

# What is Cell Differentiation?



Students, write your response!

# What is Cell Differentiation?

Cell Differentiation is the process of cells becoming different types of cells

- **Multicellular organisms, like us, are possible because of cell differentiation.**
- Cell differentiation occurs during multicellular **development.**



# What is Cell Differentiation?

If cells did NOT differentiate to become different types of cells, **every cell would have to do every single job in the body:**

- Make energy
- Absorb nutrients
- Produce movement
- Support the body
- Send electrical signals

If this were the case, there would be no way large multicellular organisms could survive.

- **Undifferentiated cells could never keep up doing it all.**

# What is Cell Specialization?

Cell differentiation leads to **cell specialization** and **divides the labor of cells** in multicellular organisms.

Cell specialization is **the process of cells differentiating to perform different functions (specialized)**.

Examples:

- Nerve cells communicate responses to stimuli.
- Muscle cells contract producing movement.
- Red blood cells carry oxygen through blood vessels.

# Stem Cells

Cell differentiation and specialization is **directly related to stem cells.**

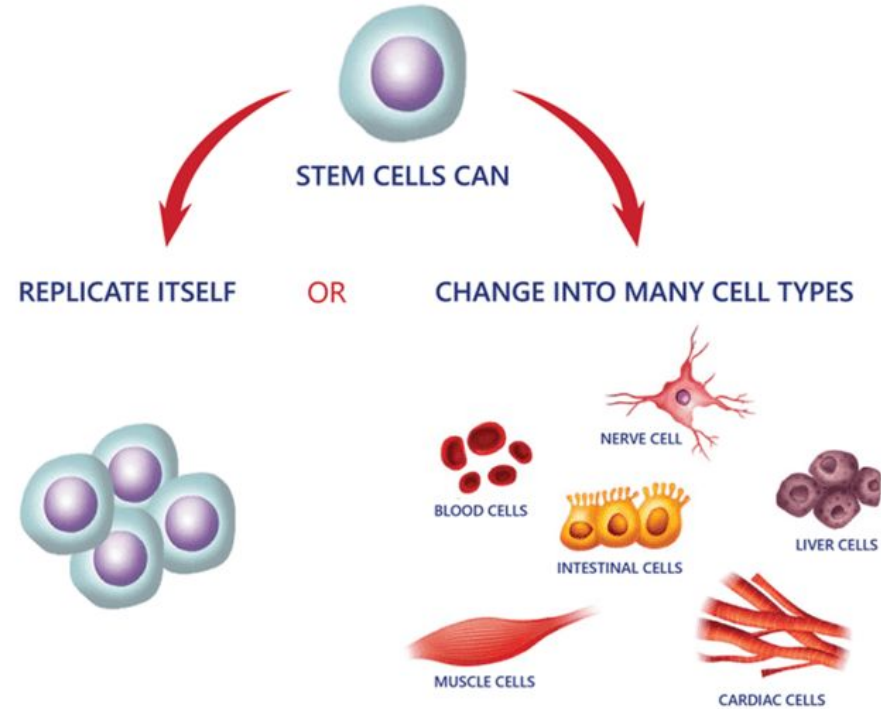
Stem cells are **undifferentiated and therefore unspecialized cells,** so the cells are basically “**blank slates.**”

Stem cells have the **ability to differentiate to give rise to one or more types of specialized cells.**

