smooth so they can pass through blood vessels



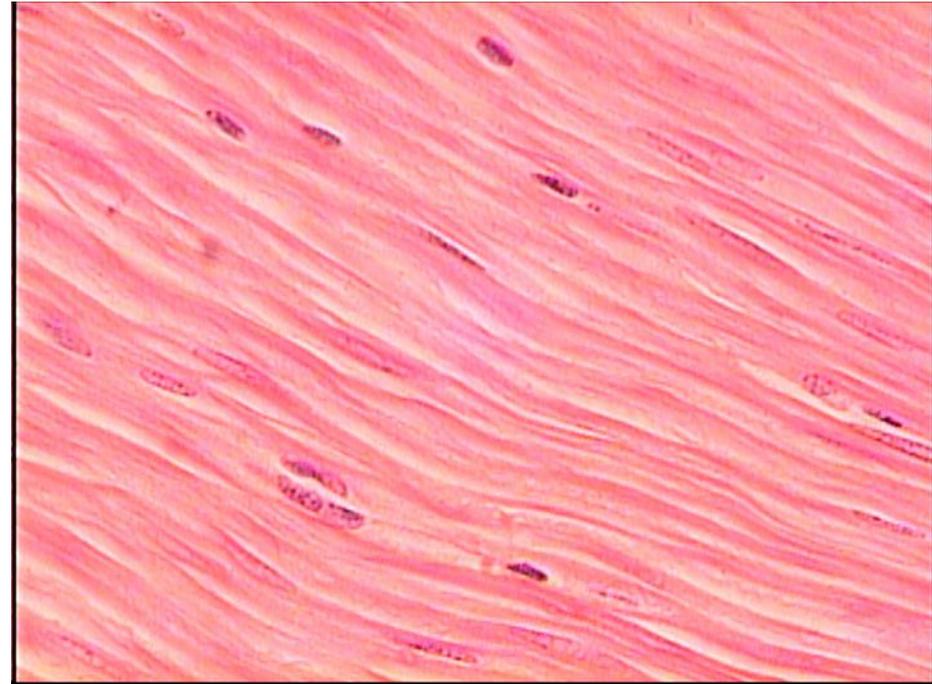
# SPECIALIZATION IN ANIMAL CELLS

- White blood cells
  - Engulf bacteria and fight infection



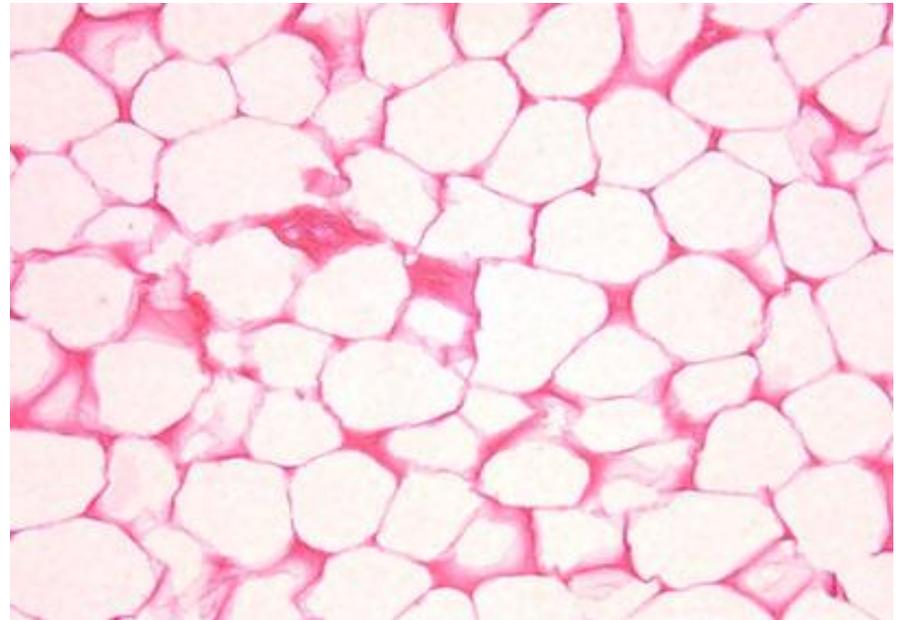
# SPECIALIZATION IN ANIMAL CELLS

- Muscle cells
  - Contain many mitochondria
  - Arranged in bundles called muscle fibres



