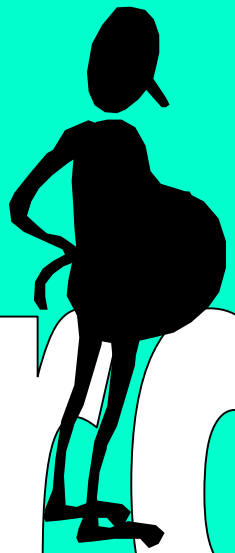
Glenlola Collegiate School

excellence through commitment, contribution and caring

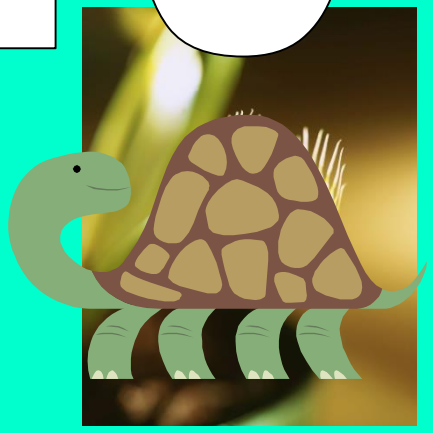
1.1

cells

All living things are made of cells and show 7 characteristics of life



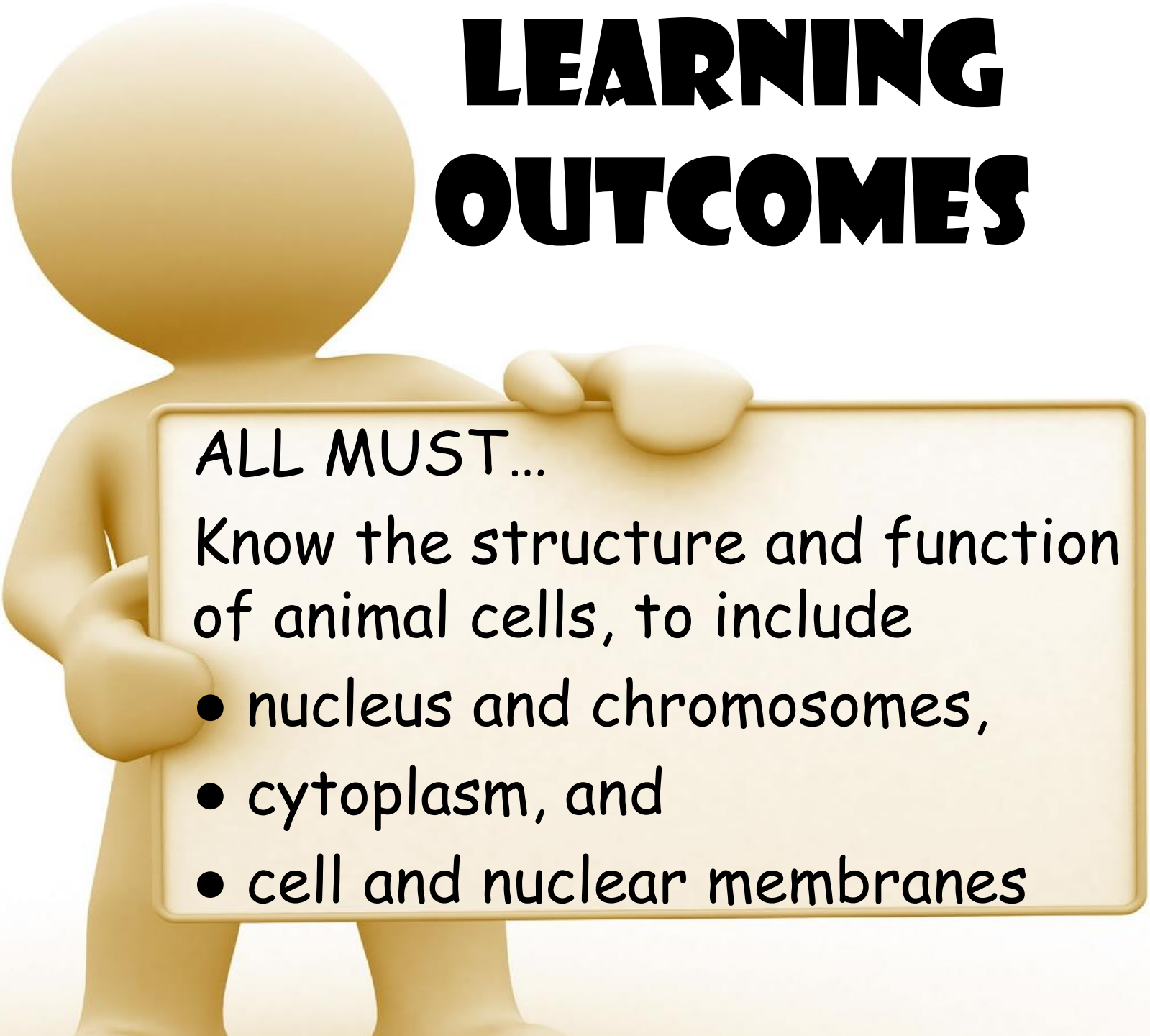
mrs nerg



starter activity

- View the pictures of animal, plant and bacteria cells.
- Use the pictures and your knowledge of cells from Y8 to make a list of the similarities and differences
- Share your list with your pair & class.

LEARNING OUTCOMES

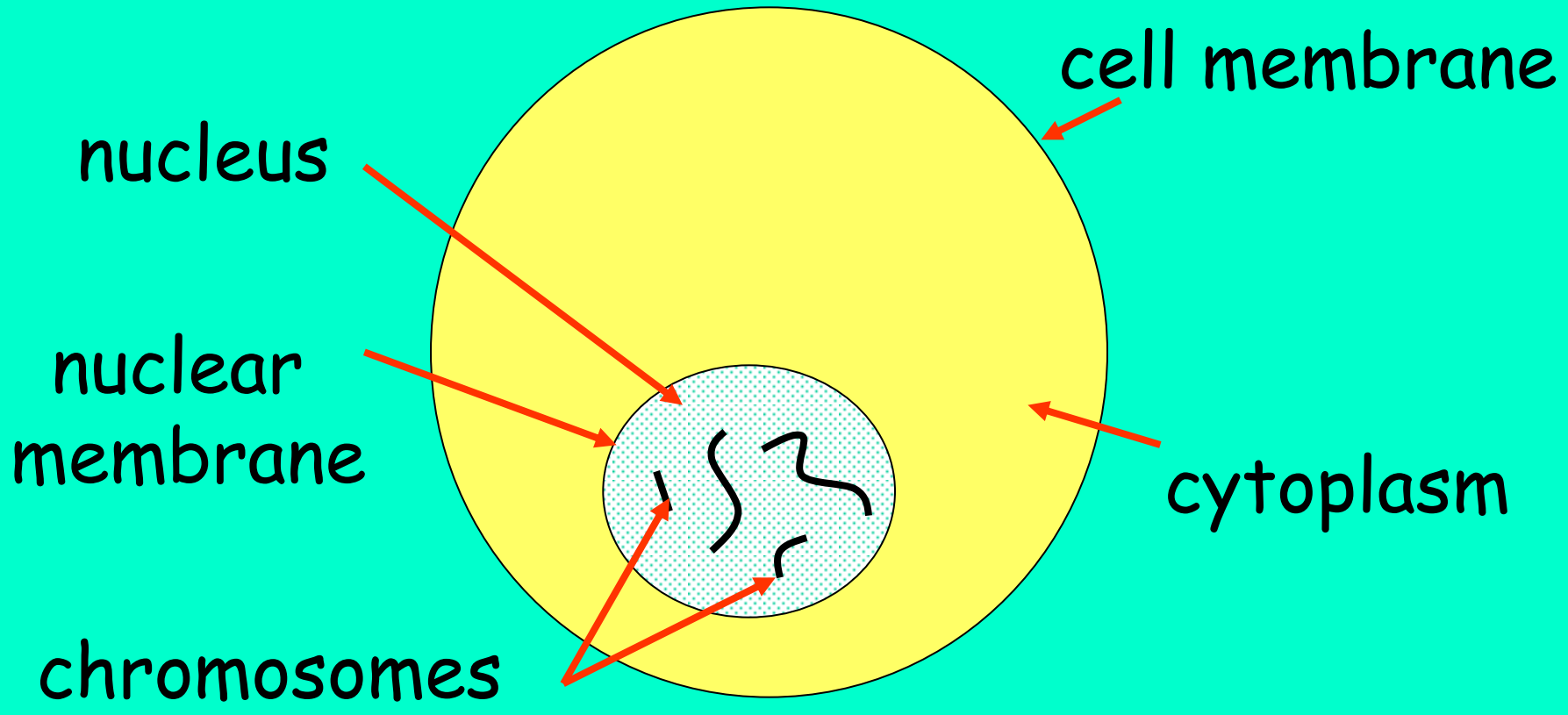


ALL MUST…

Know the structure and function of animal cells, to include

- nucleus and chromosomes,
- cytoplasm, and
- cell and nuclear membranes

animal cells



nucleus

Contains **chromosomes** made up of long lengths of **DNA** that code for many characteristics

