

The background features a light beige color with a large, semi-transparent green circle on the left side containing a faint leaf pattern. On the right side, there are abstract, rounded shapes in a reddish-brown color, with a white wavy line curving across the bottom.

# Stem Cells



# Warm up

In groups, identify the type of cell and what it does for the body.

You will then share with the group.

# STEM CELLS?





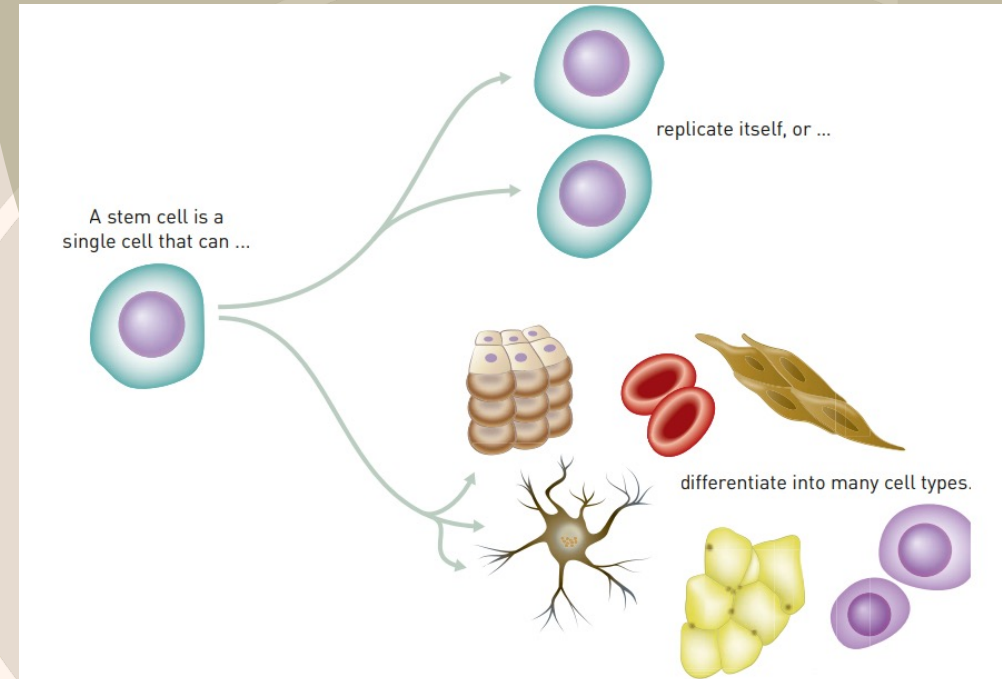
# Checklist for this lesson.

**Answer syllabus dot point:**

- Understand that stem cells differ from other cells by being unspecialised and have properties of self renewal and potency**
- 
- To understand what a stem cell is and why they are needed**
-

# What is a stem cell?

- Stem cells are unspecialised cells that can develop into many different cell types.
- Stem cells may develop into a specialised or differentiated cell type.
- For example:
  - Blood cells
  - Skin cells
- Stem cells can activate any part of their genetic material if it is needed.
  - A hair cell doesn't need to use the same molecules as a kidney cell, so it is able to turn off the DNA for the kidney cells and work as only as a hair cell.
- This cell is now specialised