# SPECIALIZATION IN ANIMAL CELLS

- Fat cells
  - Contain large vacuoles to store fat molecules



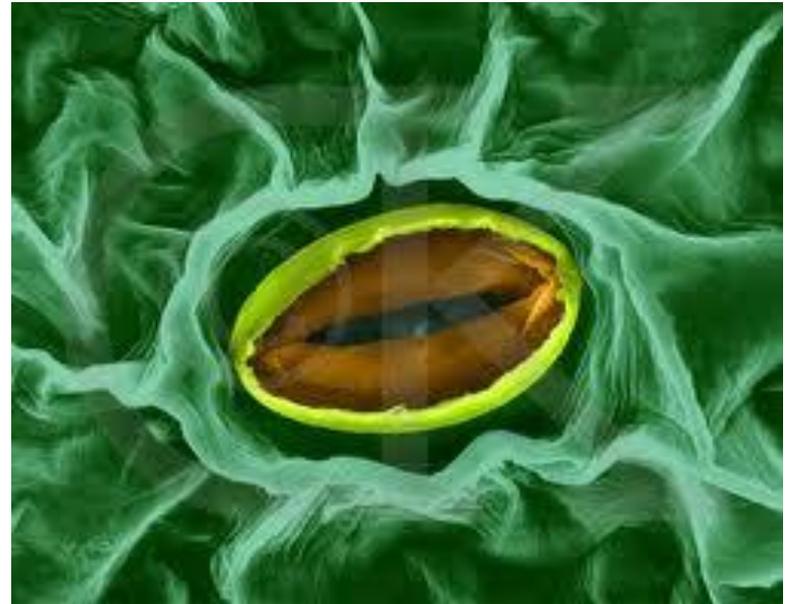
# SPECIALIZATION IN ANIMAL CELLS

- Nerve cells
  - Long, thin with many branches
  - Conduct electrical impulses to coordinate body activities