# Stem Cells

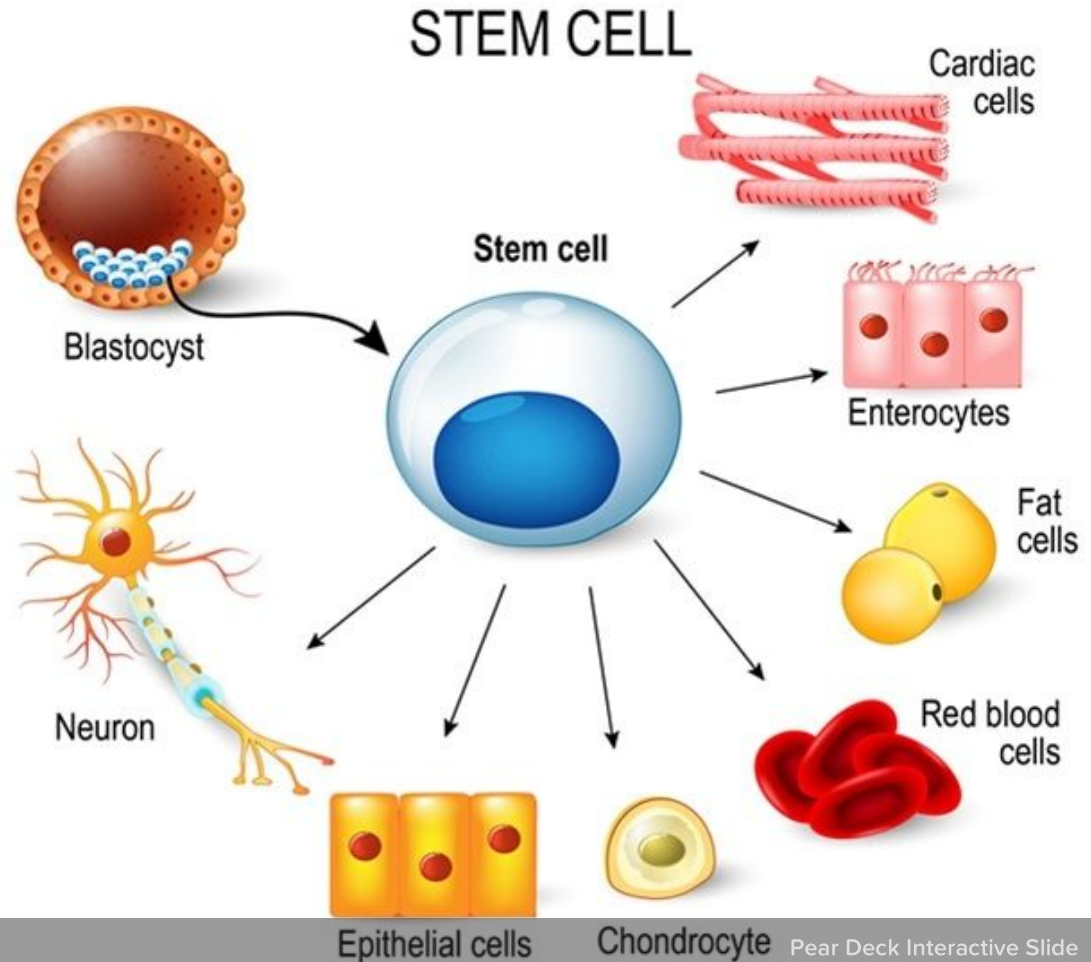
Stem cells have several abilities:

1. They can divide and make copies of themselves for long periods of time.
2. They can develop into specialized cell types through differentiation.



# Stem Cells

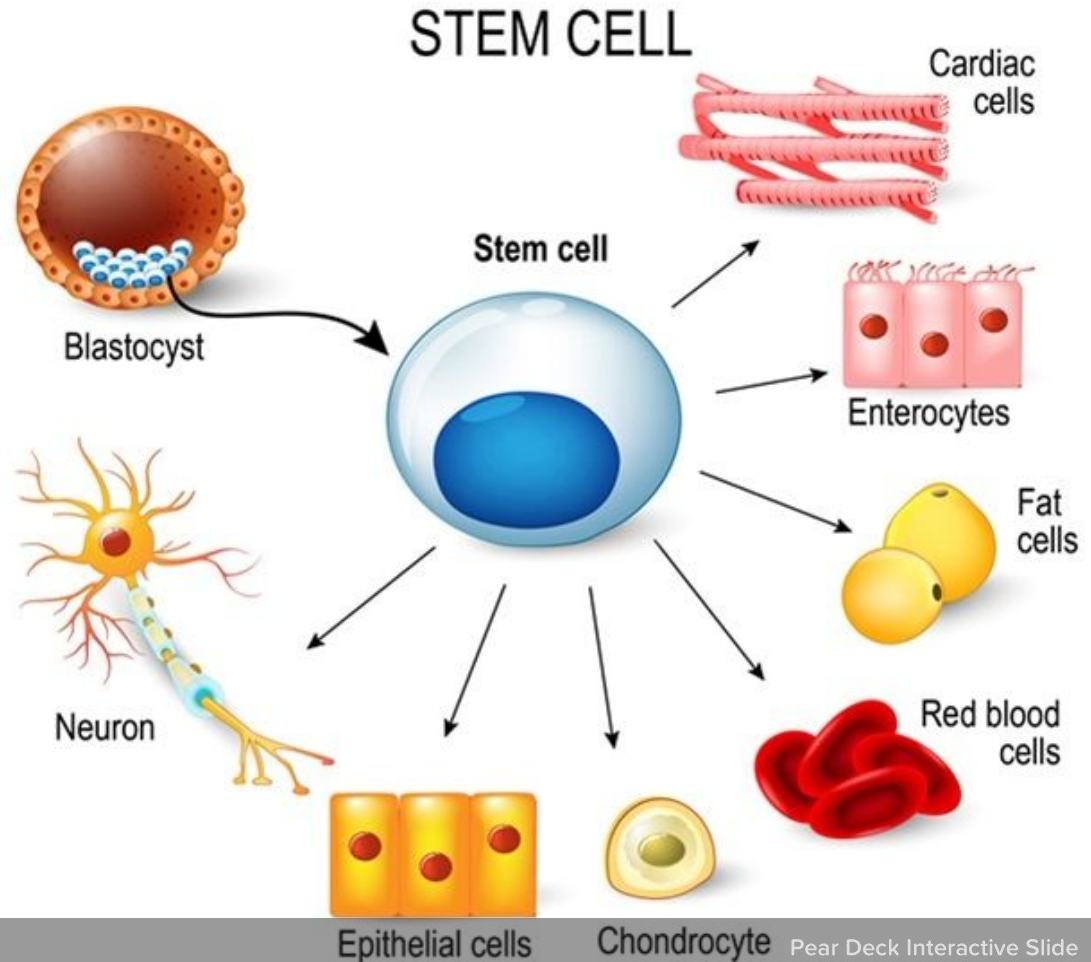
Looking at the diagram, what type of cells could stem cells differentiate into?