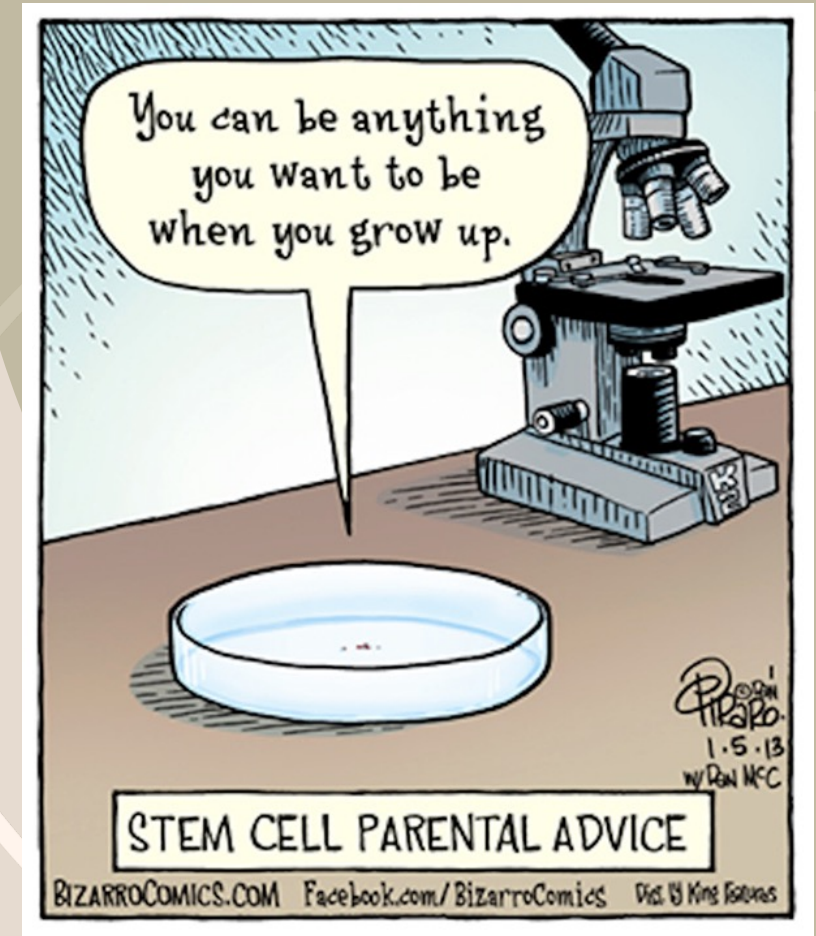
# What is a stem cell?

- There are two types of stem cells:
  1. Adult stem cells- responsible for repair and renewal in the adult body
  2. Embryonic stem cells- capable of differentiating into any cell needed for an embryo.
    - Using embryos does involve many ethical issues which is why some information about embryo stem cells is unknown.
- All stem cells have two main properties:
  1. Self- renewal
  2. Potency



# Self renewal

- The process in which stem cells divide to make more stem cells.
- The division is to maintain the undifferentiated stem cells.
- Stem cells can go through several cycles without needing to differentiate.



# Potency

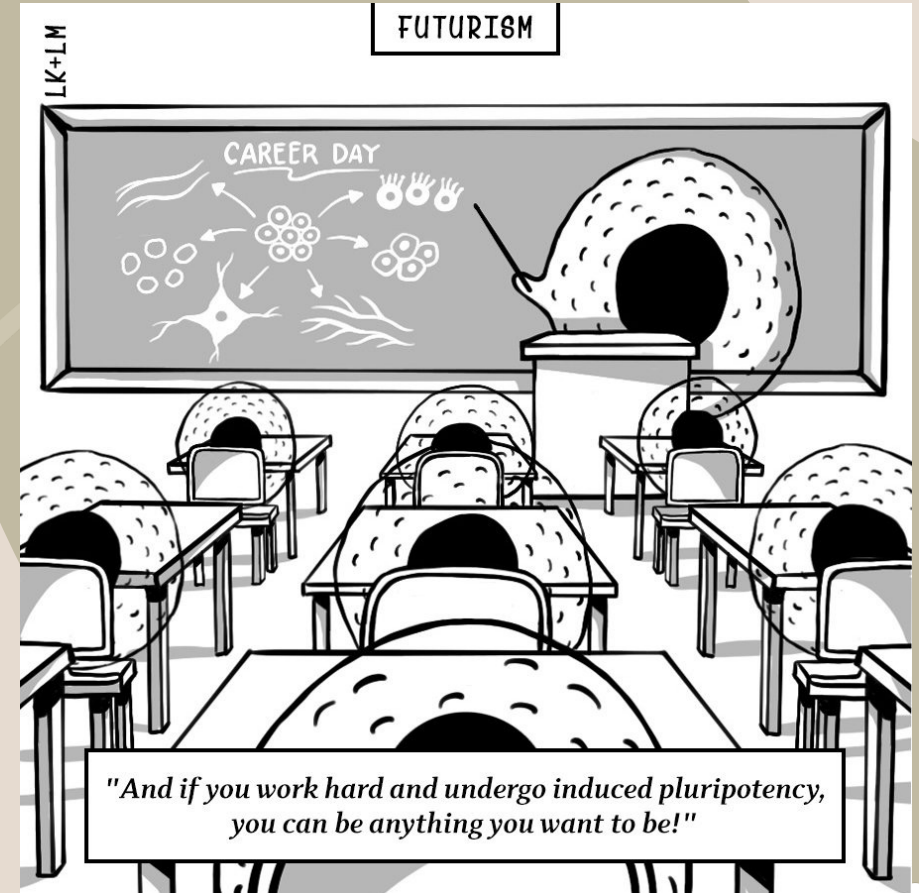
- The ability to differentiate into specialised cells.
- Animals and plants have different potent stem cells
- Animals have multipotent, oligopotent, unipotent, pluripotent and totipotent stem cells
- Plants have stem cells too