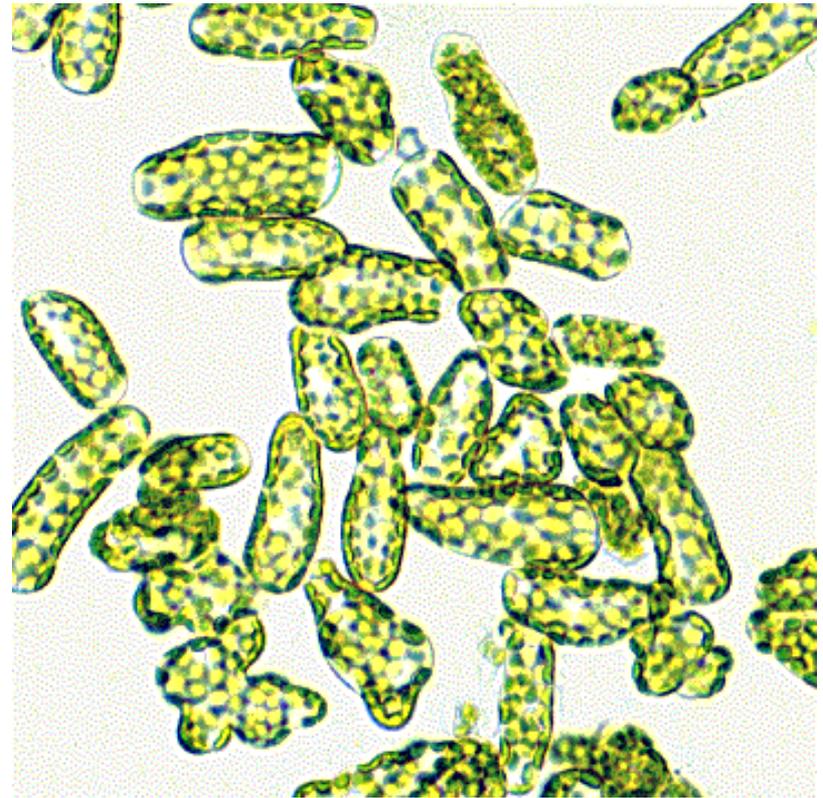
# SPECIALIZATION IN PLANT CELLS

- Guard cells
  - Found on leaves
  - Control water loss



# SPECIALIZATION IN PLANT CELLS

- Photosynthetic cells
  - Contains many chloroplasts

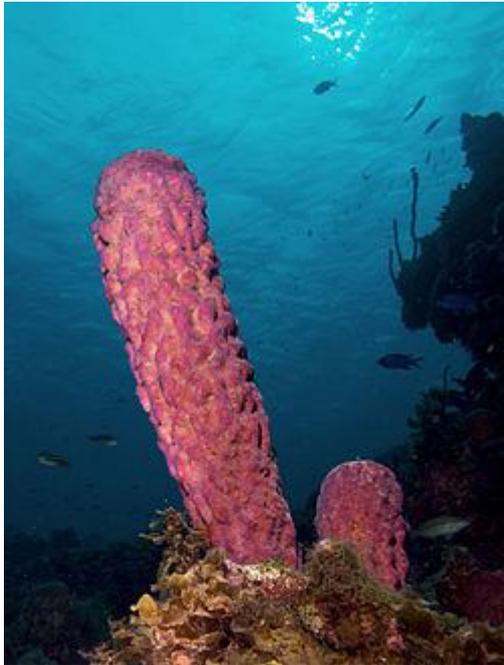


# **THE HIERARCHY OF STRUCTURE IN ANIMALS**

# MULTICELLULAR ORGANISMS

- Made up of many different specialized cells
- Specialized animal cells cannot survive on their own and work as part of a much larger group of cells that make up the body of an organism
- Large animals may be made up of trillions of individual cells

# COMPLEXITY IN ANIMALS



■ Sponge



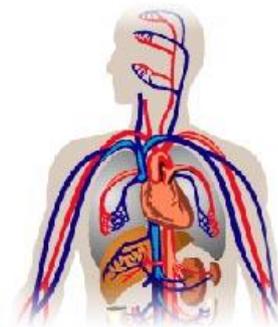
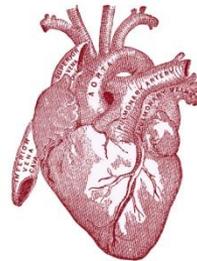
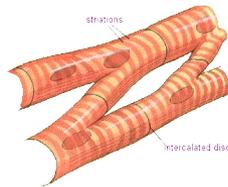
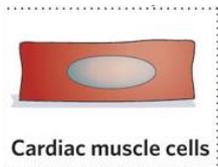
Vertebrate

# HIERARCHY OF ANIMALS

- Cells are organized in a **hierarchy**
- Functioning of organisms depends on the hierarchy of organization within an animal
- Example:
  - Cell → Tissue → Organ → Organ System → Organism