Short lengths of DNA on a chromosome form genes that code for a single characteristic

cytoplasm

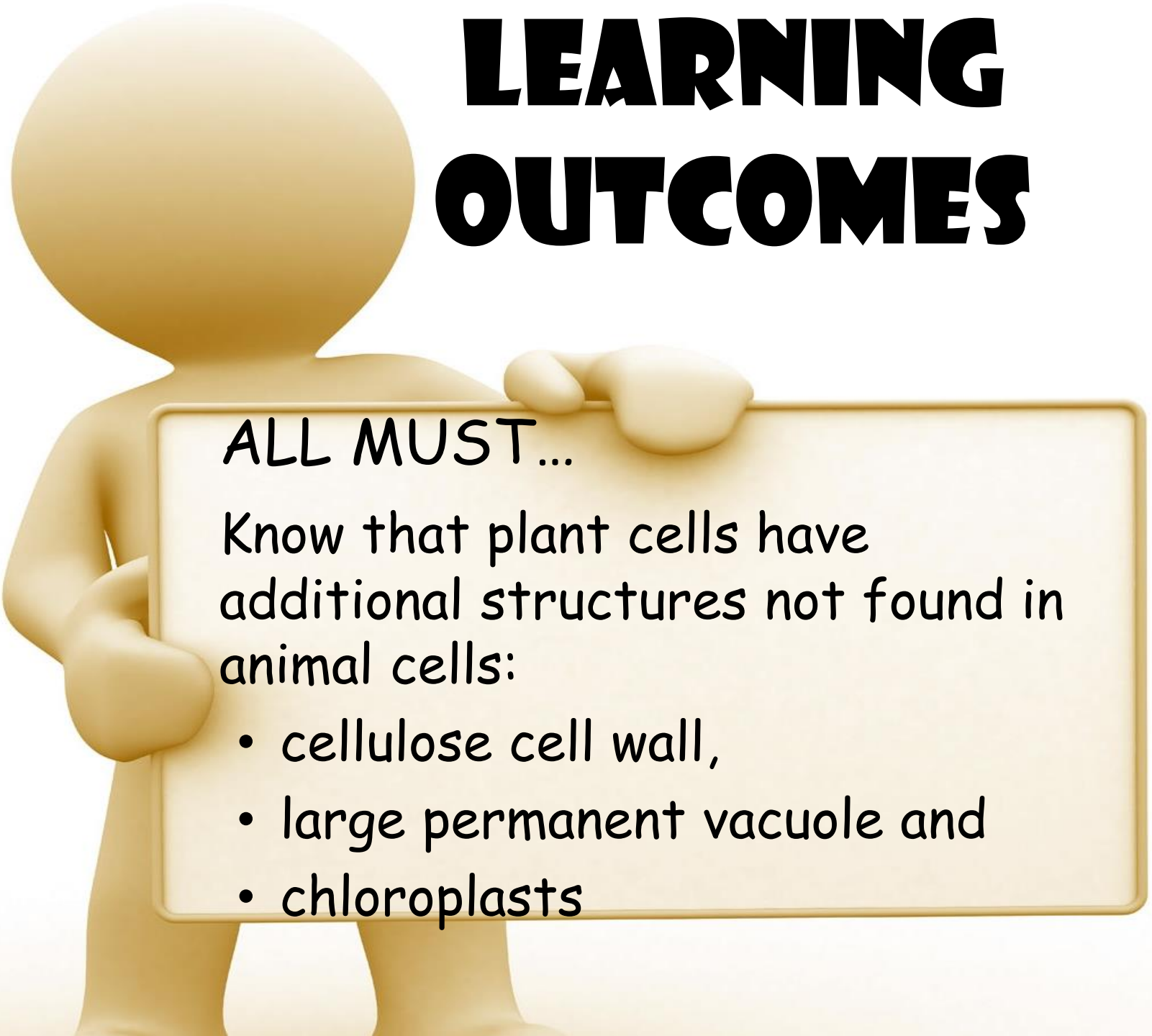
Chemical reactions occur here

cell membrane

Controls movement of substances **in + out of cell**

It is **selectively permeable** as only some substances can pass through.

LEARNING OUTCOMES



ALL MUST…

Know that plant cells have additional structures not found in animal cells:

- cellulose cell wall,
- large permanent vacuole and
- chloroplasts

plant cells

The **cell membrane**, **cytoplasm**, **nucleus**, **nuclear membrane** and **chromosomes** found in animal cells are also found in plant cells.
Plant cells also contain:

cell wall

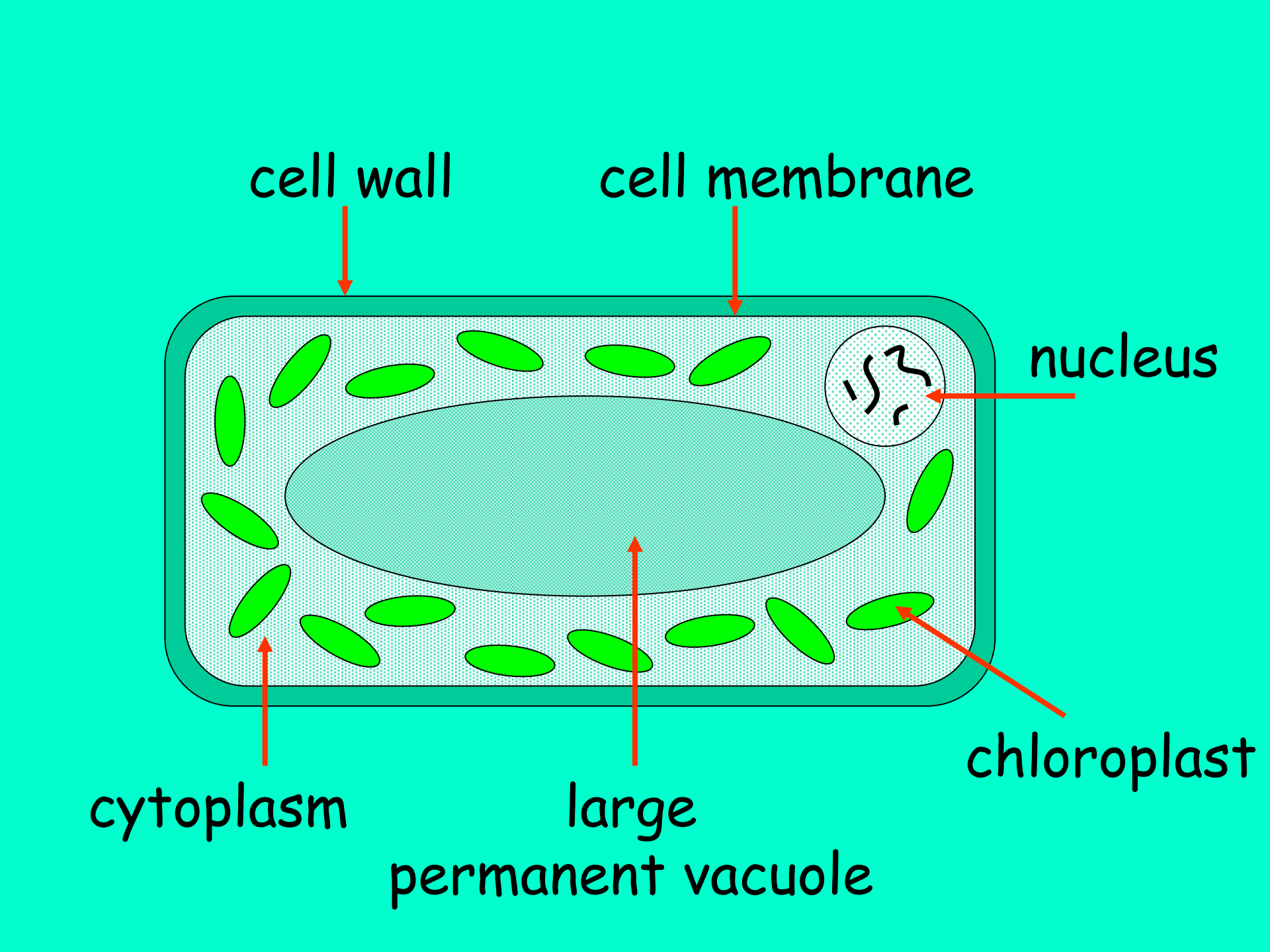
Made of **cellulose**
Provides support and protection, fully permeable

chloroplast

Contains **chlorophyll** to trap sunlight for **photosynthesis** to make glucose

large permanent vacuole

Stores water and sugars as sap and provides shape + **support**


cell wall
cell membrane
nucleus
chloroplast
cytoplasm
large permanent vacuole

bacterial cells

These are very simple cells, they have a **cell membrane** and **cytoplasm** but have a number of differences to plant and animal cells. They have:

cell wall

NOT made of cellulose
Provides support and protection, fully permeable

A loop of DNA is found loose in the cytoplasm

no nucleus

plasmids

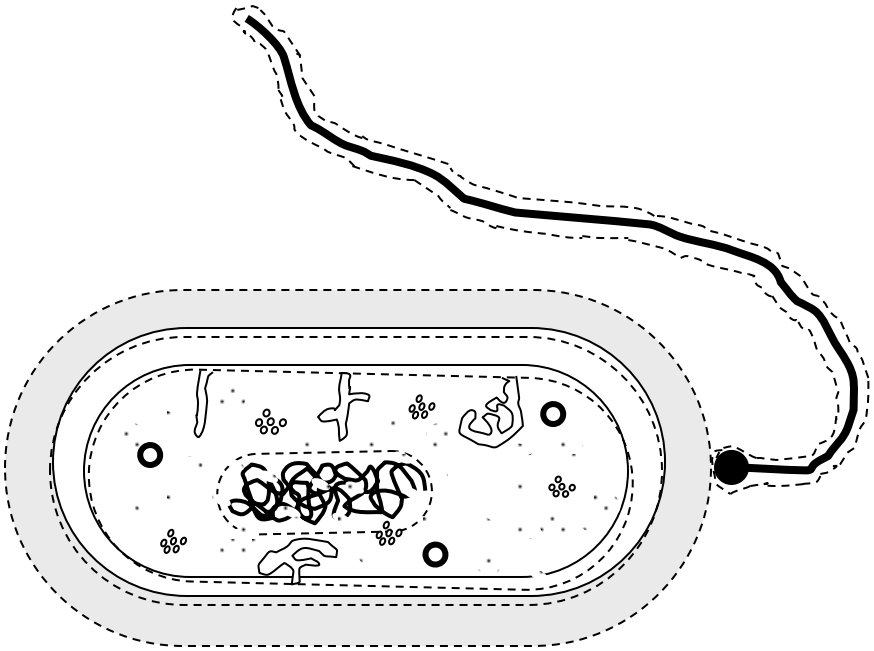
Smaller rings of DNA that contain genetic information

Plasmid
circular piece of DNA

cell wall
a thick strong layer containing murein (not cellulose)