Students, write your response!

# Stem Cells

How do you think stem cells differentiate to create specialized cell types?



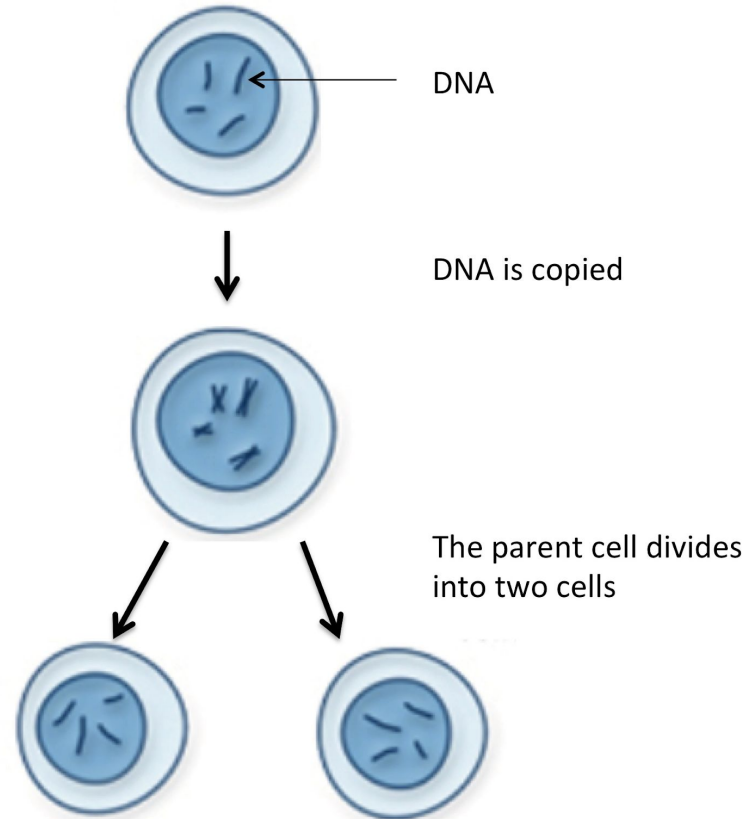
Students, write your response!