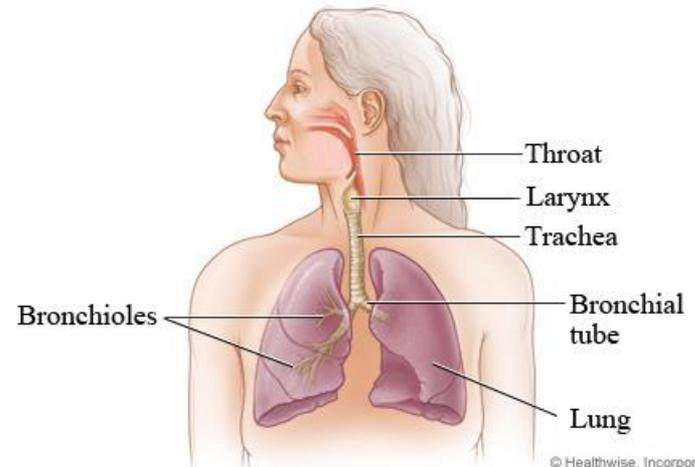
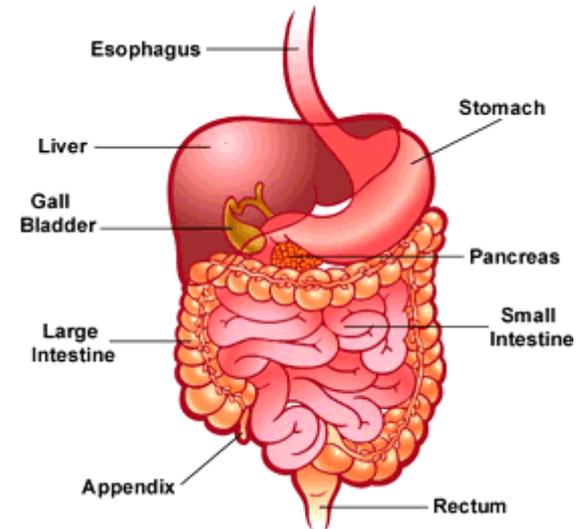
# EXAMPLE: HIERARCHY IN ANIMALS

- **Cell** (heart muscle cell) →  
**Tissue** (heart muscle tissue) →  
**Organ** (Heart) →  
**Organ system** (circulatory system) →  
**Organism** (human)



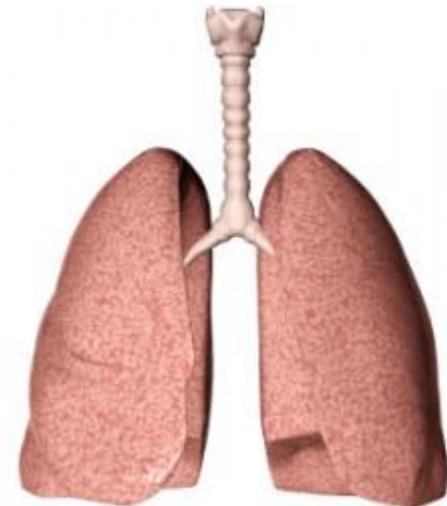
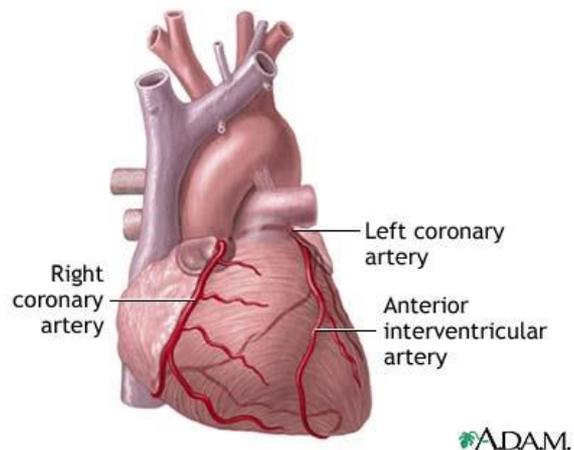
# ORGAN SYSTEM

- Contain one or more organs and structures that work together to perform a vital life function
- **Example:**
  - Digestive system,
  - Circulatory system,
  - Respiratory system



# ORGAN

- Made up of two or more types of tissue that work together to perform a complex life function
- **Example:**
  - Heart, lungs, stomach