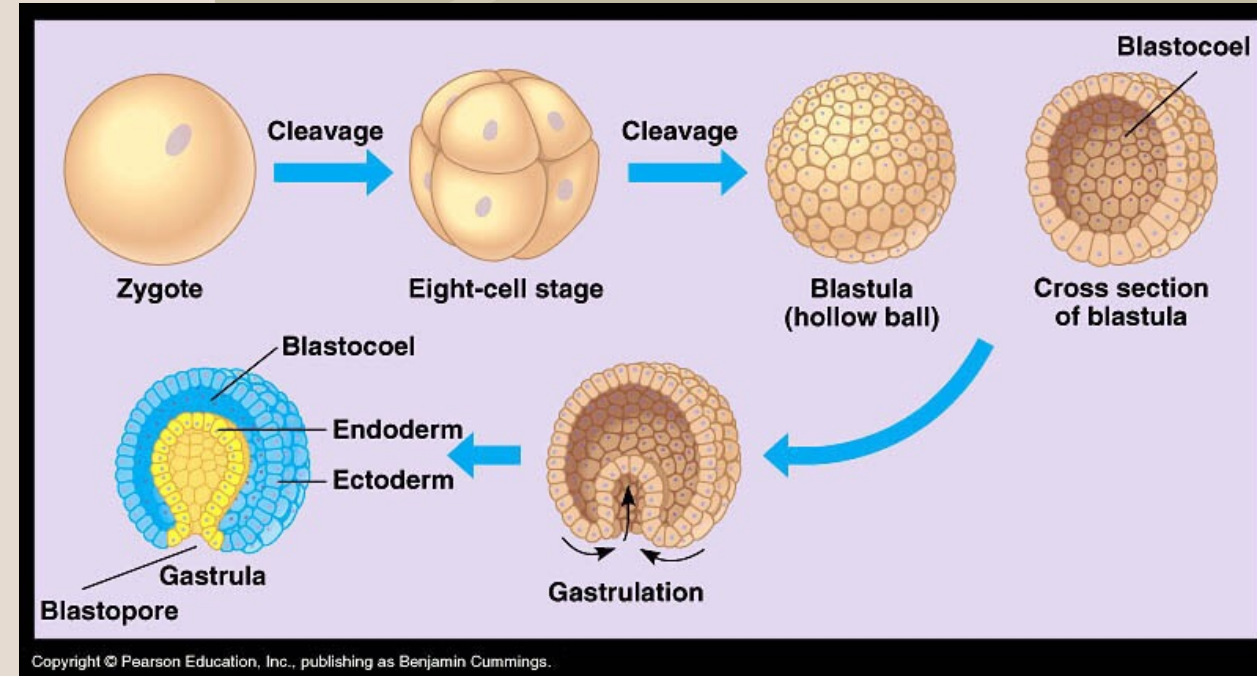
# Potency

- **Multipotent**= a stem cell that can only differentiate into a limited number of closely related cell types
- **Oligopotent**= a stem cell that can only differentiate into a few cell types
- **Unipotent**= a stem cell that can only form one cell type on division
- **Totipotent**= an undifferentiated cell that can later differentiate into any type of cell
- **Pluripotent**= a stem cell that can differentiate into any cell type within a broad group