# Process of Cell Differentiation Leading to Cell Specialization

**Step 1:** Stem cells make identical copies of their DNA.

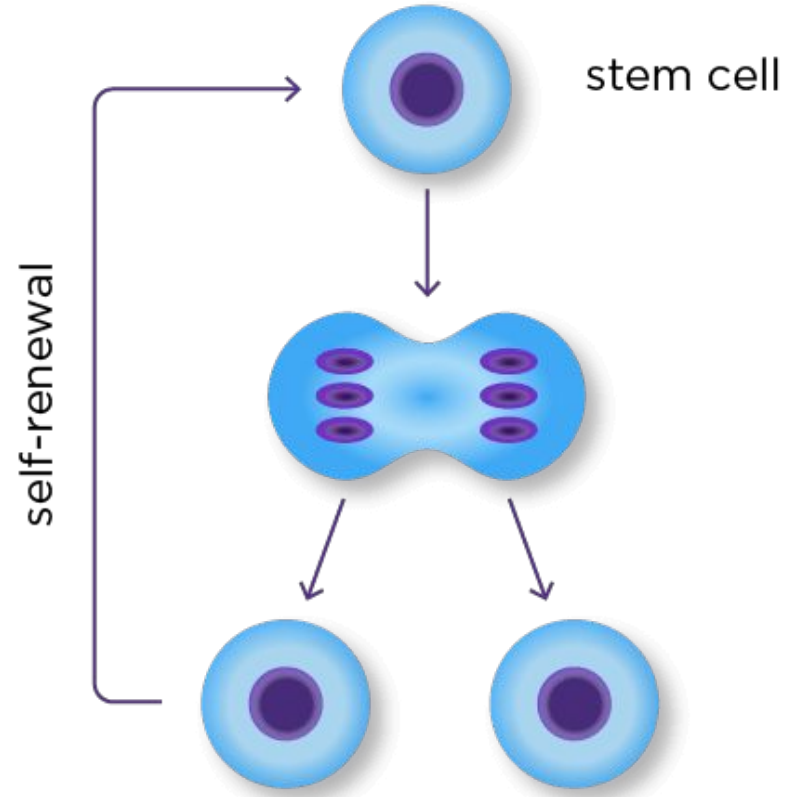
- DNA is an instruction book containing the directions to form a cell.



# Process of Cell Differentiation Leading to Cell Specialization

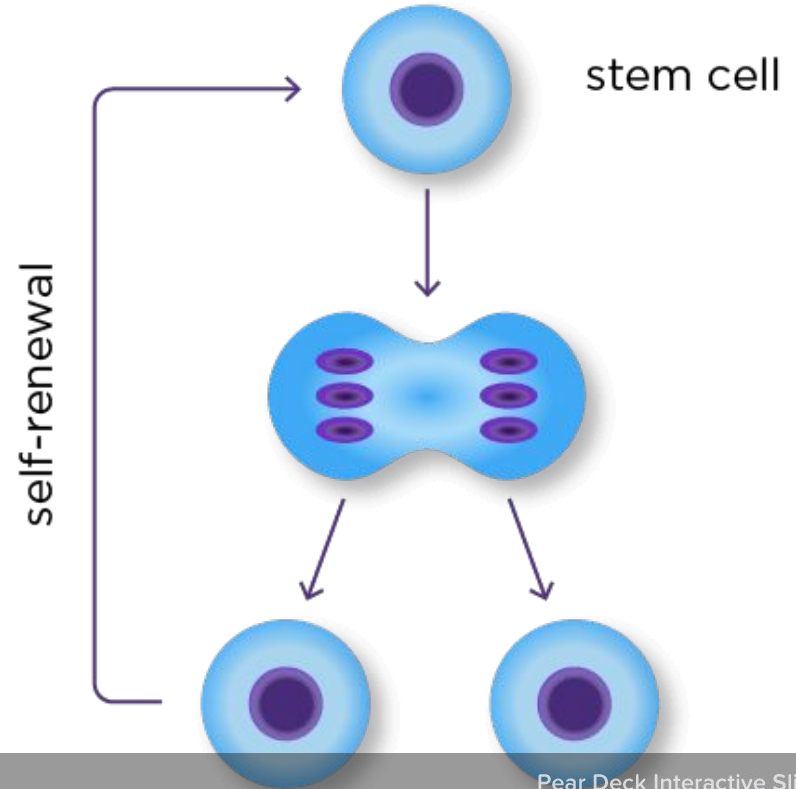
**Step 2:** Stem cells divide making identical copies of themselves.

- Stem cell copies contain identical DNA.



# Process of Cell Differentiation Leading to Cell Specialization

If stem cell copies all contain identical DNA (instructions), how do cells differentiate to become specialized?



Students, write your response!