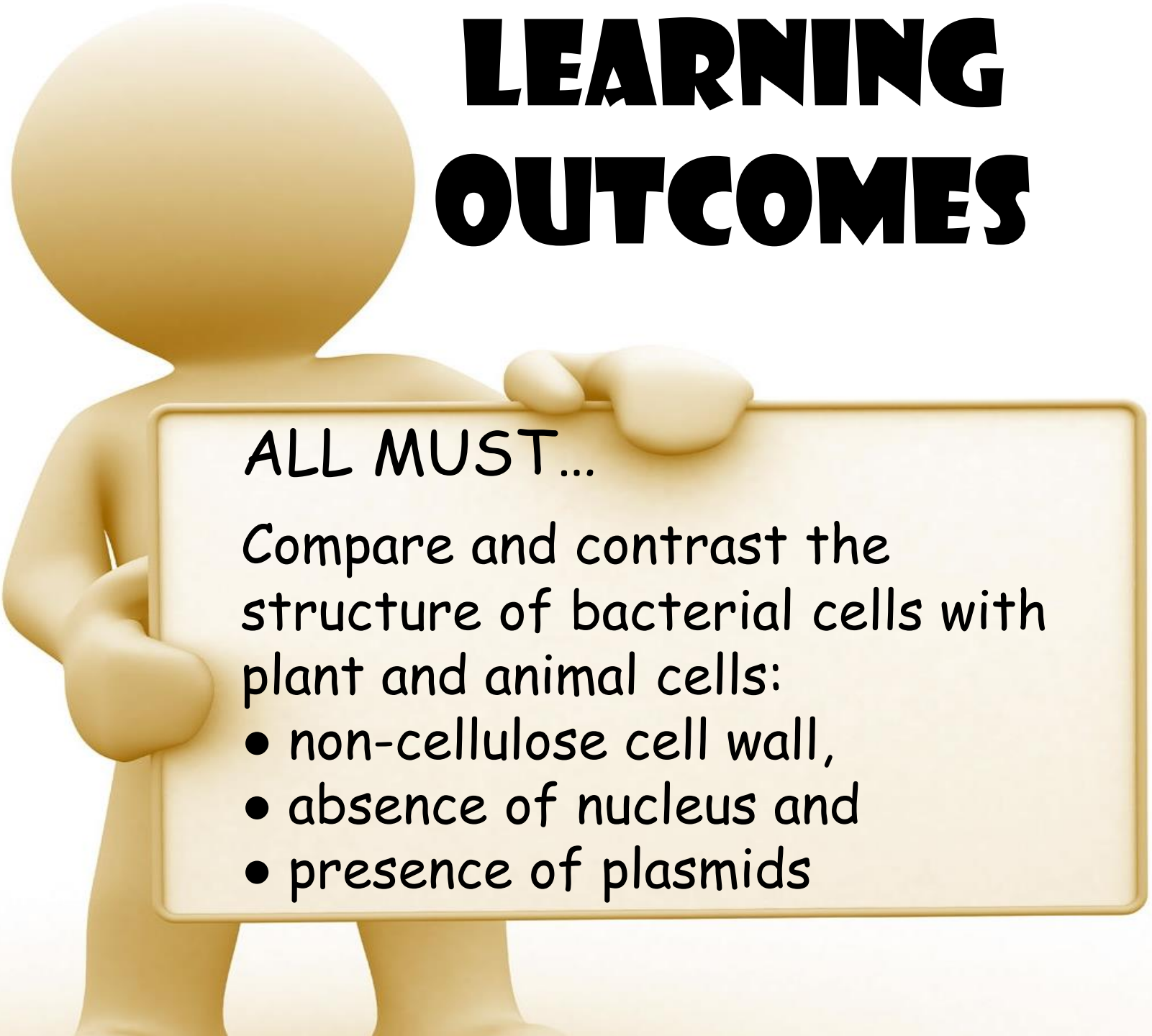
cell membrane
lies between cytoplasm and cell wall

DNA
long coiled loop of genetic material lies free in the cytoplasm



flagellum
tail enables bacterium to move (not always present)

LEARNING OUTCOMES



ALL MUST…

Compare and contrast the structure of bacterial cells with plant and animal cells:

- non-cellulose cell wall,
- absence of nucleus and
- presence of plasmids

similarities and differences between animal, plant and bacterial cells

Structure	Animal cell	Plant cell	Bacterial cell
Cell membrane	✓	✓	✓
Cytoplasm			
Nucleus			
Chromosomes			
Nuclear membrane			
Cell wall			
Large permanent vacuole			
Chloroplast			
Plasmid			

similarities and differences between animal, plant and bacterial cells

Structure	Animal cell	Plant cell	Bacterial cell
Cell membrane	✓	✓	✓
Cytoplasm	✓	✓	✓
Nucleus	✓	✓	✗
Chromosomes	✓	✓	✗
Nuclear membrane	✓	✓	✗
Cell wall	✗	✓	✓
Large permanent vacuole	✗	✓	✗
Chloroplast	✗	✓	✗
Plasmid	✗	✗	✓