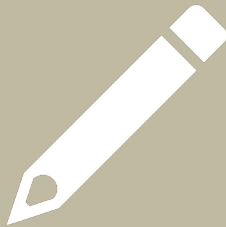
# Stem cells in animals

- During the process of cell production, the gametes or haploid cells (egg and sperm) form together into a zygote or a diploid cell
- This zygote undergoes rapid cell division to form a blastula
- After the blastula is formed this cell is now a gastrula
- The gastrula is a double walled cluster of cells that consists of the endoderm and the ectoderm (we'll look at this more next lesson)



# Stem cells in animals

- Animal stem cells can repair and regenerate tissues.
- Found mostly in bone marrow and the brain
- These cells continuously repair tissues in the human body





# How did we go?

**Answer syllabus dot point:**

- Understand that stem cells differ from other cells by being unspecialised and have properties of self renewal and potency**
- 
- To understand what a stem cell is and why they are needed**
-



# Quiz Time 😊

Go to [Quizziz.com](https://www.Quizziz.com)

The winning person/s gets a chocolate



**STOP!**





# Cell Differentiation and Specialisation



# Checklist for this lesson.

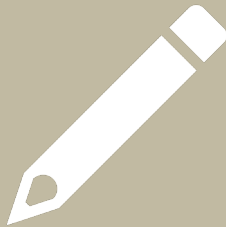
## **Answer syllabus dot point:**

- Recognise that stem cells differentiate into specialised cells to form tissues and organs in multicellular organisms.
-



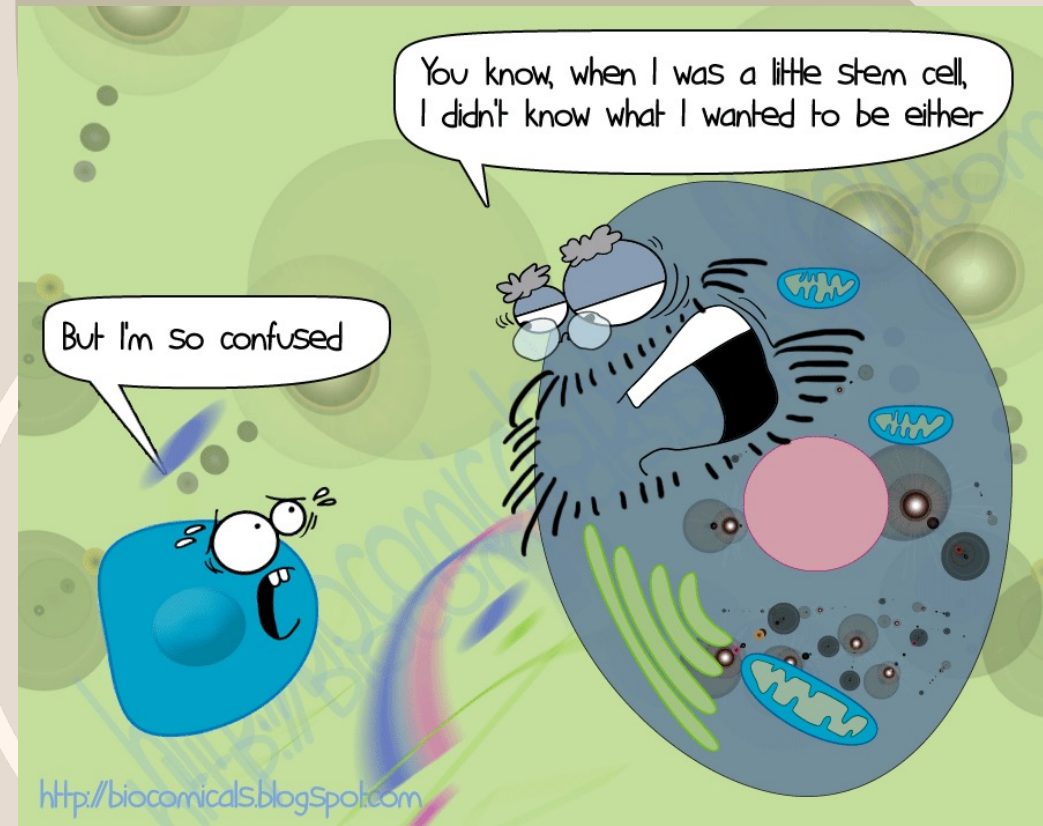
# Cell differentiation

- Based on last lesson, what do you know about stem cell differentiation?
- Differentiation is important for multicellular organisms because they are able form specialised cells.
- When a stem cell differentiates and becomes a new cell it cannot make replicas of itself.
- Plants have a similar process of cell differentiation, but the functions are completely different.