# TISSUE

- A collection of similar cells that perform a particular, but limited, function
- **Example:**
  - Epithelial tissue, connective tissue, muscle tissue, nerve tissue

# EPITHELIAL TISSUE

- Lines the body cavities and outer surfaces of body
- Protects structures
- Forms glands that produce hormones, enzymes, and sweat



Epithelial tissue

# CONNECTIVE TISSUE

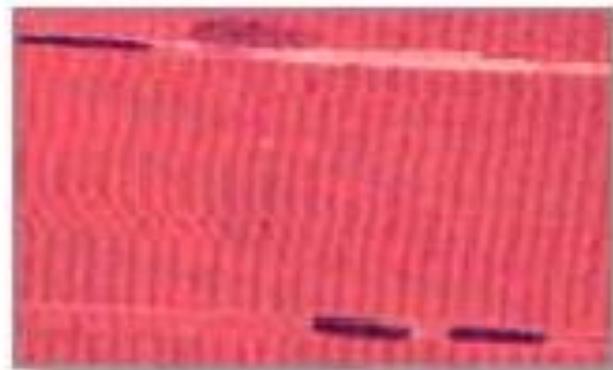
- Supports and protects structures
- Forms blood
- Stores fat
- Fills empty space



Connective tissue

# MUSCLE TISSUE

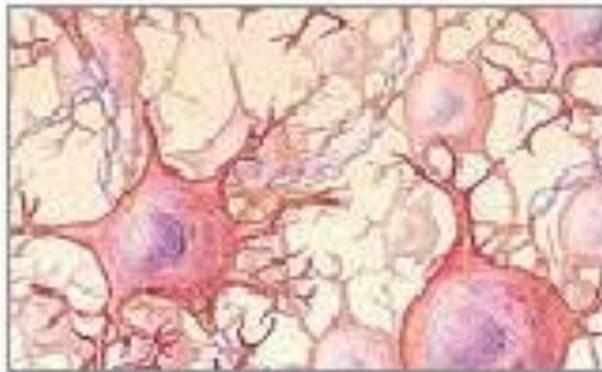
- Allows for movement



Muscle tissue

# NERVE TISSUE

- Responds to stimuli
- Transmits and stores information

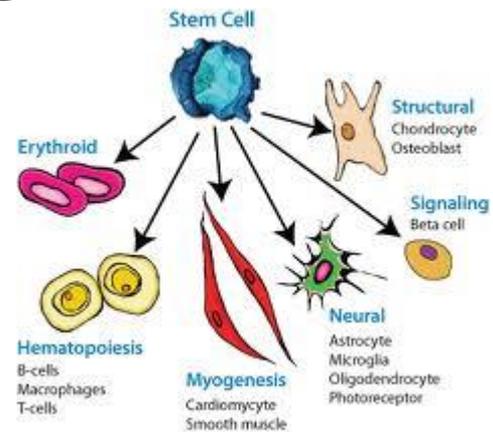


Nervous tissue

# **STEM CELLS AND CELLULAR DIFFERENTIATION**

# CELLULAR DIFFERENTIATION

- The process that produces specialized cells.
- Differentiation is directed by the DNA inside each cell and is passed from parent to offspring.



