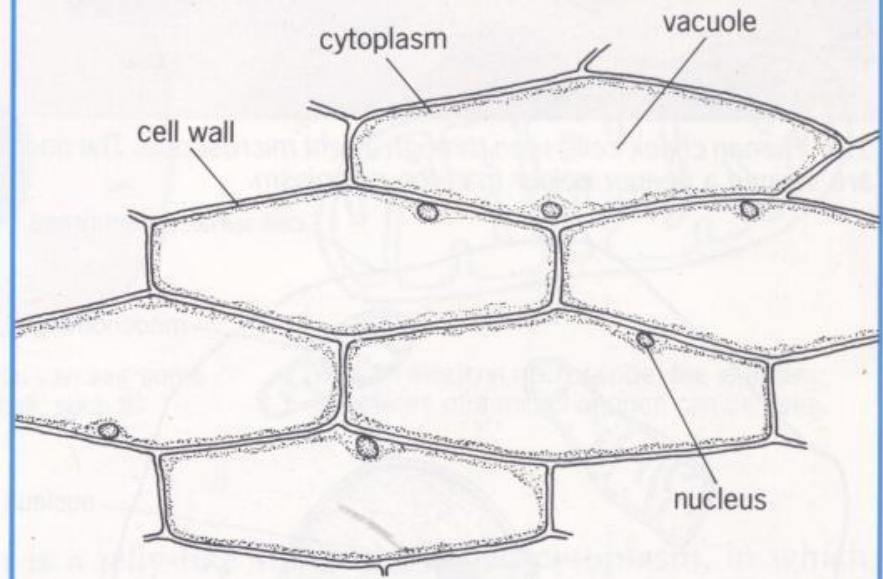


1.7 Human cheek cells seen through a light microscope



1.8 Onion epidermis cells seen through a light microscope

# **CHAPTER 6**

## **Model of Cells**

### **– The Basic Unit of Life**

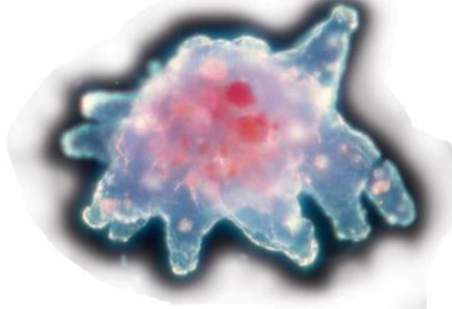
# 1 The Basic Units of Life

- Organisms are composed of one (unicellular) or more cells (multicellular)

## Examples of Unicellular organisms:

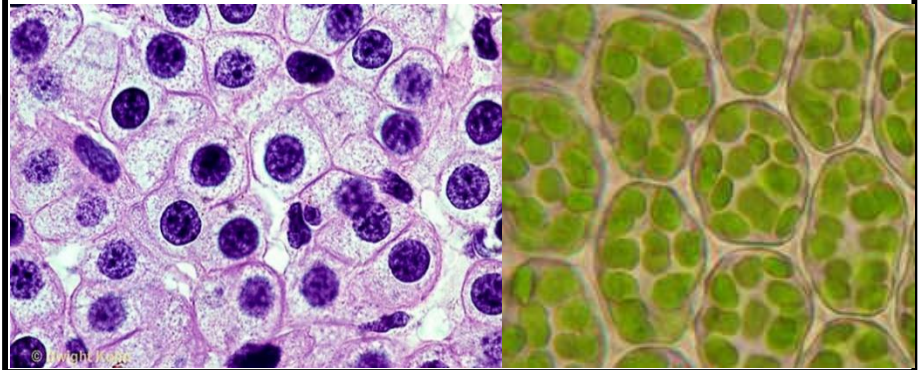


Bacteria



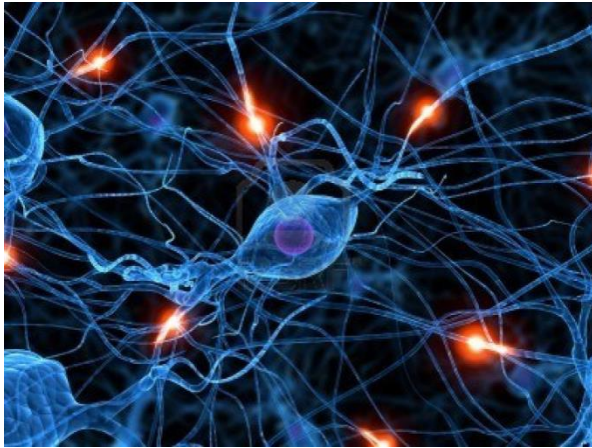
Amoeba

## Examples of Multicellular organisms: human beings, plants

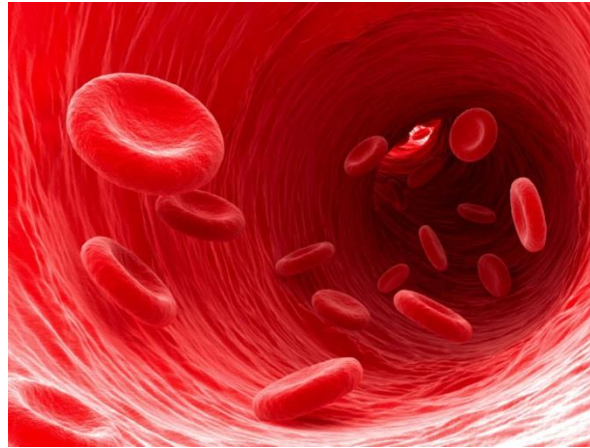


## 6.1 What are Cells?

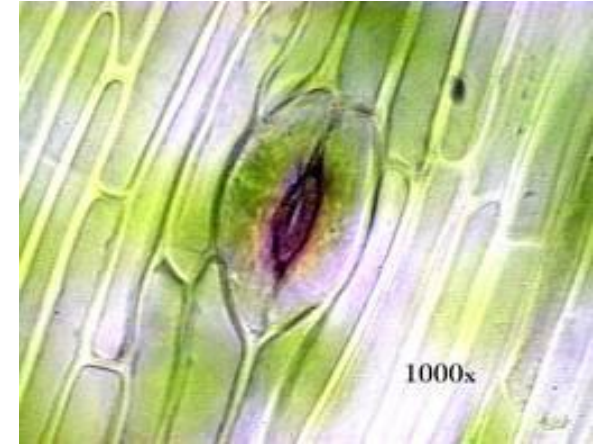
- Cells vary in shape, size and structure according to their function.



Nerve cells have long extensions.



Red blood cells are round and biconcave in shape.



Guard cells are bean-shaped.



# 6.1 What are Cells?

- Most cells are too small to be seen by the naked eye.
- Hence, one way to study cells is to use microscope.