VIDEO CLIPS

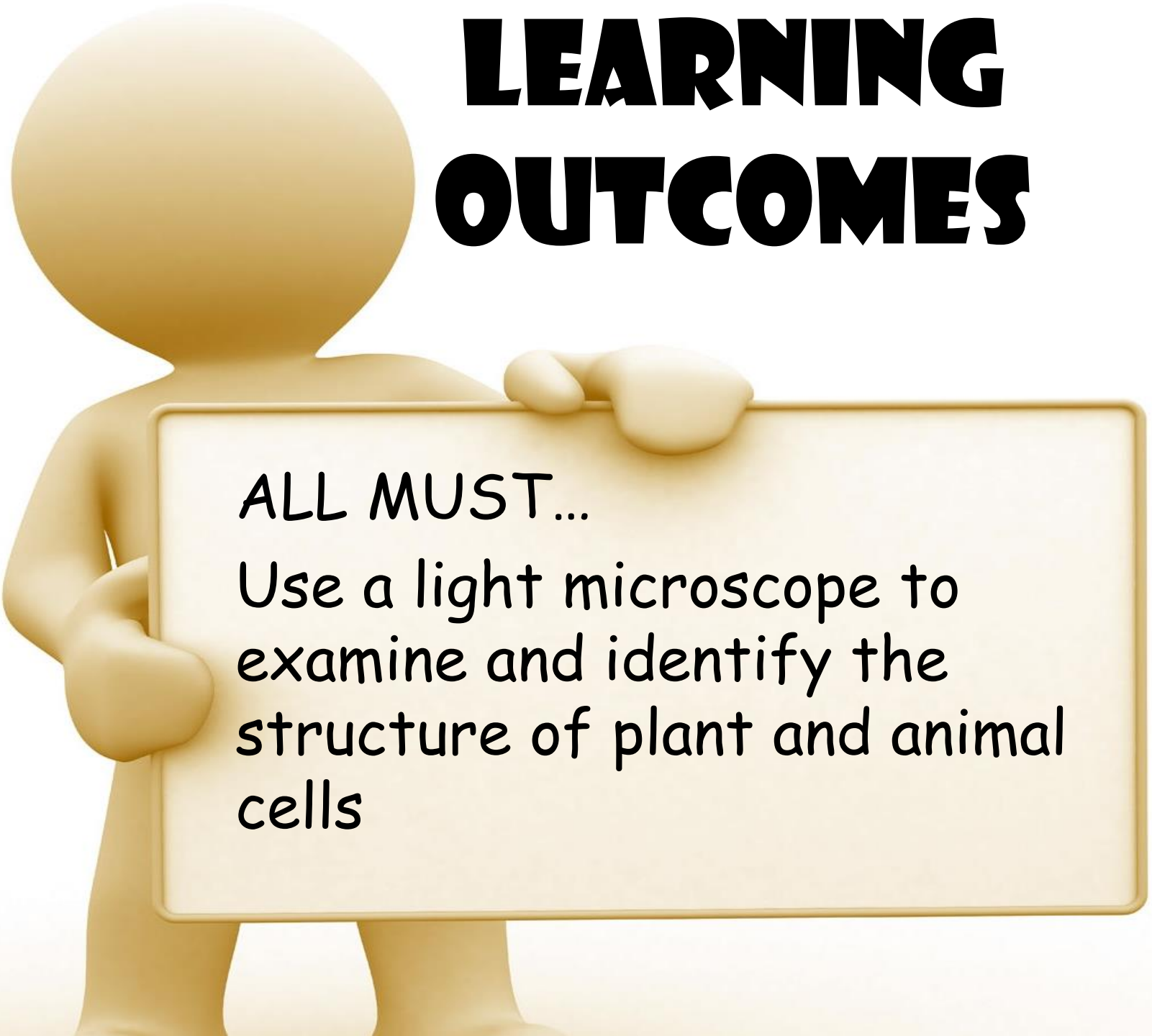
1832 cells & their function

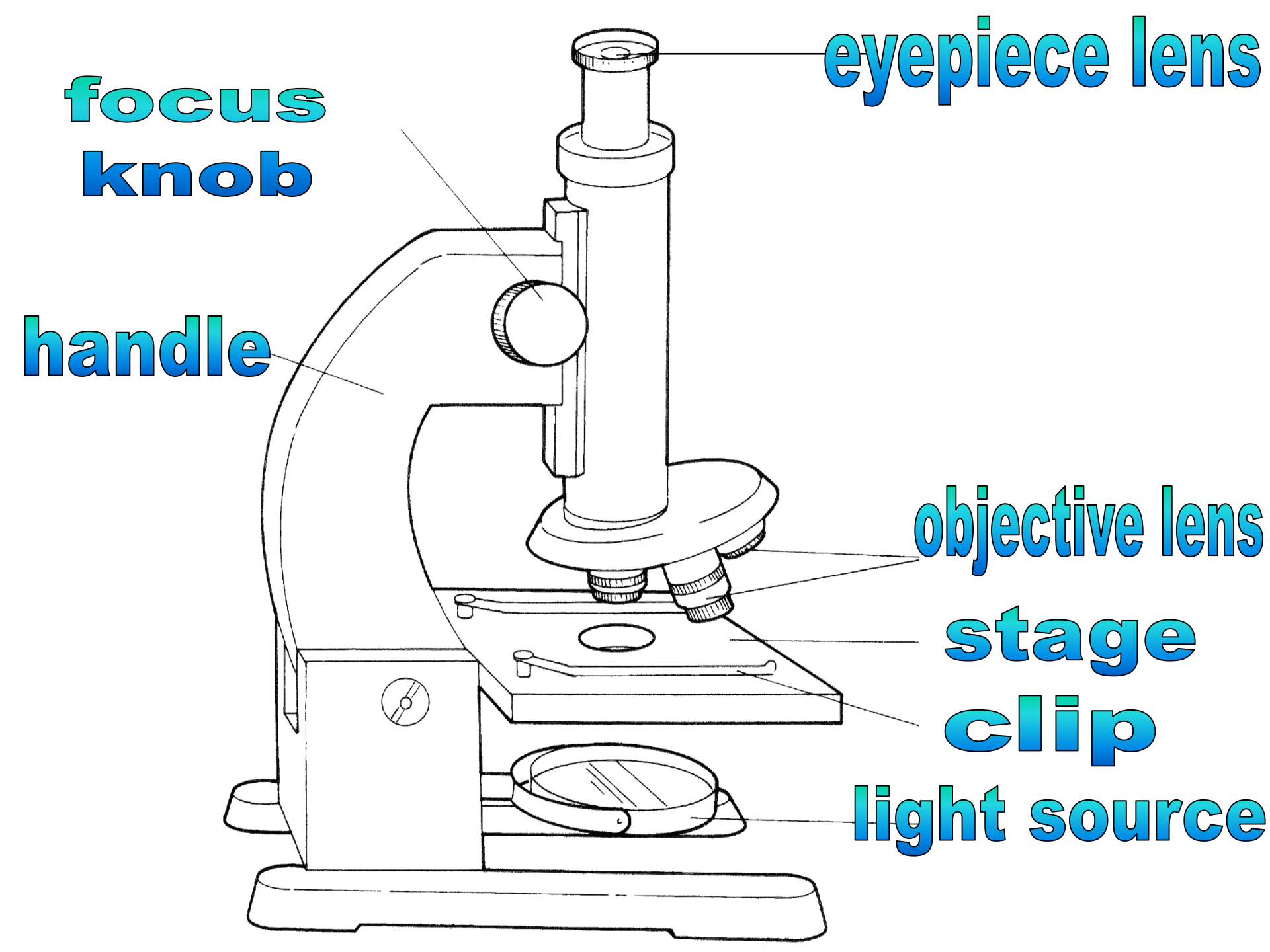
4188 plant & animal cells

http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/

Chose: cells

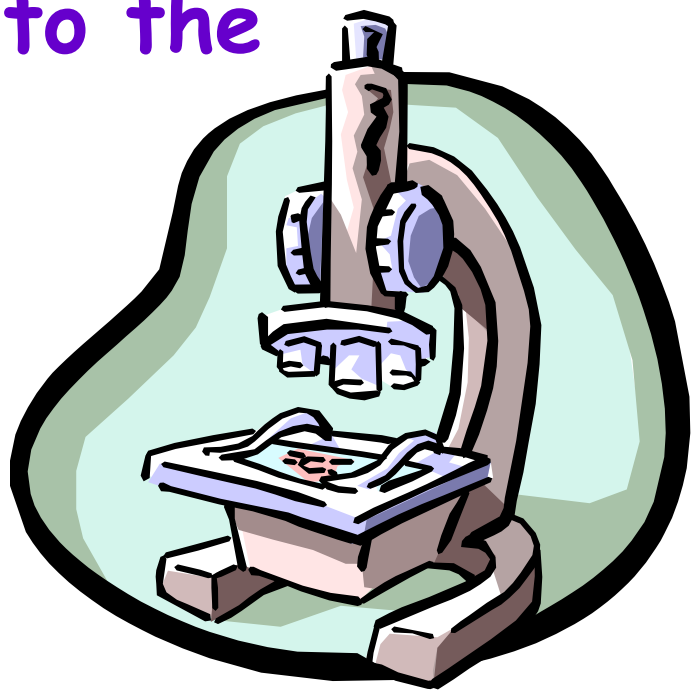
LEARNING OUTCOMES



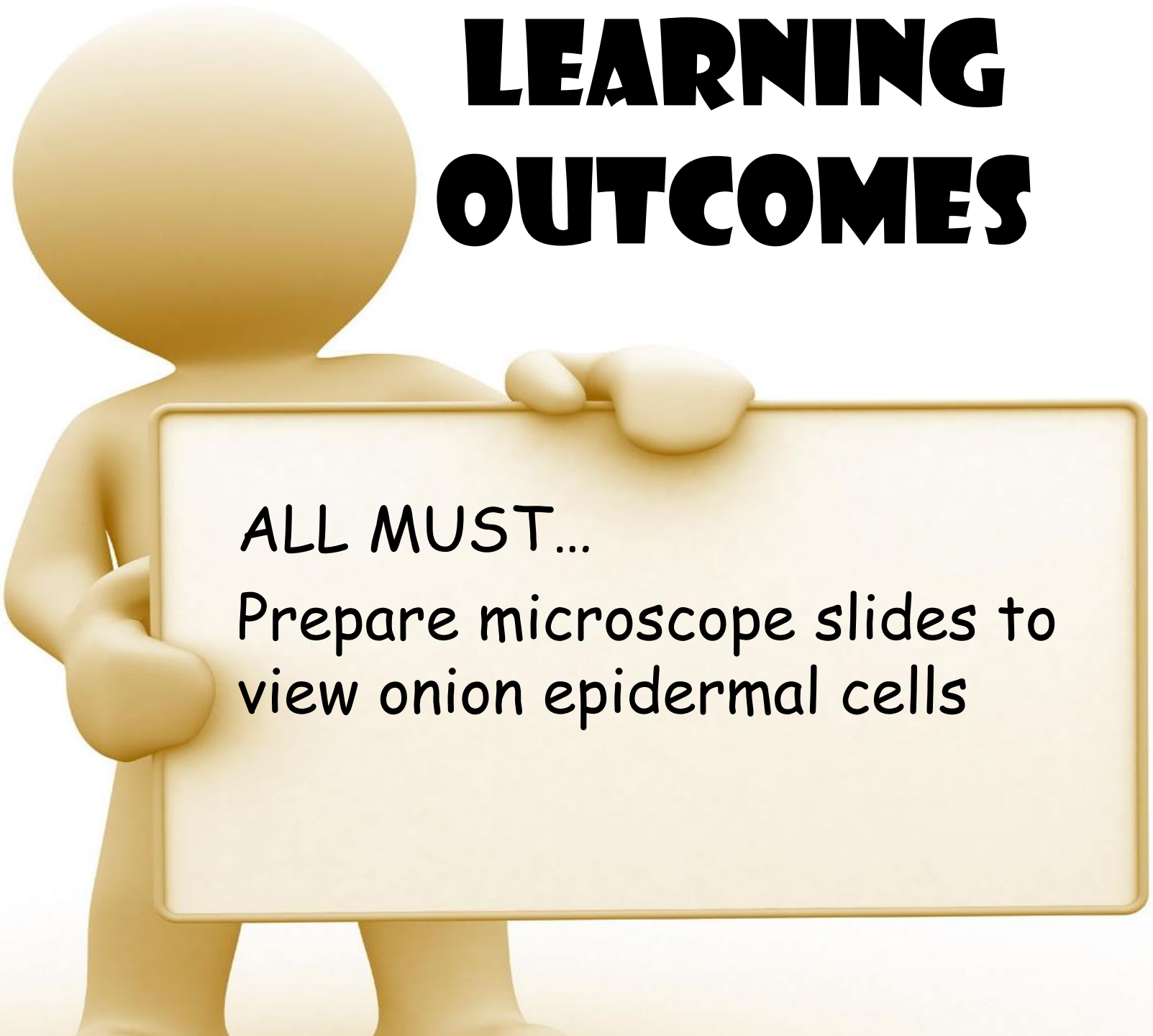

eyepiece lens
focus knob
handle
objective lens
stage
clip
light source

The Microscope

- When viewing objects start with **the low power objective lens first**
- This ensures you **can locate the object**
- It also **prevents damage to the objective lens**



LEARNING OUTCOMES



ALL MUST…

Prepare microscope slides to view onion epidermal cells

QUESTION 1A & B HOMEWORK BOOKLET

Magnification

This is the extent to which an object has been enlarged.

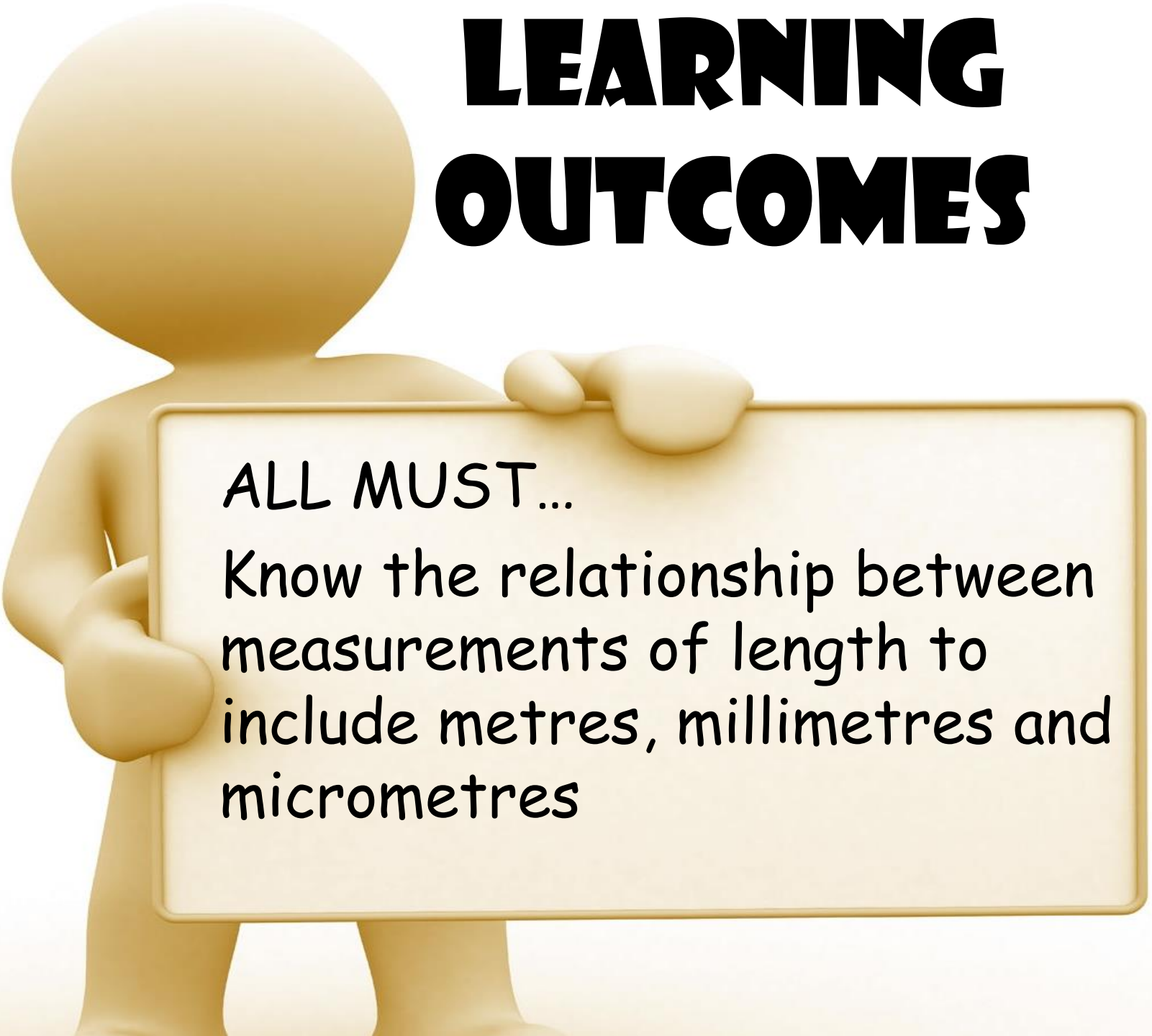
TO FIND THE MAGNIFICATION FROM A MICROSCOPE

$$\text{Magnification} = \text{mag of eyepiece lens} \times \text{mag of objective lens}$$