# STEM CELLS

- **stem cell:** a cell that can differentiate into many different cell types

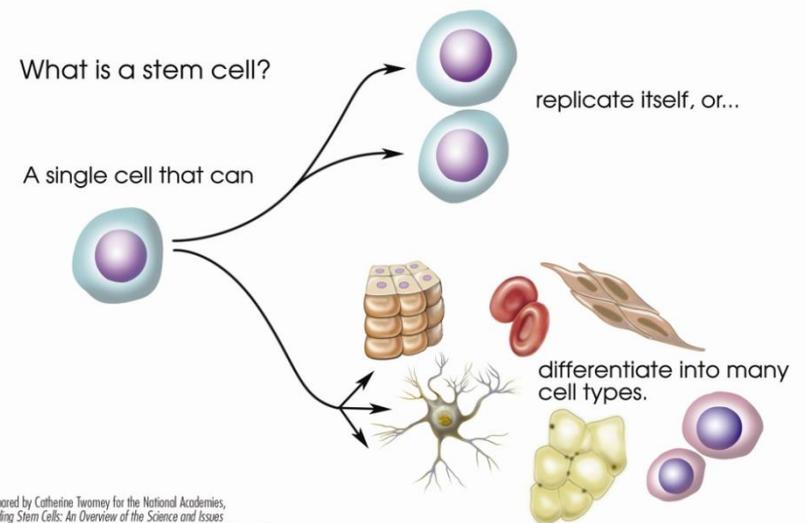
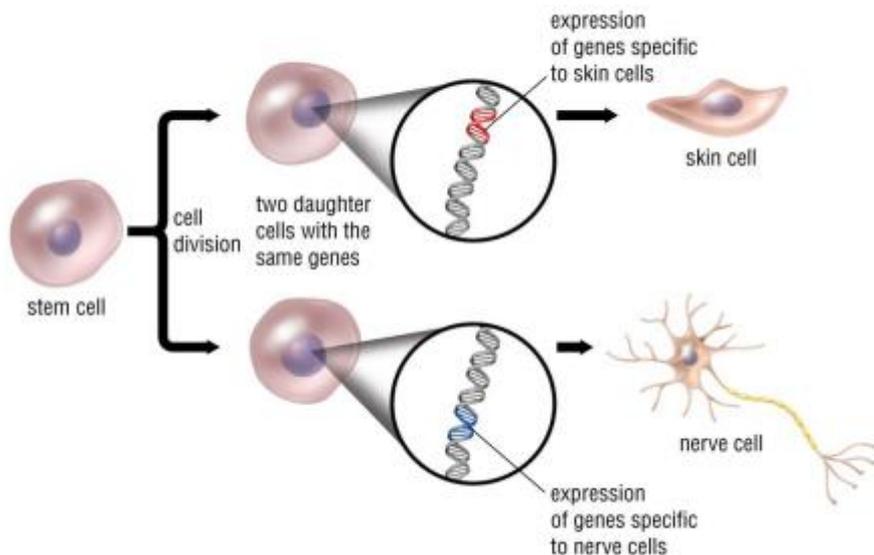
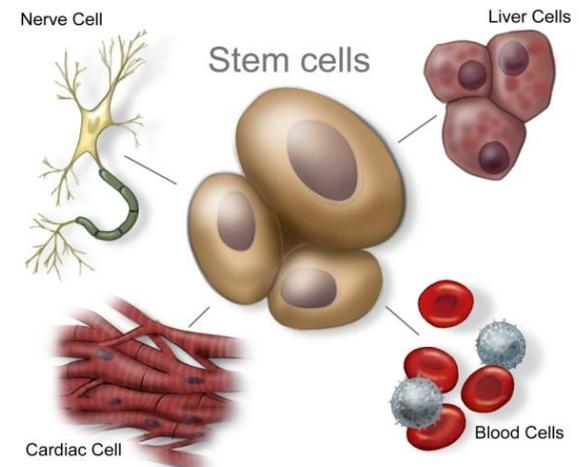
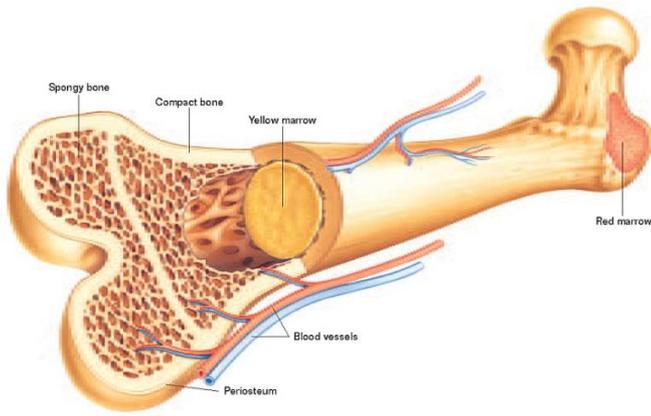


Image prepared by Catherine Twomey for the National Academies, *Understanding Stem Cells: An Overview of the Science and Issues* from the National Academies, <http://www.nationalacademies.org/stemcells>. Academic noncommercial use is permitted.