**Human cheek cells  
under the microscope**

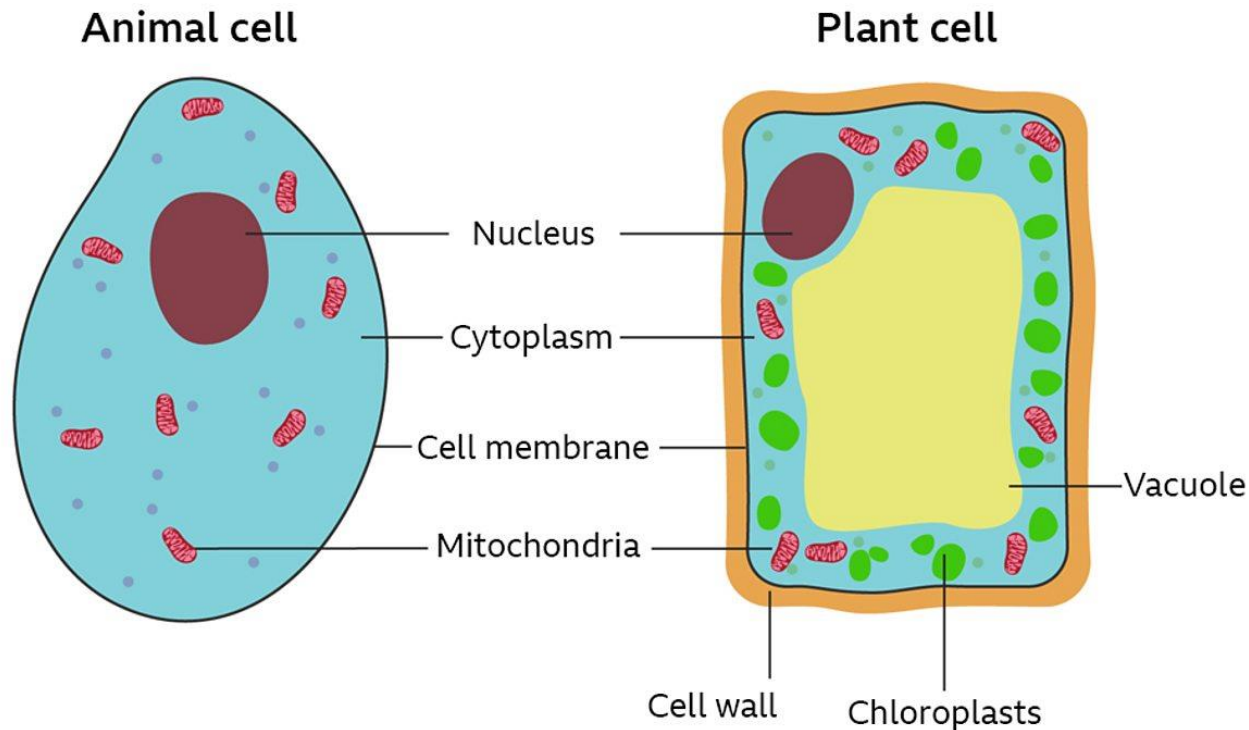


**Onion cells under  
the microscope**



# Cell Structures

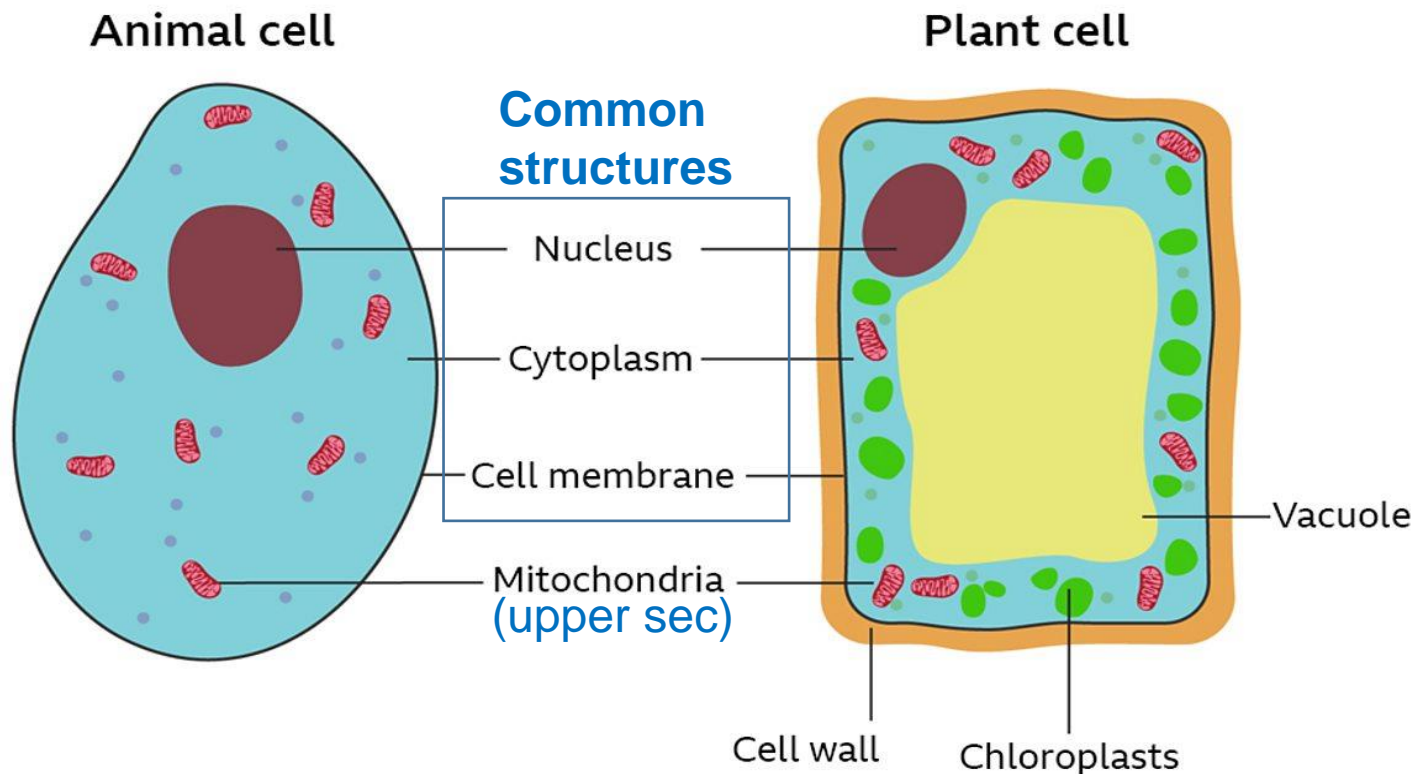
- Scientists study parts of a cell using a cell model.
- This allows scientists to:
  1. Identify possible diseases or disorders in a person
  2. Determine if the cell is an animal or plant cell



# What is inside a typical cell?

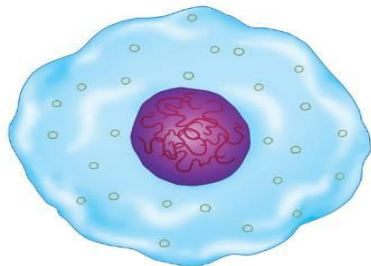
- Cells can be broadly categorised into plant and animal cells.
- The following are common structures present in both plant and animal cells.