So nerve cell viewed using the
X4 objective lens and X10 eyepiece
will be magnified X40 (4X10)

Using X10 objective lens and same eyepiece
They will be magnified
X100 (10 X 10)

LEARNING OUTCOMES

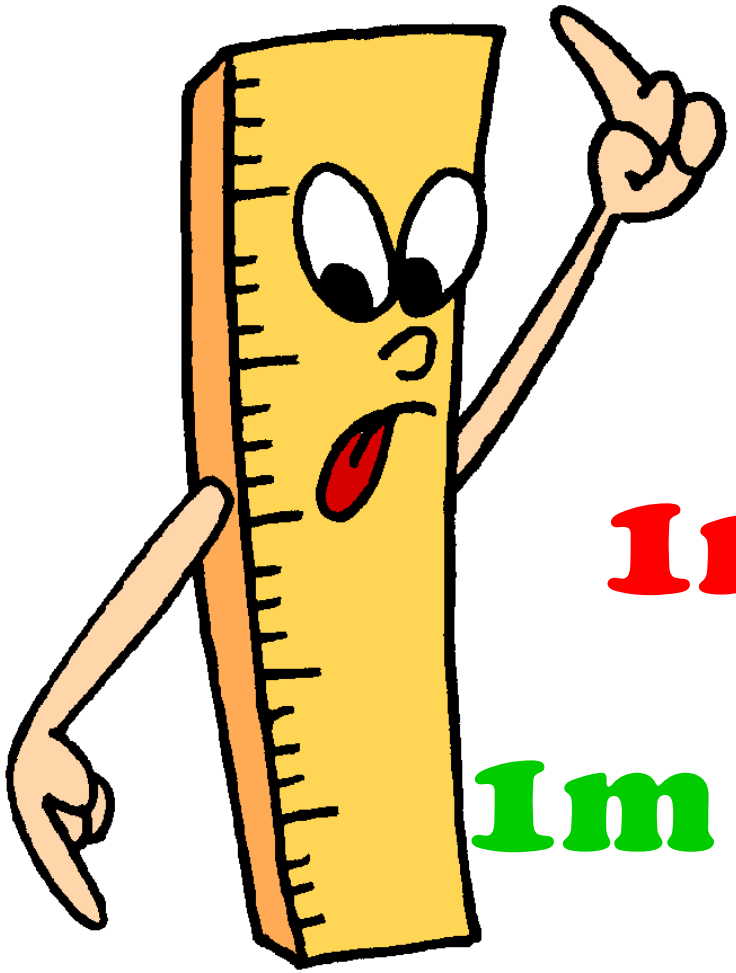


starter activity

COMPARE THE SIZE OF THE CELLS IN THE ANIMATION

http://learn.genetics.utah.edu/content/cells/scale/

SIZE MATTERS!



1m = 1000mm

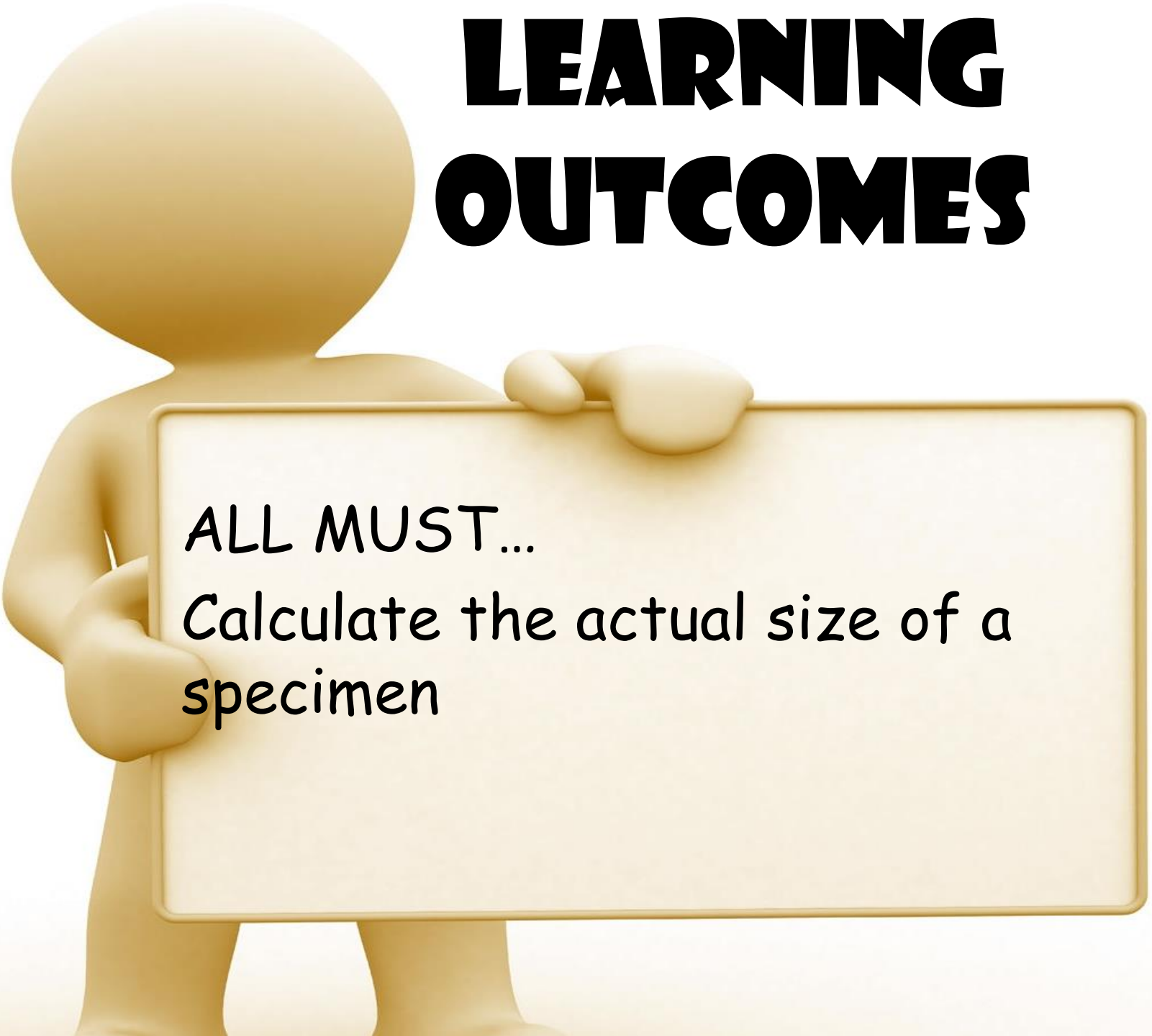
1mm = 1000μm

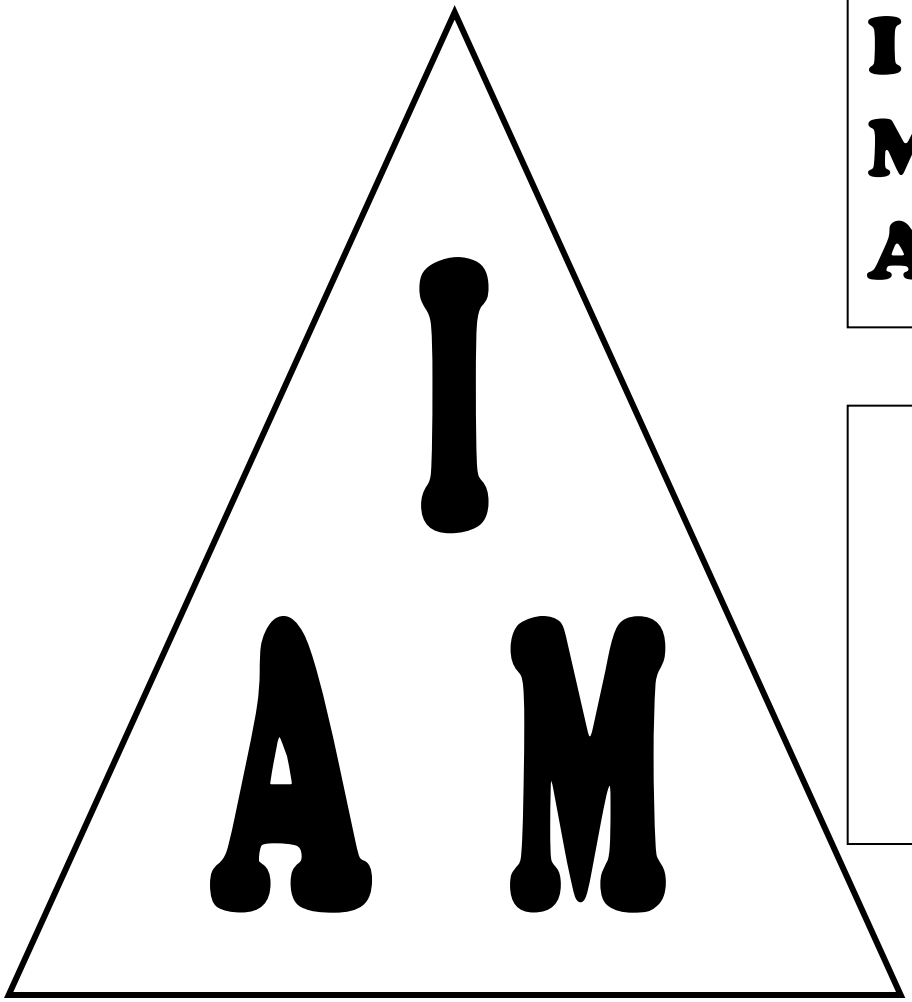
1m = 1 000 000μm

CONVERT THE SIZES BELOW:

	Size		
Object	Metres (m)	Millimetres (mm)	Micrometres (μm)
Plant cell	0.0001	0.1	100
Red blood cell	0.000008	0.008	8
Bacterial cell	0.0000006	0.0006	0.6
Hair	0.00015	0.15	150
Chloroplast	0.00001	0.01	10
Measles virus	0.0000002	0.0002	0.2

LEARNING OUTCOMES





I = IMAGE SIZE
M = MAGNIFICATION
A = ACTUAL SIZE

equations

I = A X M
A = I / M
M = I / A

USING AN IMAGE TO FIND
Magnification and Measurement

1. A cell measures 20 μm in length. When it is magnified using a microscope the image measures 3.6 mm.
   What is the magnification used?