# Process of Cell Differentiation Leading to Cell Specialization

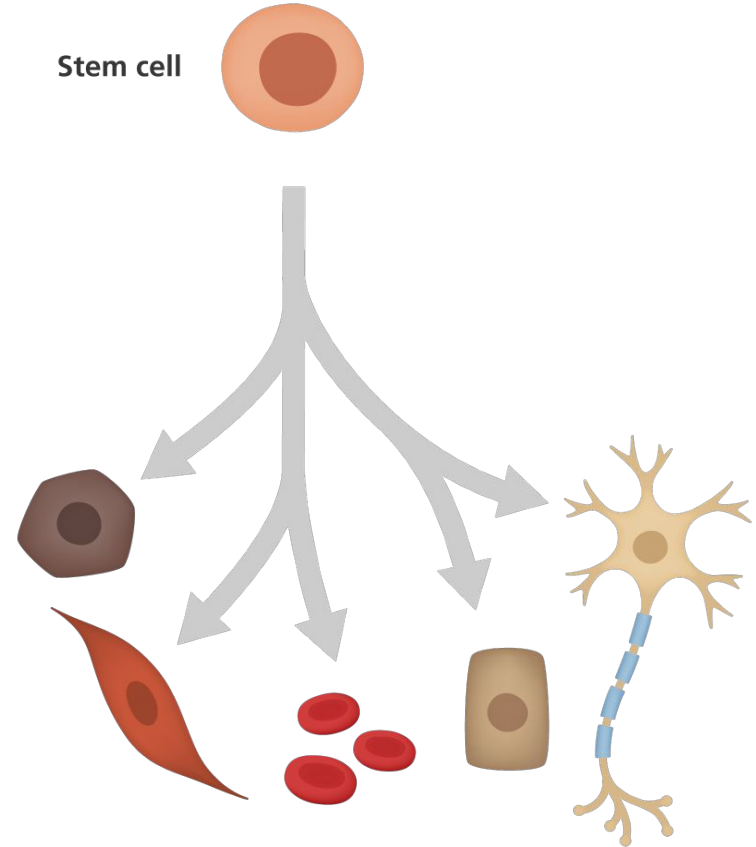
**Step 3: Stem cell copies follow their DNA instructions differently.**

- Cell “listens” to some instructions and “ignores” other instructions
- Parts of DNA (genes) can be “turned on” = expressed or “turned off” = repressed



# Process of Cell Differentiation Leading to Cell Specialization

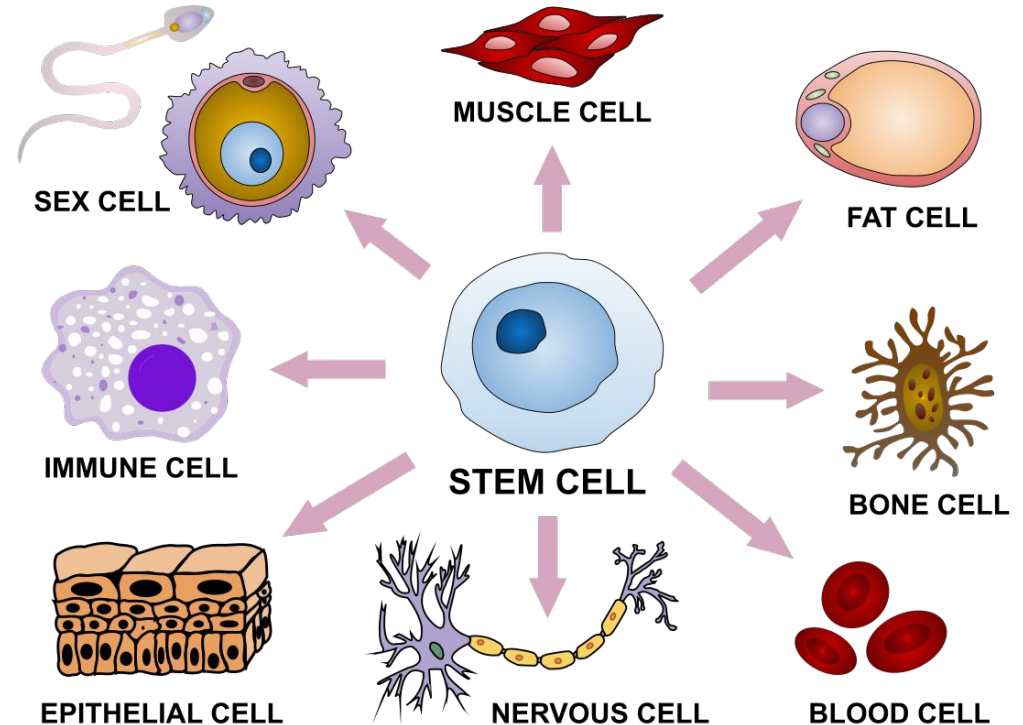
**Step 4:** Expressing different genes leads to cells having different structures (cell differentiation).



# Process of Cell Differentiation Leading to Cell Specialization

**Step 5:** Cell differentiation leads to cell specialization.

- Differentiated cells become specialized for a certain function based on their structures.



# TRUE or FALSE...

All cells (stem and differentiated cells) contain the same DNA.



Students choose an option

# TRUE or FALSE...

Each cell expresses it's DNA the same.



Students choose an option



# What is the relationship between STRUCTURE and FUNCTION?



Students, write your response!

# What is the relationship between **STRUCTURE** and **FUNCTION**?

**STRUCTURE determines FUNCTION.**

- The **structure** of a cell allows the cell to perform **it's job** **efficiently**.