## Common structures present in Plant & Animal Cells



Structure	Function
<p><b>Cell membrane</b></p> <ul style="list-style-type: none"> <li>A thin and <u>partially permeable</u> membrane surrounding the cells of <u>both</u> plants and animals.</li> </ul>	<ul style="list-style-type: none"> <li><u>Controls</u> the substances <u>entering</u> and <u>leaving</u> the cell <ul style="list-style-type: none"> <li>➤ Generally allows glucose, water and oxygen to <u>enter</u></li> <li>➤ Generally allows waste products to <u>leave</u></li> </ul> </li> <li>Serves as a <u>boundary</u> between the cell and external environment.</li> </ul>

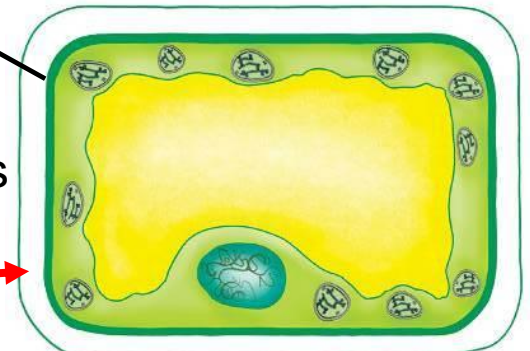
**Animal cell**



**Cell membrane**

Cell membrane is beneath cell wall in plant cells

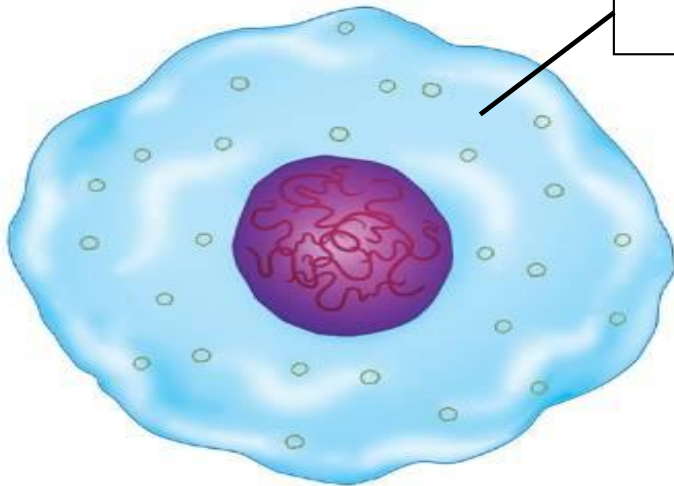
**Plant cell**



**Cell wall (not cell membrane)**

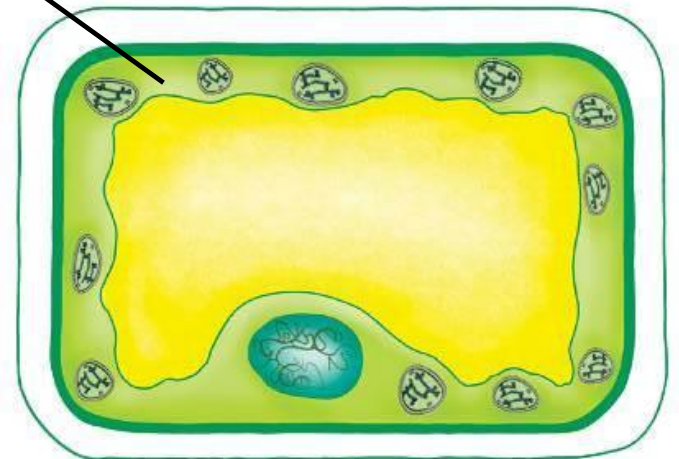
Structure	Function
<p><b>Cytoplasm</b></p> <ul style="list-style-type: none"> <li>• A jelly-like substance within the cell that contains many organelles.</li> </ul>	<ul style="list-style-type: none"> <li>• Contains vacuoles to <u>store food</u></li> <li>• Site where many <u>chemical</u> reactions take place</li> </ul>

**Animal cell**



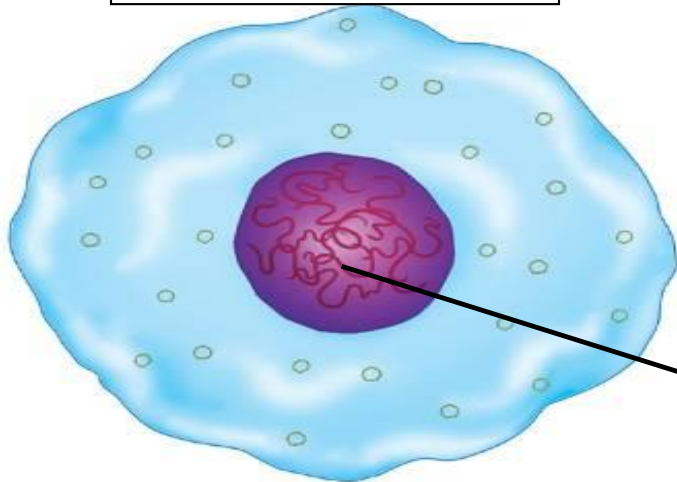
**Cytoplasm**

**Plant cell**

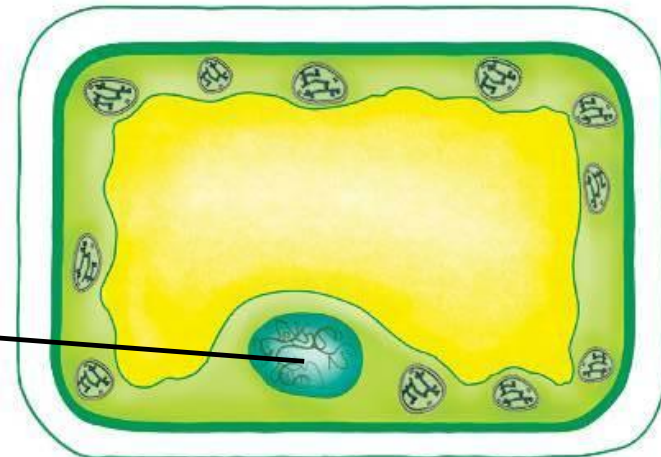




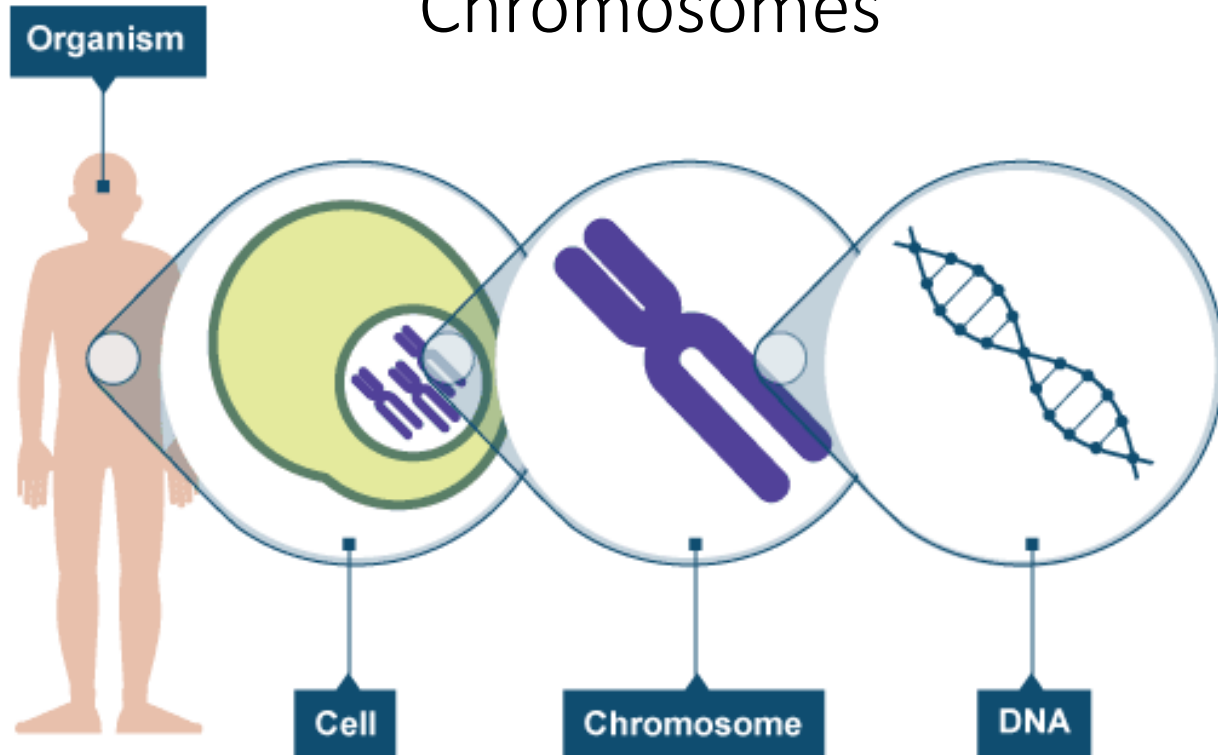
Structure	Function
<p><b>Nucleus</b></p> <ul style="list-style-type: none"> <li>• Spherical shape</li> <li>• Largest structure in animal cell</li> <li>• Contains <u>chromosomes</u> which carry genetic information</li> </ul> <p>Animal cell</p>	<ul style="list-style-type: none"> <li>• Controls <u>cell activities</u> (eg. repair of worn-out parts)</li> <li>• Responsible for <u>cell reproduction / cell division</u></li> </ul> <p>Plant cell</p>