   Actual size = 20 μm
   Image size = 3.6 mm
   Change to μm = 3600μm
   Calculate magnification
   M = I/A = 3600/20 = X180

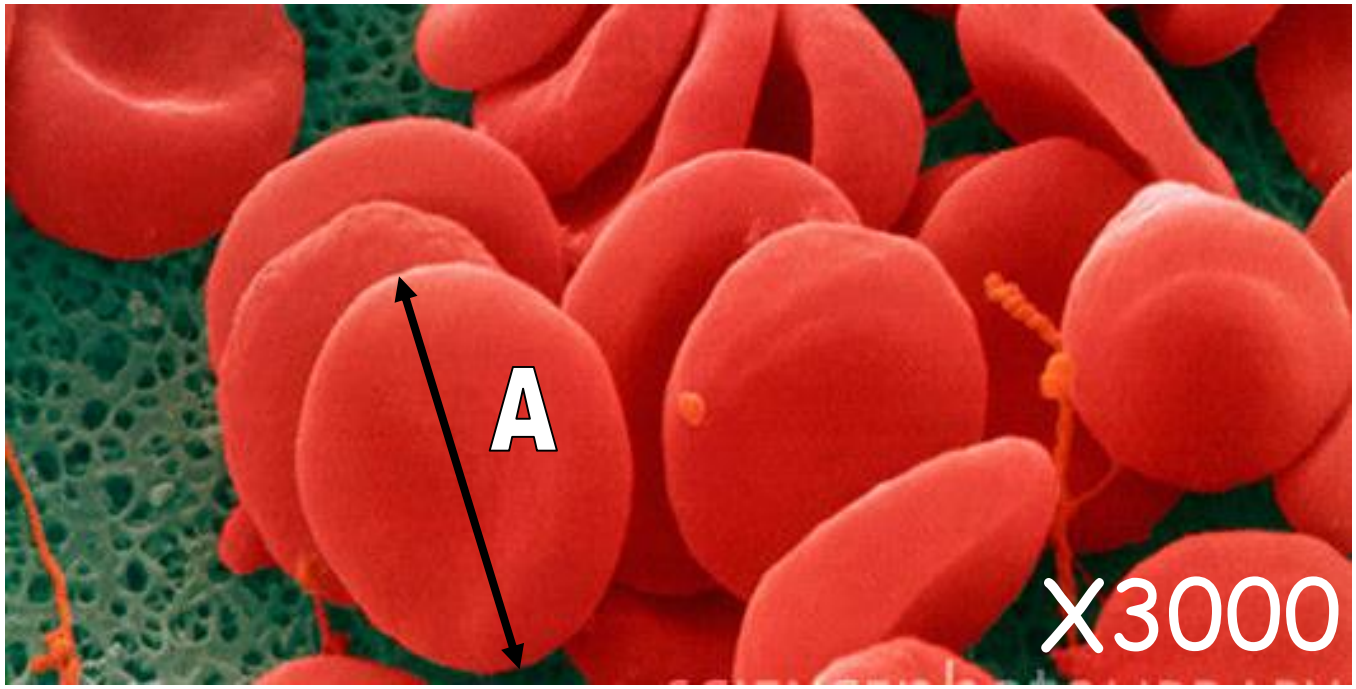
2. The bacterium *E. coli* is a rod shaped microorganism that lives in the human gut. It has a length of 2μm. Calculate its IMAGE SIZE when magnified X600.

Actual size: A = 2μm

Magnification: M = X600

SIZE (I = MXA): I = 600X2 =1200μm

3. Calculate ACTUAL SIZE of red blood cell A:



Measure cell A: I = 30mm

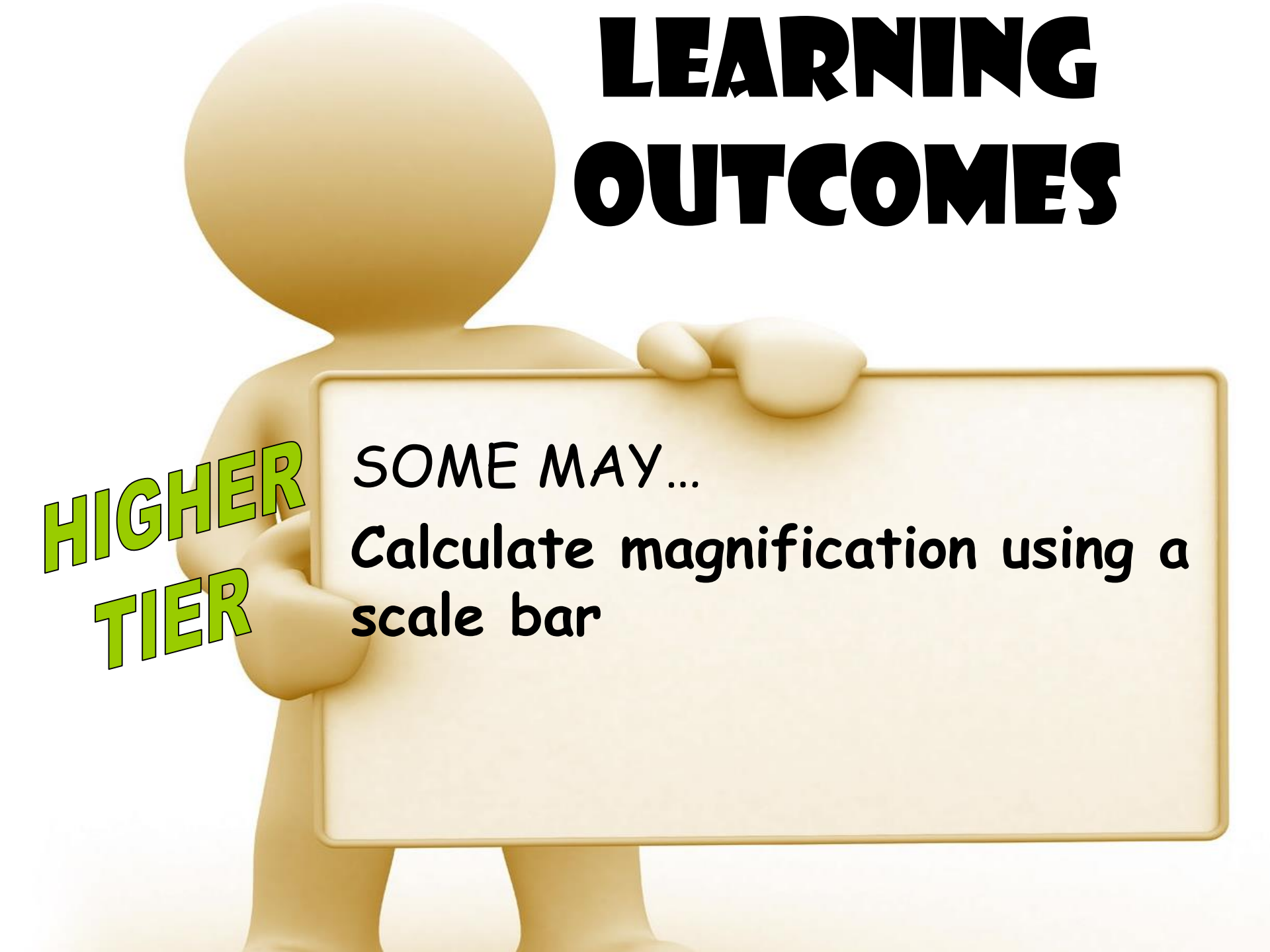
Convert mm into µm: I = 30 000µm

You are given the Magnification: M = X3000

Calculate ACTUAL SIZE (A = I/M):

A =30 000/3000 = 10µm

LEARNING OUTCOMES



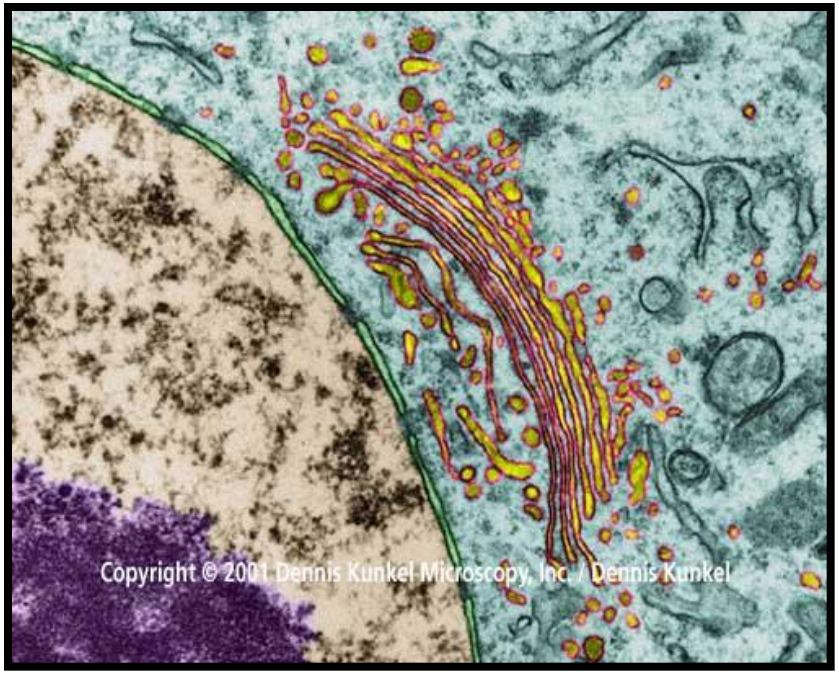
HIGHER TIER

SOME MAY…

Calculate magnification using a scale bar

Calculating magnification using the scale bar:

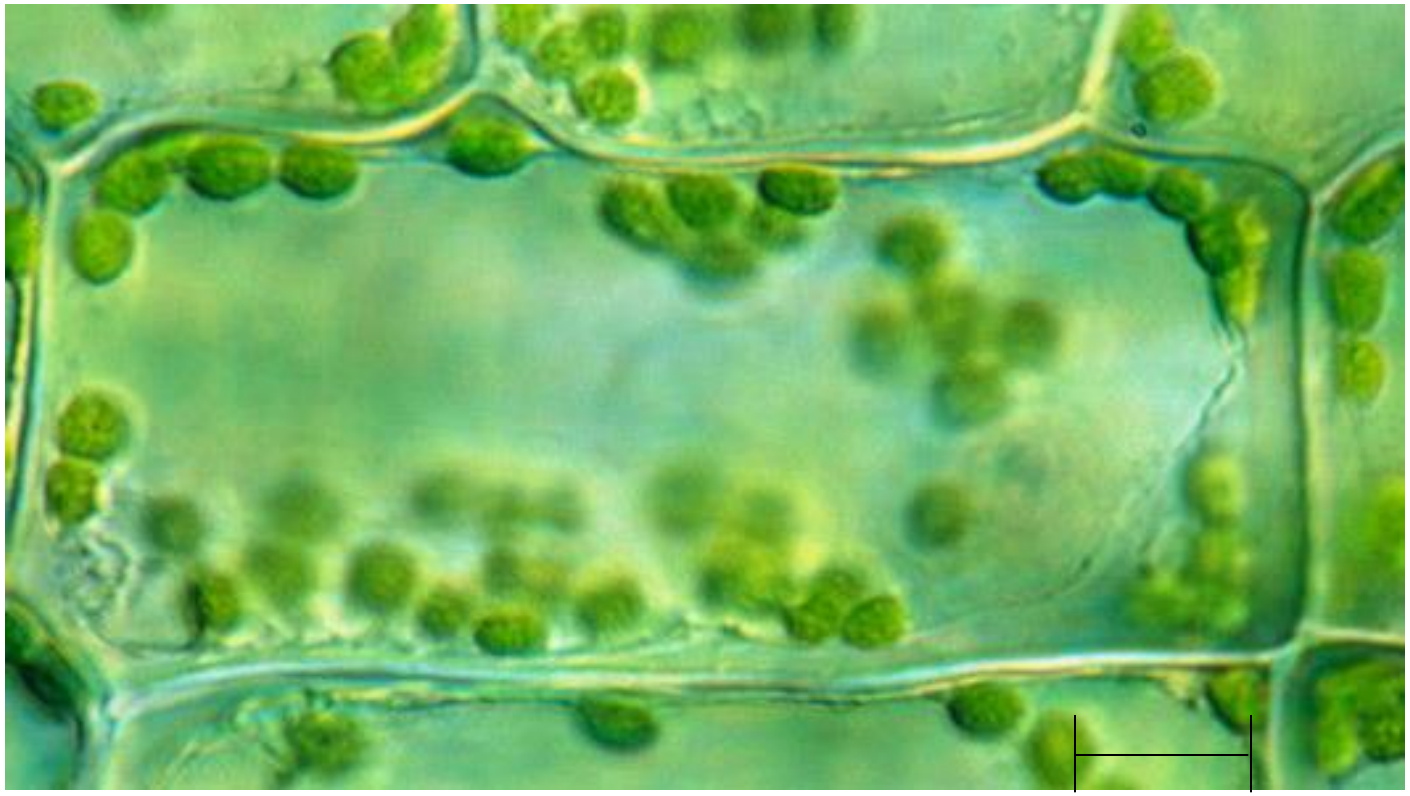
- If a scale bar is present on a photomicrograph then you can measure it instead of a part of the picture. The length of the scale bar on the ruler is the "Image size" (measure in mm) and the "actual size/length" of it should be written under it



- We now must convert our mm to micrometres to make sure the units are the same

- Therefore using our triangle (magnification = image size / actual size), we can work out the magnification of that photomicrograph!

1. Calculate MAGNIFICATION of this plant cell using the scale bar:



Read scale bar: A = 100µm

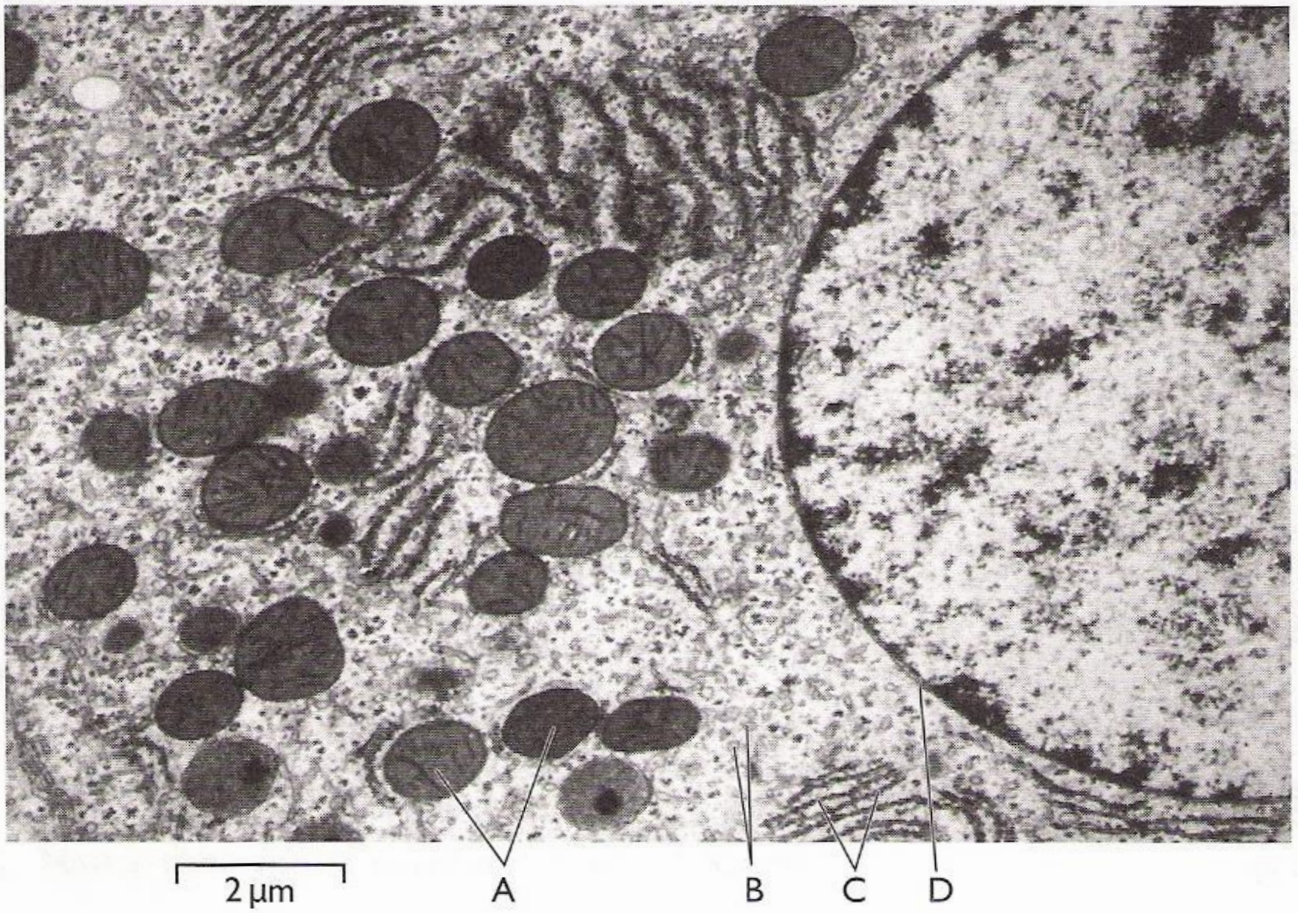
Measure scale bar: I = 12mm

Convert mm into µm: I = 12 000µm

Calculate MAGNIFICATION(M = I/A):

M = 12 000/100 = 120µm

2. The photograph below is an electron micrograph of part of a eukaryotic cell.



Patricia Schulz, Peter Arnold Inc./SPL

(b) The photograph has a scale bar indicating 2 µm. Use this to calculate the magnification of this electron micrograph. Show your calculations. (3 marks)

size of image = real size × magnification

(b) The scale bar is **9** mm long ✓ which is **9000** µm ✓, so magnification is **9000** ÷ 2 **4500** times ✓

All stages in the calculation (measurement of scale bar, unit conversion and determination of magnification) are correct and clearly shown. Showing each stage is important because if a 'slip' is made at any stage, marks can still be awarded for the correct procedure. The candidate gains all 3 marks.

QUESTION 1C & 2
HOMEWORK BOOKLET

HOMEWORK

PAGE 13

MEASURING CELLS

1.

Magnification = eyepiece X objective lens

X6 X10 = X60
X6 X40 = X240

X10 X10 = X100
X10 X 40 = X400

2.