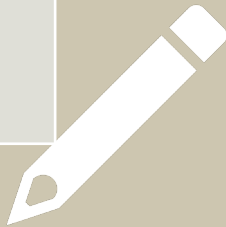
# What can differentiated cells do?

- Differentiated stem cells can specialise and develop into tissues and organs in multicellular organisms.
- Cells found in the gastrula (in the embryo stage) determine what specialised cell they will form
- The gastrula consists of the ectoderm, endoderm and the mesoderm- these sections have stem cells that can be specialised for particular parts of the body.



# What can differentiated cells do?

Ectoderm	Mesoderm	Endoderm
<ul style="list-style-type: none"><li>• Skin</li><li>• Nervous system</li><li>• Hair and nails</li></ul>	<ul style="list-style-type: none"><li>• Skeleton</li><li>• Muscles</li><li>• Kidney, uterus</li><li>• Blood and blood vessels</li><li>• Dermis</li><li>• Reproductive organs</li></ul>	<ul style="list-style-type: none"><li>• Lining of alimentary canal. Trachea, bronchus, lungs</li><li>• Lining of urethra and bladder</li><li>• Glands (including liver and pancreas)</li></ul>

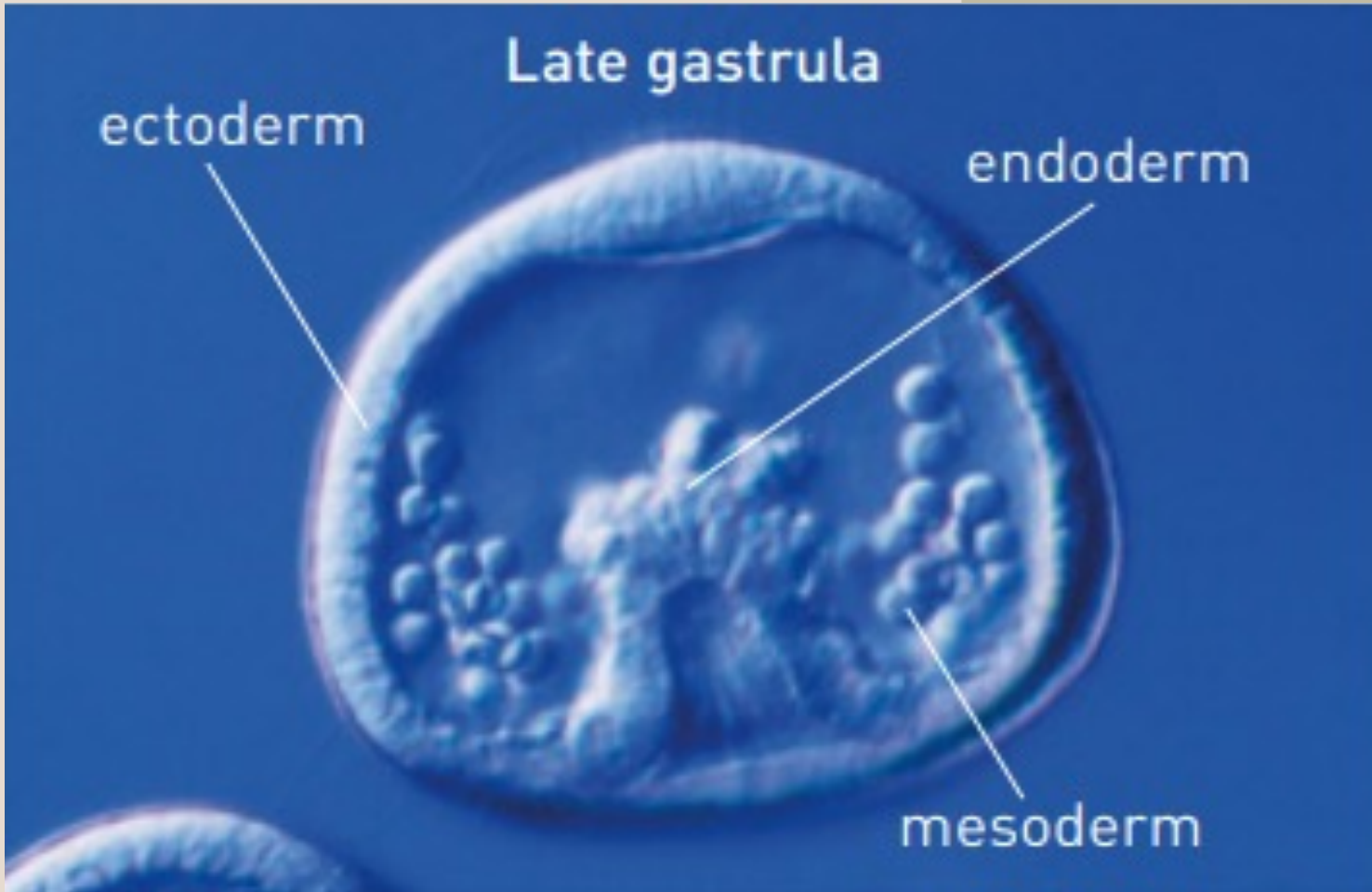


## Late gastrula

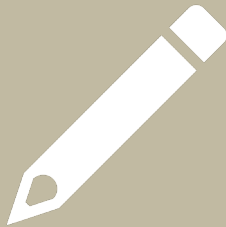
ectoderm

endoderm

mesoderm



- After the formation of the gastrula, the cell ball continues to divide, and the cells continue to specialise into tissues and organs.
- Stem cells are present from the beginning stages of an embryo all the way to adult development.
  
- Next lesson we will look at cell organisation within the body.



# Question time!

- 6 Totipotent stem cells:
- A have many genes permanently switched off
  - B can only differentiate into a single cell type
  - C can differentiate into a limited number of cell types
  - D can turn on any gene in their genetic material
- 7 The potency of a stem cell refers to its ability to:
- A go through several cell cycles in a short period of time
  - B maintain its integrity even with long delays between cell divisions
  - C remain unspecialised
  - D differentiate into specialised cell types

## Short answer

### **Describe and explain**

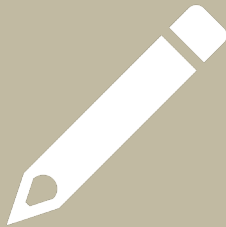
- ★ **10 Describe** the ethical issues involved in embryonic stem cell research for medical therapies.
- ★ **11** Cells are invariably very small in size and can usually only be seen under a microscope. As organisms become larger their cell numbers remain the same size, but increase in number. **Explain** this phenomenon.

### **Apply, analyse and interpret**

- ★ **12 Compare** a stem cell, a fully differentiated body cell and a cancer cell.

### **Investigate, evaluate and communicate**

- ★★ **13 Define** a bioartificial organ. **Discuss** how the organ is generated.