Nucleus



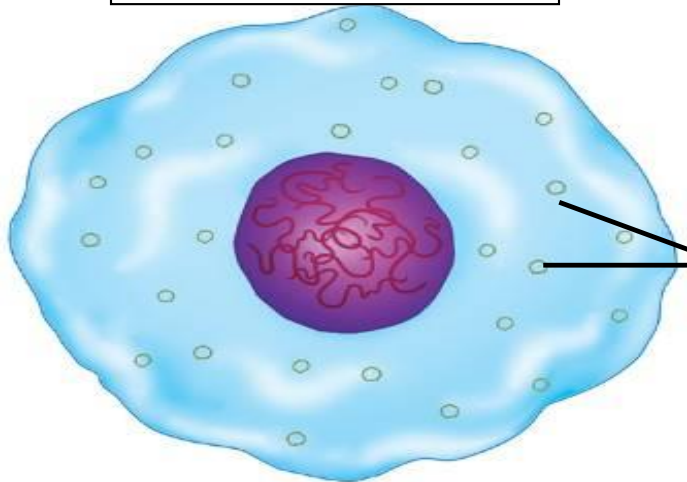
# Chromosomes



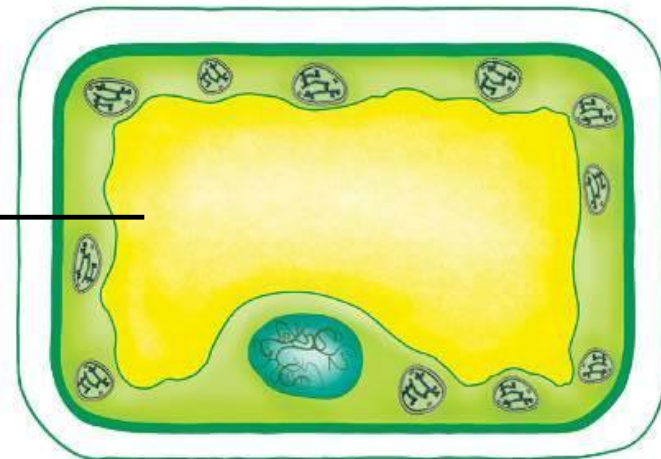
- Long **thread-like** structures found in nucleus
- Contains **genes** that carry genetic material
- (DNA - deoxyribonucleic acid) to be passed down from parents to offspring

Structure	Function
<b>Vacuole</b> <ul style="list-style-type: none"> <li>• Fluid-filled spaces surrounded by membranes</li> <li>• Found in the cytoplasm</li> </ul>	Stores water and other nutrients <ul style="list-style-type: none"> <li>• <u>Small and numerous</u> in animal cells.</li> <li>• <u>One large and central</u> vacuole in plant cells.</li> </ul>