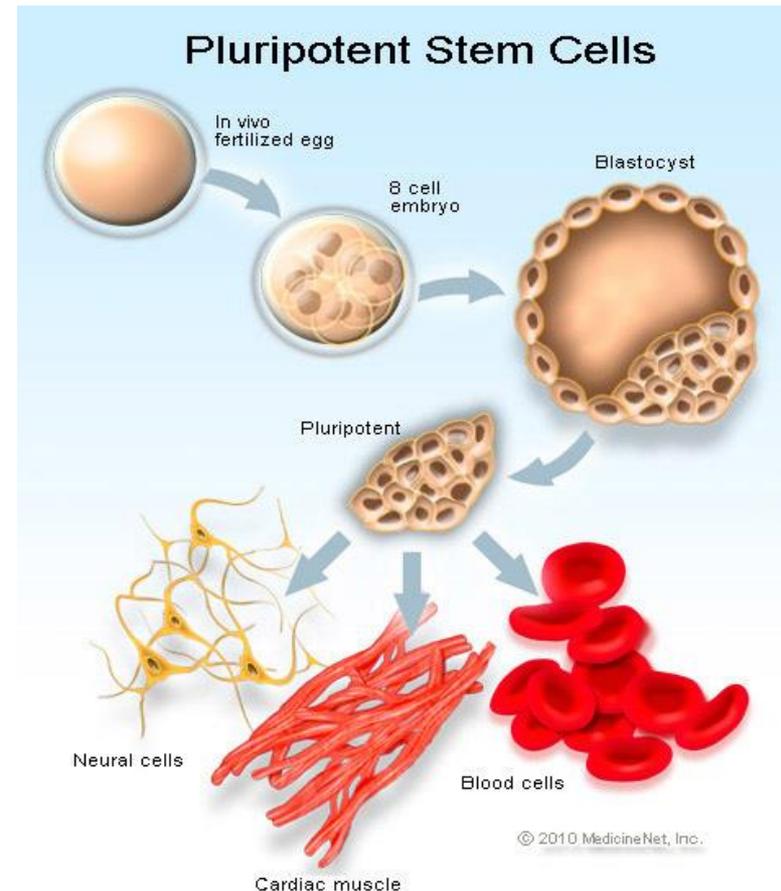
# TYPES OF STEM CELLS

- **Embryonic Stem Cells:** are pluripotent; they can differentiate into **ANY** type of cell in the body
- **Adult Tissue Stem Cells:** are multipotent; they exist within specialized tissue and can only differentiate into **certain** types of cells



# SOURCES OF STEM CELLS

- Embryonic stem cells come from embryos.
- Adult stem cells are found in differentiated tissues throughout the body.



# REGENERATION OR REPAIR

- In complex animal cells, certain tissues have the ability to repair or regenerate themselves after being damaged (muscle, skin, bone), while others do not (nerve).

# EXAMPLES

## CORD BLOOD

- Blood from the umbilical cord immediately after birth is a rich source of stem cells that can differentiate into different types of blood cells. They are multipotent.
- It can be stored or banked for use later in life by the child or a sibling for treatment of illnesses such as leukemia.

# REGENERATION OR REPAIR

- In complex animal cells, certain tissues have the ability to **repair or regenerate** themselves after being damaged (muscle, skin, bone), while others do not (nerve).
- Ex: salamanders, starfish, and flatworms can regrow lost limbs

## Regenerating a limb

A newt can regenerate an entire limb within 7-10 weeks.