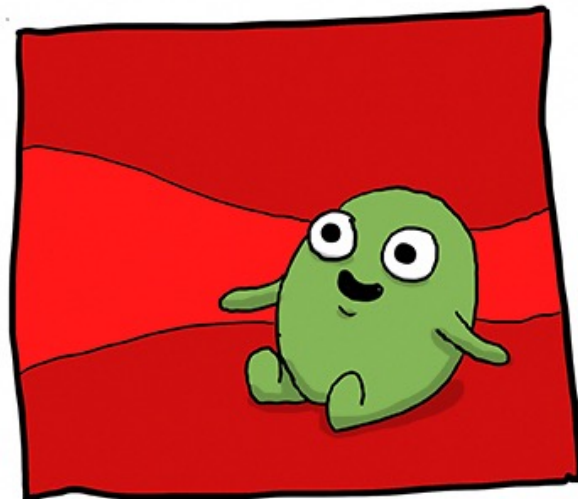
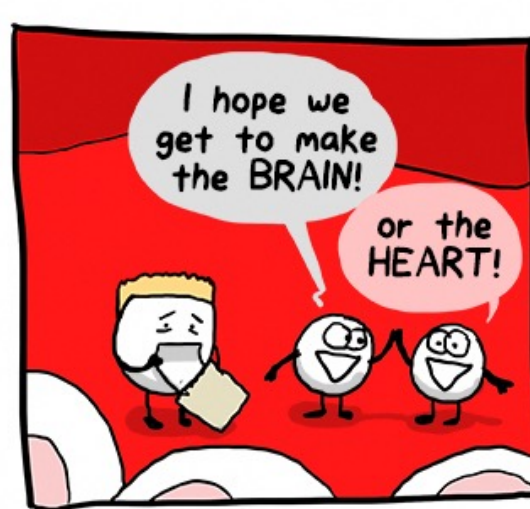
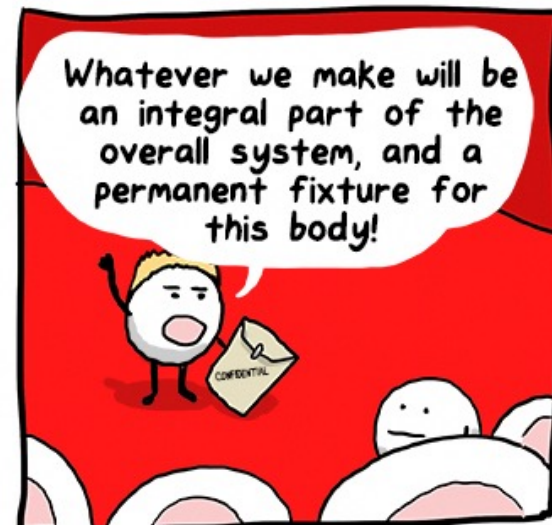
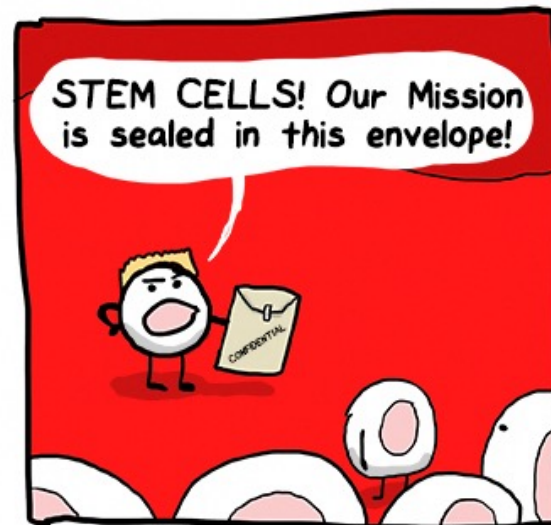


# How did we go?

## **Answer syllabus dot point:**

- Recognise that stem cells differentiate into specialised cells to form tissues and organs in multicellular organisms.
-

STOP!







# Cell Hierarchy and organisation



# Checklist for this lesson.

## **Answer syllabus dot point:**

- Understand that multicellular organisms have a hierarchical structural organisation of cells, tissues, organs and systems.