Animal cell



Plant cell

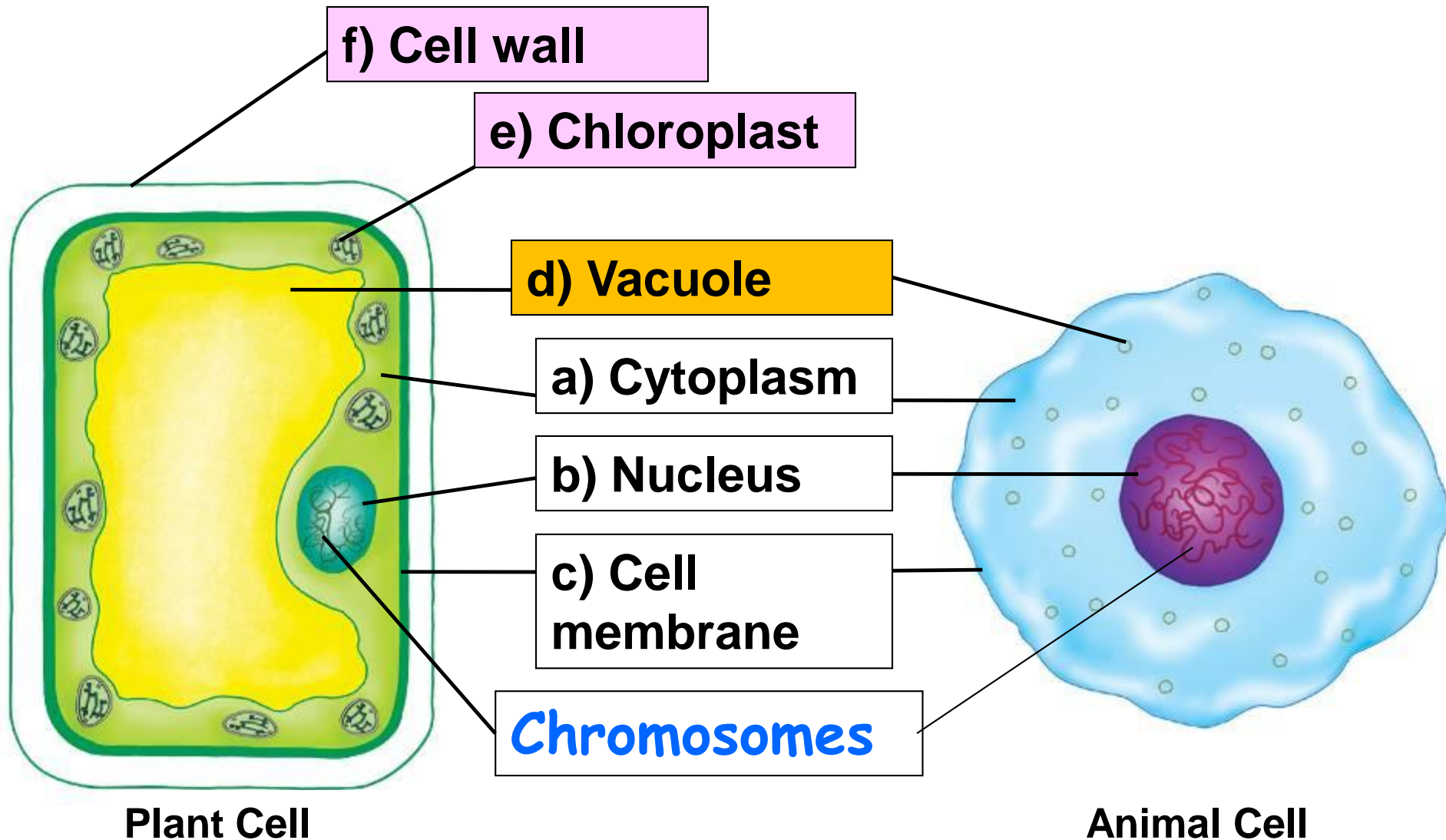


Vacuole

# **Similarities and Differences between Animal and Plant Cells**

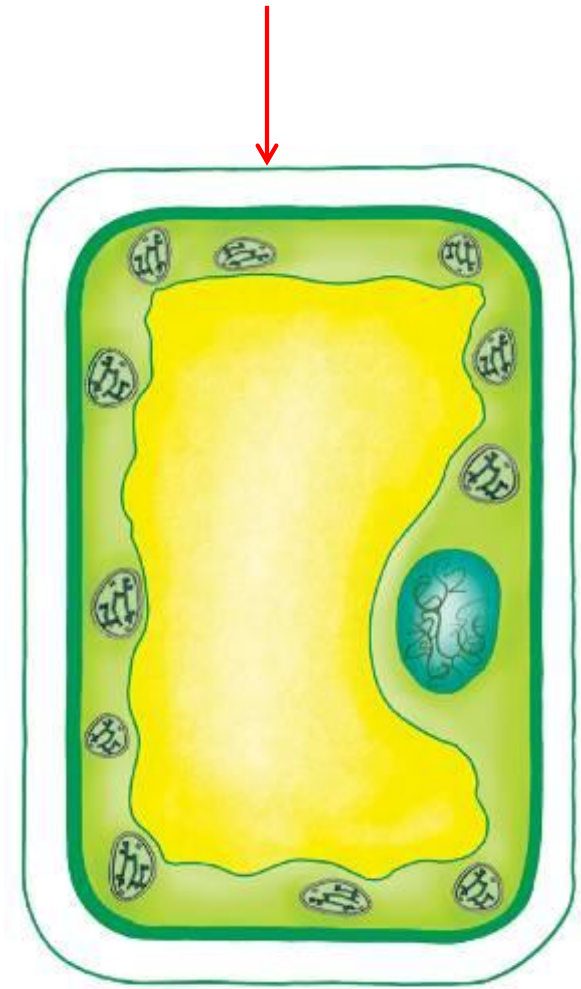


# Similarities and Differences between Animal and Plant Cells



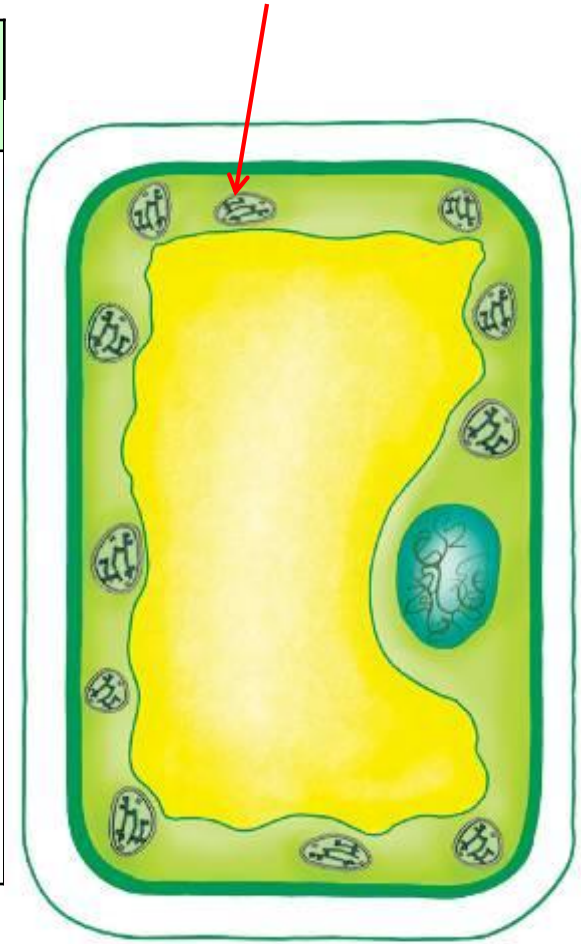
# Structure in Plant Cell - **CELL WALL**

Structure	Function
<p>Cell Wall</p> <ul style="list-style-type: none"><li>- Thick layer surrounding cell membrane</li><li>- Made up of <u>cellulose</u></li><li>- <u>Fully permeable</u> to substances</li></ul>	<ul style="list-style-type: none"><li>• <u>Supports</u>, <u>protects</u> and gives <u>shape</u> to the cell.</li></ul>



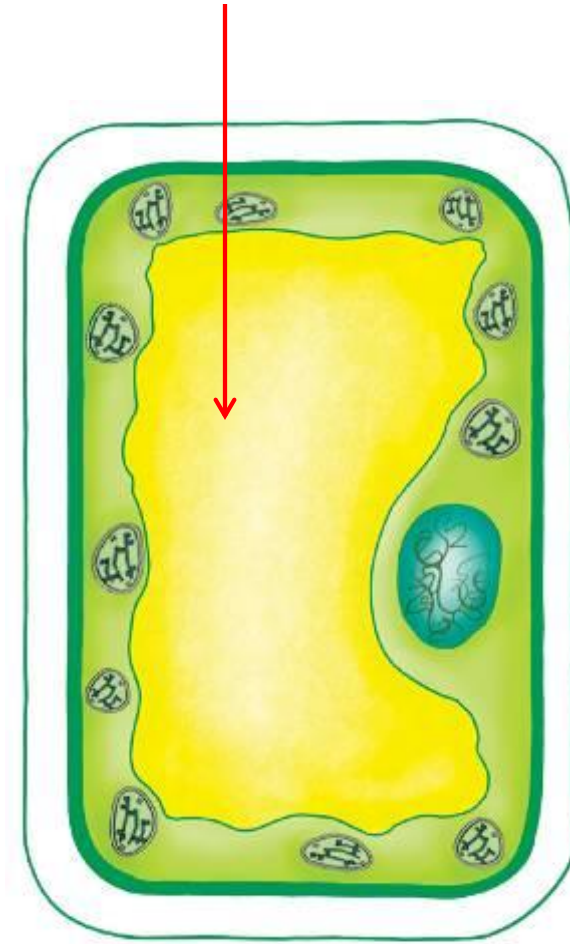
# Structure in Plant Cell - CHLOROPLASTS

Structure	Function
<p>Chloroplasts</p> <ul style="list-style-type: none"><li>Contains the green pigment, <u>chlorophyll</u></li></ul>	<ul style="list-style-type: none"><li>Chlorophyll is needed for <u>absorption</u> of <u>sunlight</u> required for <u>photosynthesis</u>.</li></ul>









# Structure in Plant Cell - **VACUOLE**

Structure	Function
<p>Vacuole</p> <ul style="list-style-type: none"><li>- Usually a <b><u>single large</u></b> fluid filled space surrounded by a membrane.</li></ul>	<ul style="list-style-type: none"><li>• Filled with <b><u>cell sap</u></b>, which contains water and dissolved minerals.</li></ul>





# Try Yourself ....

Feature	Plant cell	Animal cell
Cell wall		
Number and size of vacuoles		
Chloroplast		

# CELL ORGANISATION



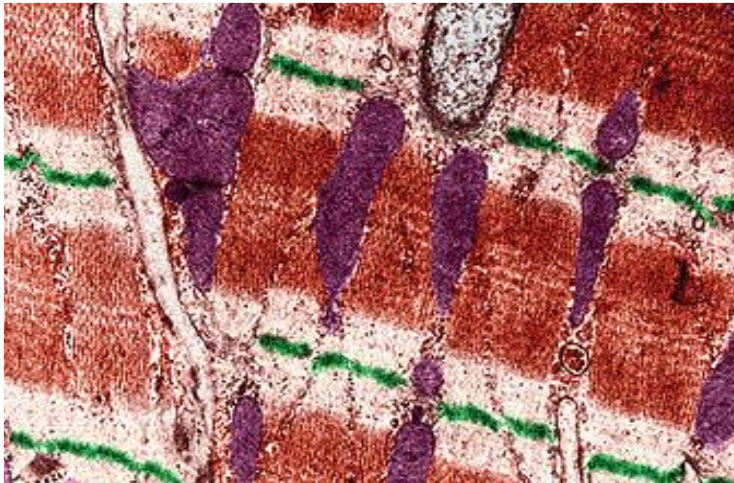
- Cells with specific functions are organised into tissues.
- Different tissues are in turn grouped into organs.
- Many organs are then grouped into organ systems.  
Eg. A human body is made up of different organs such as the heart, liver and stomach. These organs work together and make the five main organ systems in your body – the **digestive system**, the **circulatory system**, the **respiratory system**, the **skeletal system** and the **muscular system**.
- All organ systems work together to enable organism to function properly.

## 6.3 Forming a Multicellular Organism



- 1) Most cells in multi-cellular organisms have specific functions

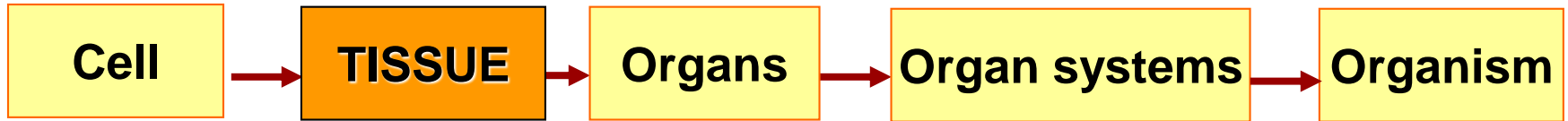
Human:



### **Heart muscle cells:**

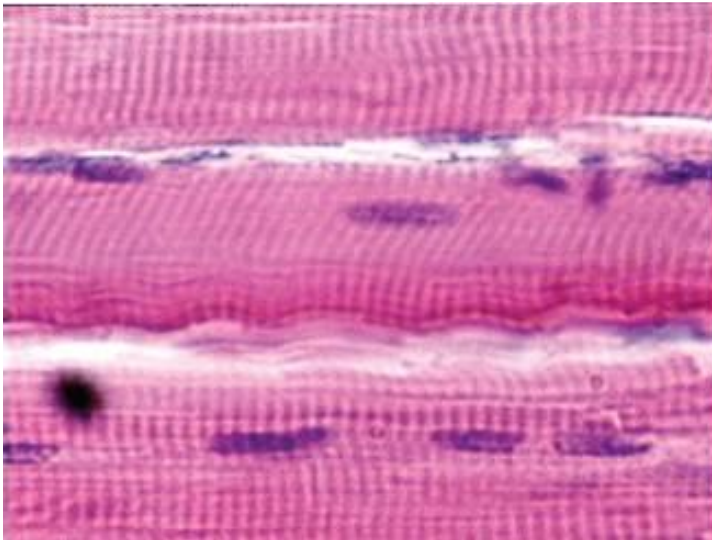
A single heart muscle cell contracts & relaxes rhythmically.

## 6.3 Forming a Multicellular Organism



2) Cells performing similar functions group together to form tissues.

Human:



### **Heart muscle tissue:**

Formed by heart muscle cells, this tissue contracts and relaxes rhythmically at a steady rate.



## 6.3 Forming a Multicellular Organism



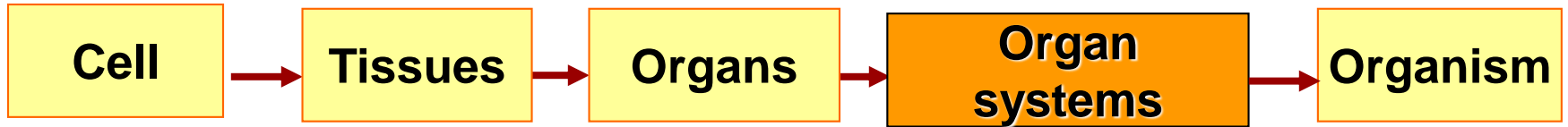
- 3) An **organ** is formed by different types of **tissues** working together to perform a specialised function.

Human:



**Heart:** An organ formed by muscle tissue, blood vessels, nerve tissue and connective tissue.  
It pumps oxygen-rich blood to all the cells in the body.

## 6.3 Forming a Multicellular Organism



4) Organs with related functions coordinate for a specialised purpose to form an **organ system**.

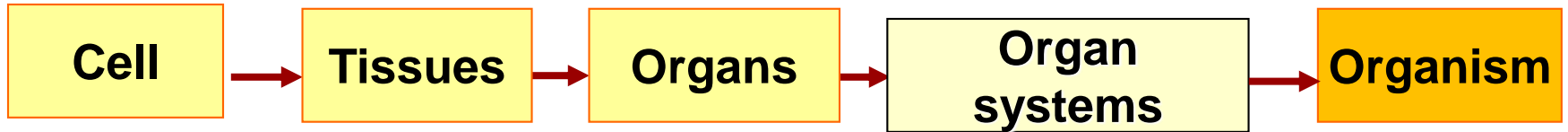
Human:



**Circulatory system:**

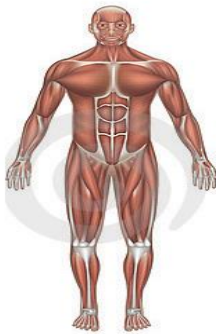
The heart, arteries and veins work together to transport blood to all parts of the body.

## 6.3 Forming a Multicellular Organism



- 5) All the organ systems work together to enable the organism to function properly.

Human:



**Human Body:** Circulatory system works with other organ systems to ensure that the human body functions properly.

## 6.3 Forming a Multicellular Organism

Another example: Plant



Plant:



### **Leaf Tissue:**

Formed by regularly shaped plant cells. It makes food through photosynthesis.