---

- State the hierarchal structure

---

# Organisation structure/ hierarchy



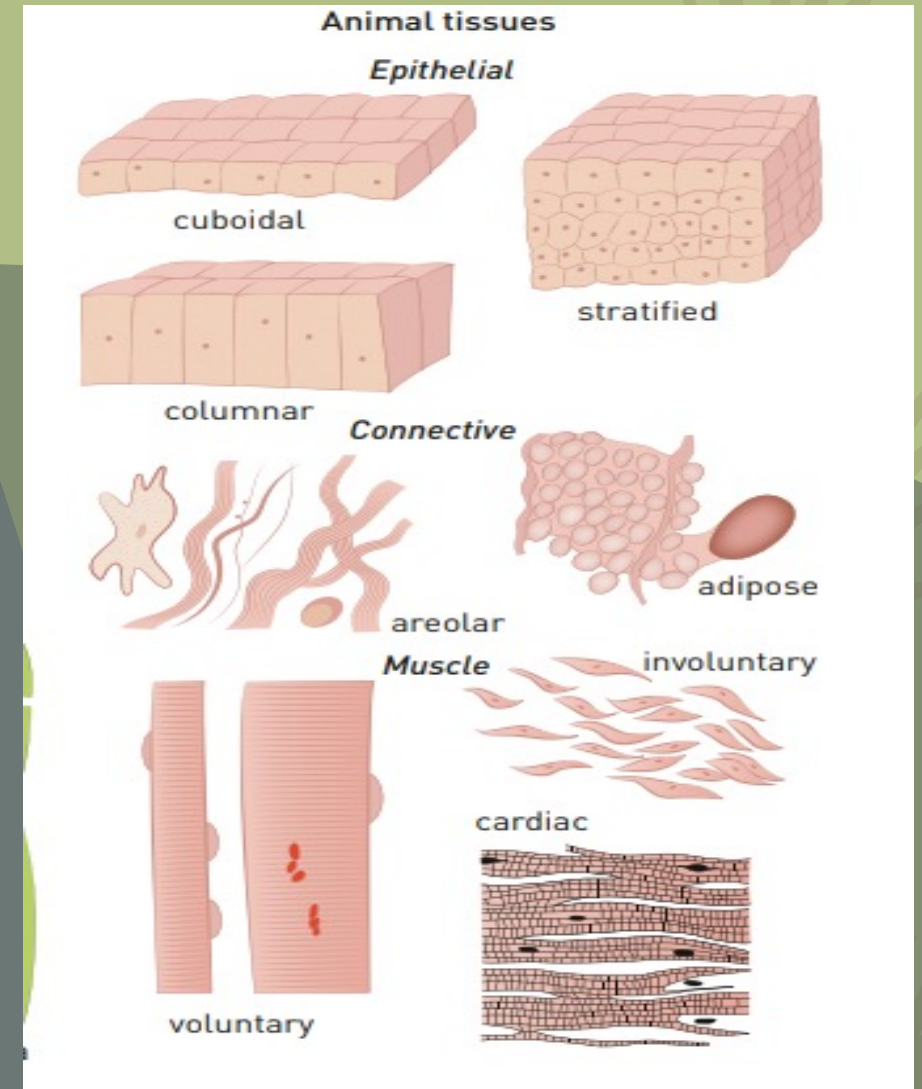
# Organisation structure/ hierarchy

- The body is organised into groups, cells, tissues, organs and systems.
- Cells are arranged in tissues
- specialised tissues are organised into the same groups.
- Organs are cells that are bound together to perform a specific function.
- Systems are organs that work together to perform a specific function



# Tissues

- Cells form together to make tissues
- There are four different types of tissue structures:
- Epithelial- surrounds and protects
- Connective- connects and supports body parts
- Muscle- helps move the body
- Nervous- carries messages from the brain



# Organs

- Organs are several types of tissues that form together.
- Organs like your brain, heart, lungs and stomach are specialised cells that have formed together to function.
- Organs use tissues like nervous tissues, muscle tissues, connective tissues and epithelial tissues to move and function.
- For example:
  - The heart uses muscle tissues to contract, it uses nervous tissues from the brain to pump blood around



# Organ systems

- Organ systems are groups of organs that work together to perform a particular function,
  - The respiratory system
  - Digestion system
  - Reproduction system
  - Nervous system
- These systems work together to carry out the life processes of a multicellular organism



# Test your knowledge

## Activity

Fill in the blanks in the table below.

Cell	Tissue	Organ	Organ System
Lymphocyte	Lymph fluid	Spleen	
	Tendon		Muscular system
Red blood cell	Bone marrow		
		Liver*	Digestive system
Egg	Ovarian follicle		


Hint: you're allowed to research 😊





# Test your knowledge

Draw your own version of cell hierarchy  
and use labels for each section



---



# How did we go?

## **Answer syllabus dot point:**

- Understand that multicellular organisms have a hierarchical structural organisation of cells, tissues, organs and systems.

---

- State the hierarchal structure

---



Quizziz Time!

Chocolates up for grabs 😊



---