## 6.3 Forming a Multicellular Organism

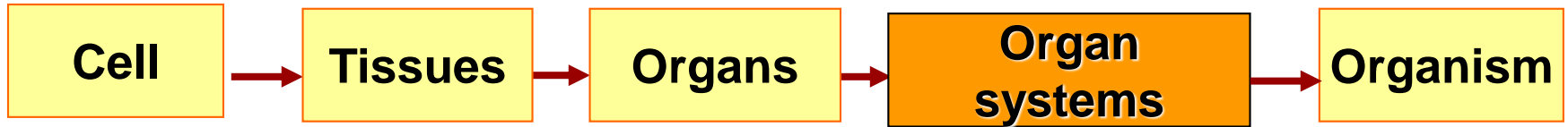


Plant:



**Leaf:** An organ formed by different leaf tissues. It is where food substances are formed.

## 6.3 Forming a Multicellular Organism



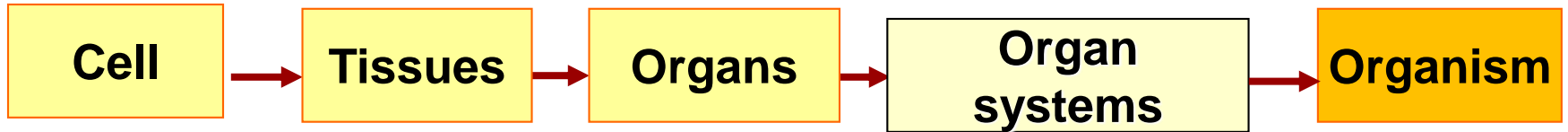
Plant:



**Root system:** Takes in water and dissolved minerals from the soil into the plant.

**Shoot system:** transports water to the leaf.

## 6.3 Forming a Multicellular Organism

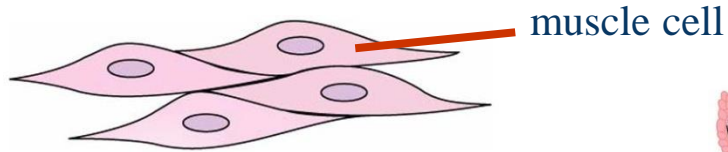


Plant:

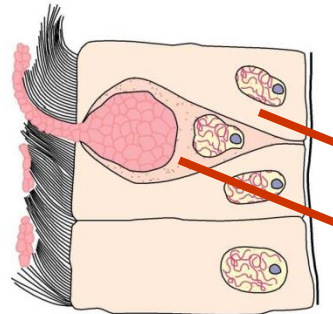


**Plant:** The shoot and root systems work together to help the plant grow and function

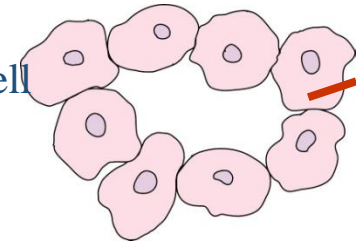
A group of cells work together to form a **tissue**.  
The following are different examples of various tissues.



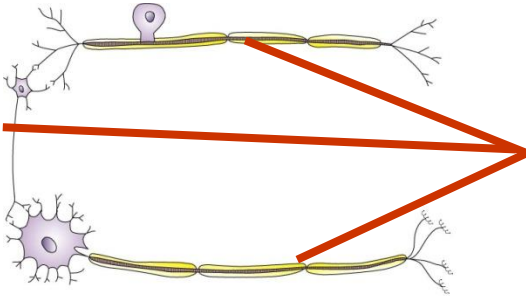
muscle tissue made up of muscle cells



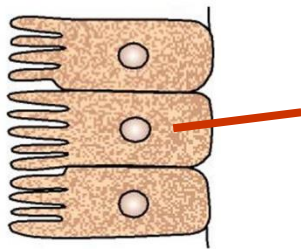
epithelium in the trachea (tissue) made up of epithelial cells and gland cells



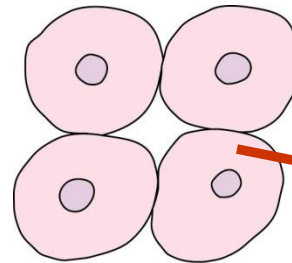
epithelium in the lungs (tissue) made up of epithelial cells



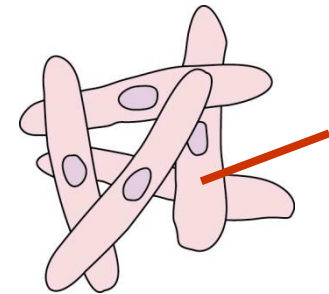
nervous tissue made up of neurones (nerve cells)



intestinal epithelium (tissue) made up of intestinal epithelial cells

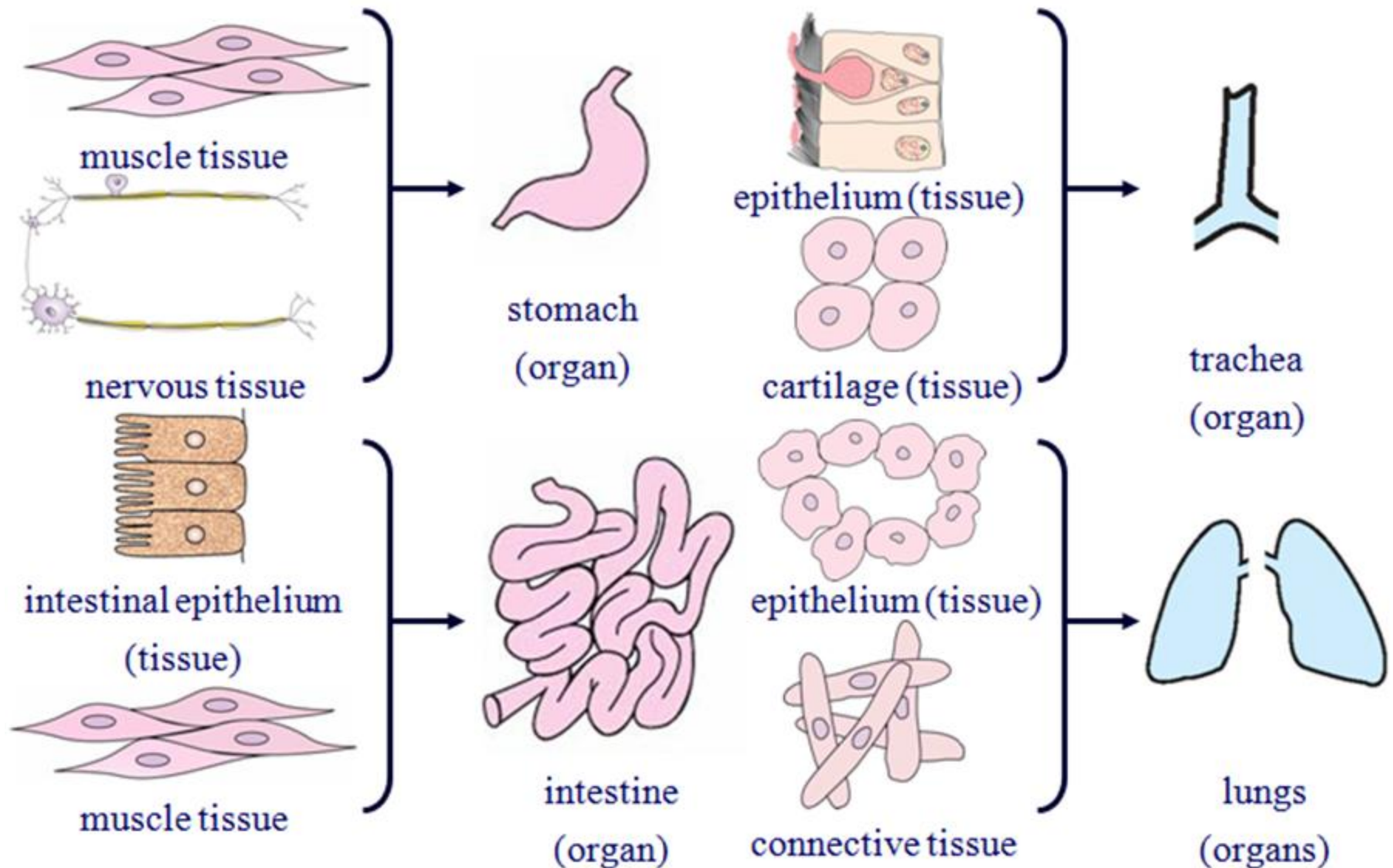


cartilage in the trachea (tissue) made up of connective tissue cells

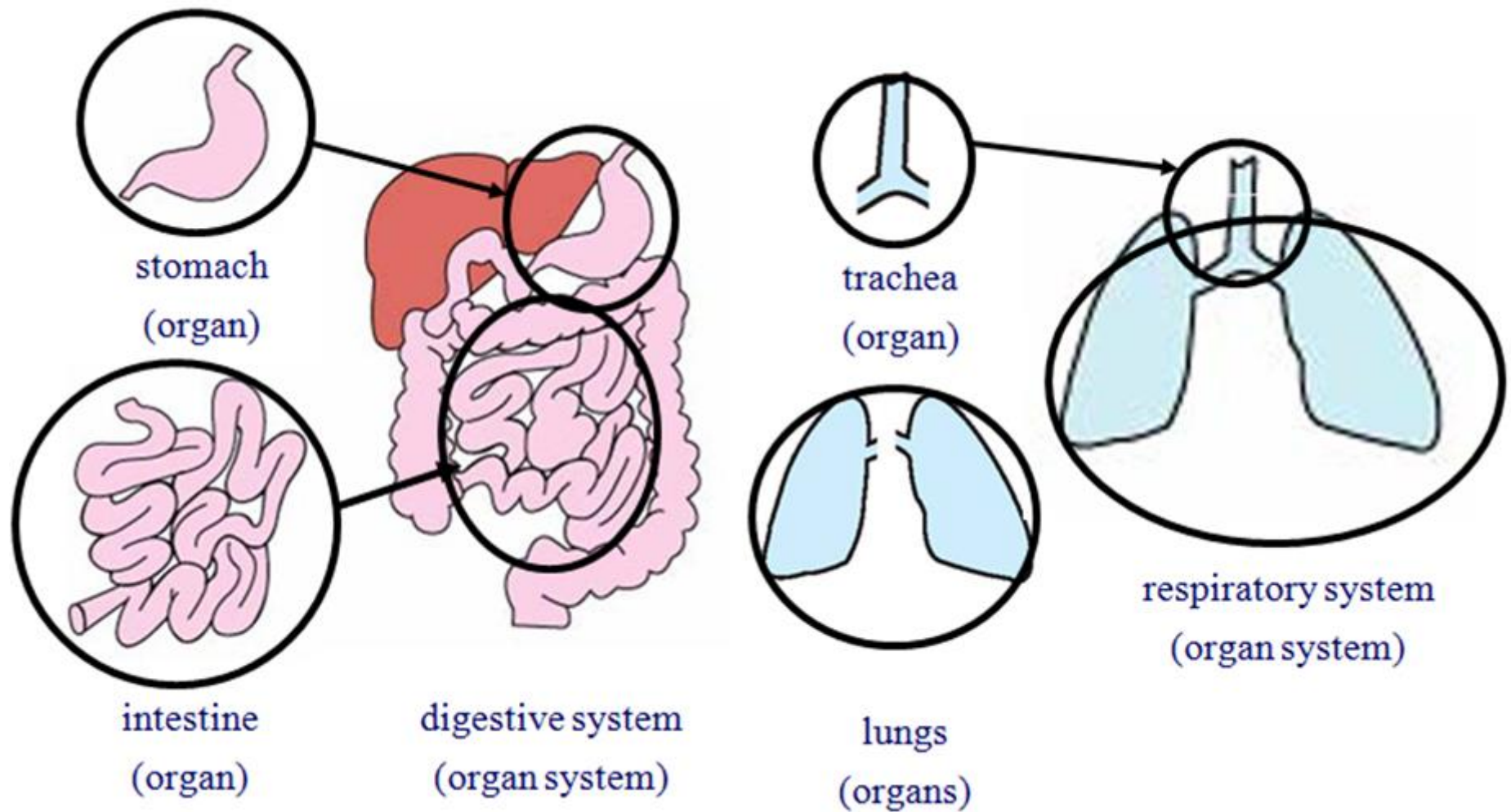


connective tissue in the lungs made up of connective tissue cells

# Different tissues group together to form an **organ**.



Several organs work together to form an **organ system**.



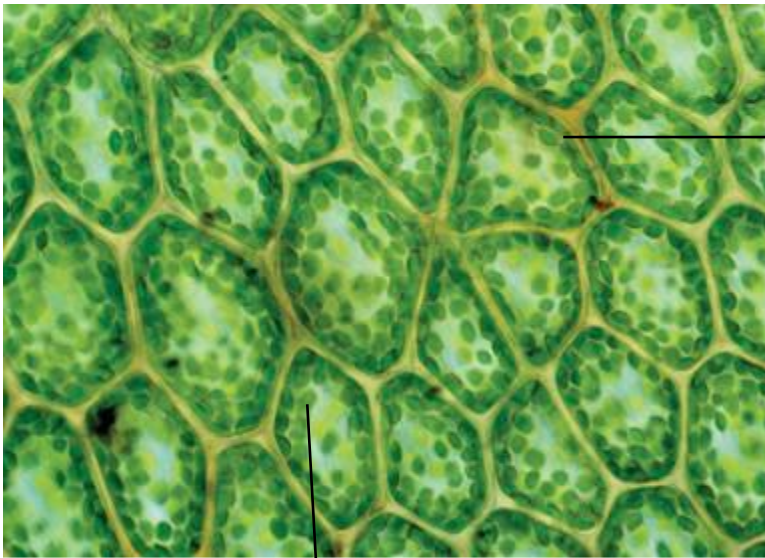


## 6.4 Division of Labour

**Division of labour** is the breakdown of work into smaller and more specific tasks for maximum efficiency.

# Division of Labour in Cells

- Each part of a cell is specially designed to carry out its specific role.



Cell membrane

- Cell membrane regulates substances that enter and leave the cell
- Water needed by photosynthesis can pass through cell membrane.

Chloroplast

- Chloroplasts allow the plant cells to carry out photosynthesis to make its own food.

# Division of Labour in Multicellular organisms

- Work is divided among each type of cell, tissue and organ to ensure body receive sufficient oxygen and energy

**Lungs in our respiratory system take in oxygen which helps release energy from our food intake.**

**Muscle tissue in our muscular system uses the released energy to contract and relax**



**Heart in our circulatory system pumps blood around the body.**

**Red blood cells in blood transport oxygen to all parts of the body**

# Division of Labour in Multicellular organisms

- Work is divided among each type of cell, tissue and organ to ensure body receive sufficient oxygen and energy

**Eg. Lungs in our respiratory system take in oxygen which helps release energy from our food intake.**

**Muscle cells contract and relax to bring about movement.**



**Cardiac muscle cells pumps blood around the body.**

**Red blood cells in blood transport oxygen to all parts of the body**

# Essential Takeaways

- Typical plant and animal cell models represent various types of cells.
- Cells are organised into tissues, organs and systems that make up a multi-cellular organism. This helps to explain the various processes occurring in our body.
- We can infer whether an organism is an animal or plant based on its cellular composition.