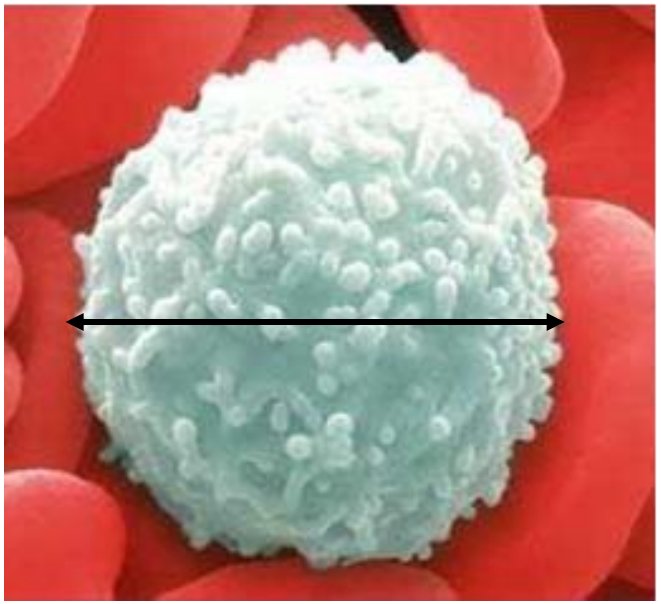
Magnification = X400

Image size = mm

= μm

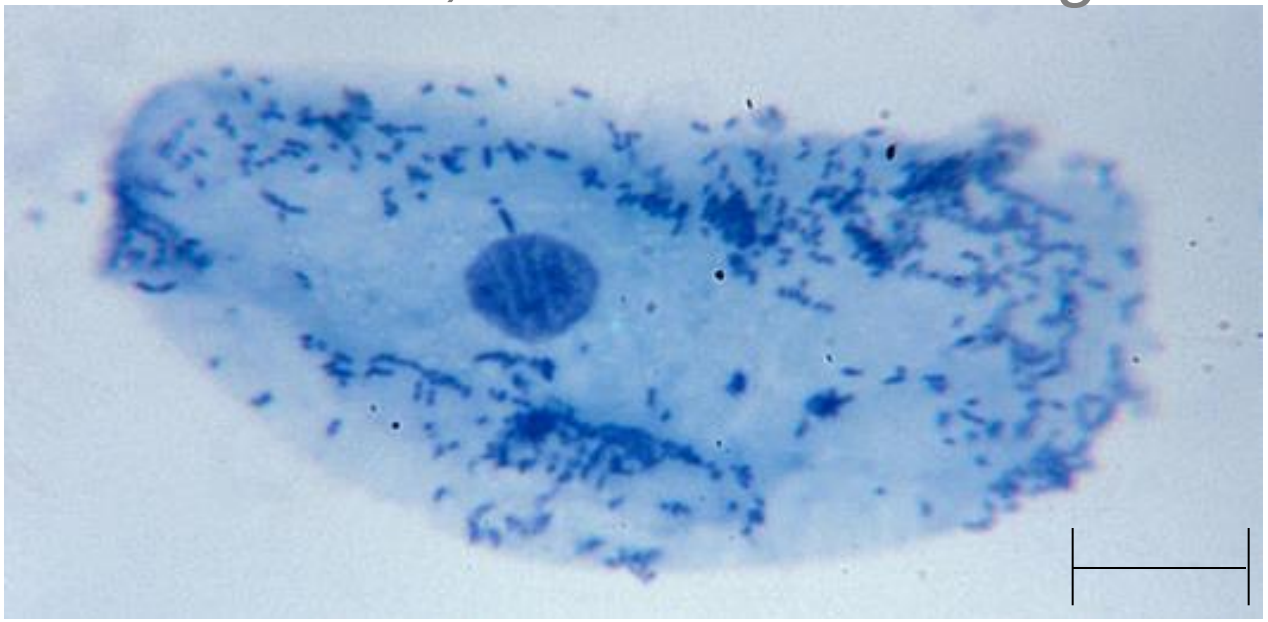
Actual size = I/M

= /400



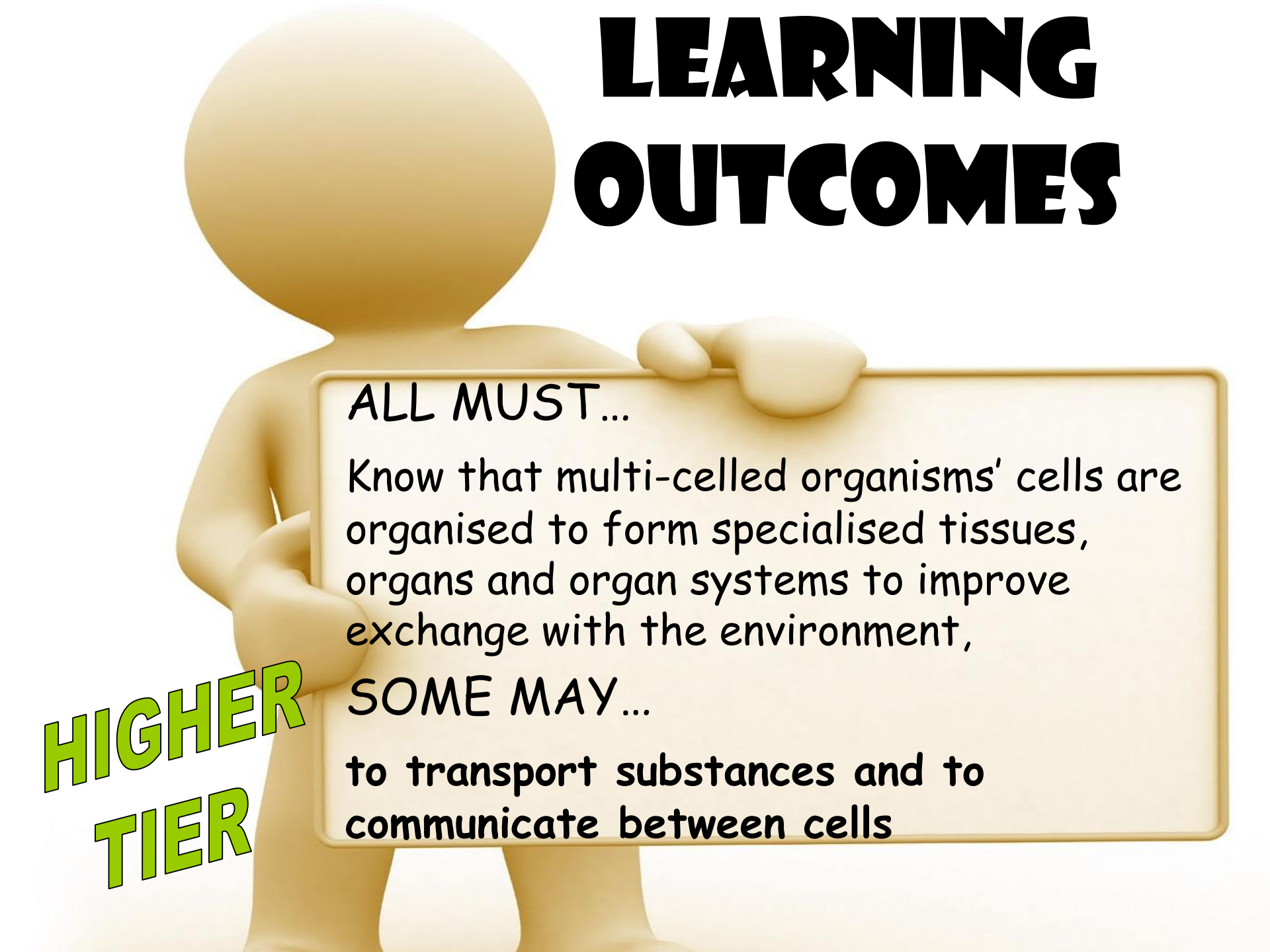
3. Calculate magnification of this cheek cell:

Note that in this case, the actual size is given in mm



1. Read scale bar: A =
2. Measure scale bar: I =
3. Convert mm into µm: I =
4. Calculate Magnification (M = I/A): M =

LEARNING OUTCOMES



ALL MUST…

Know that multi-celled organisms' cells are organised to form specialised tissues, organs and organ systems to improve exchange with the environment,

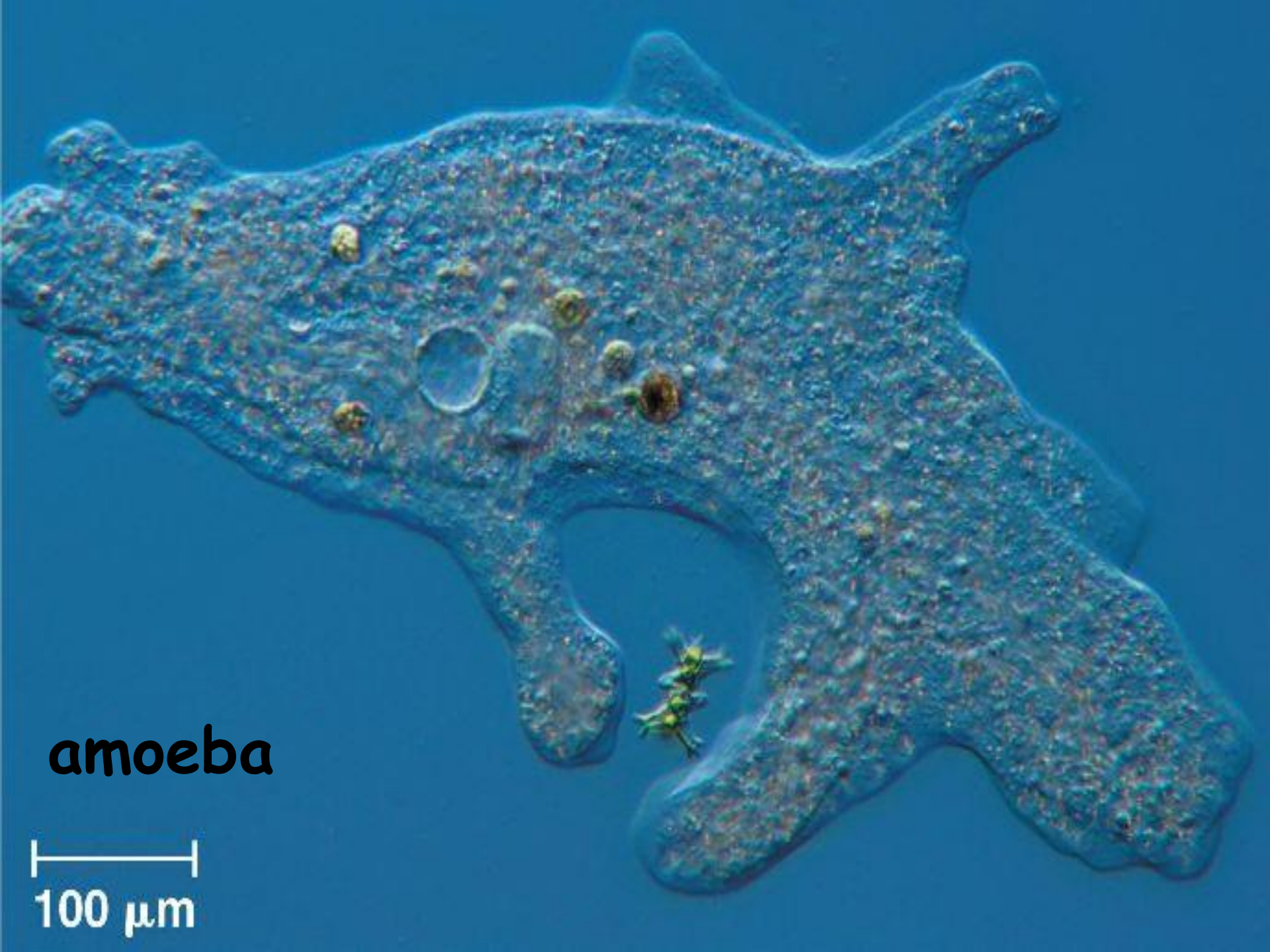
SOME MAY…

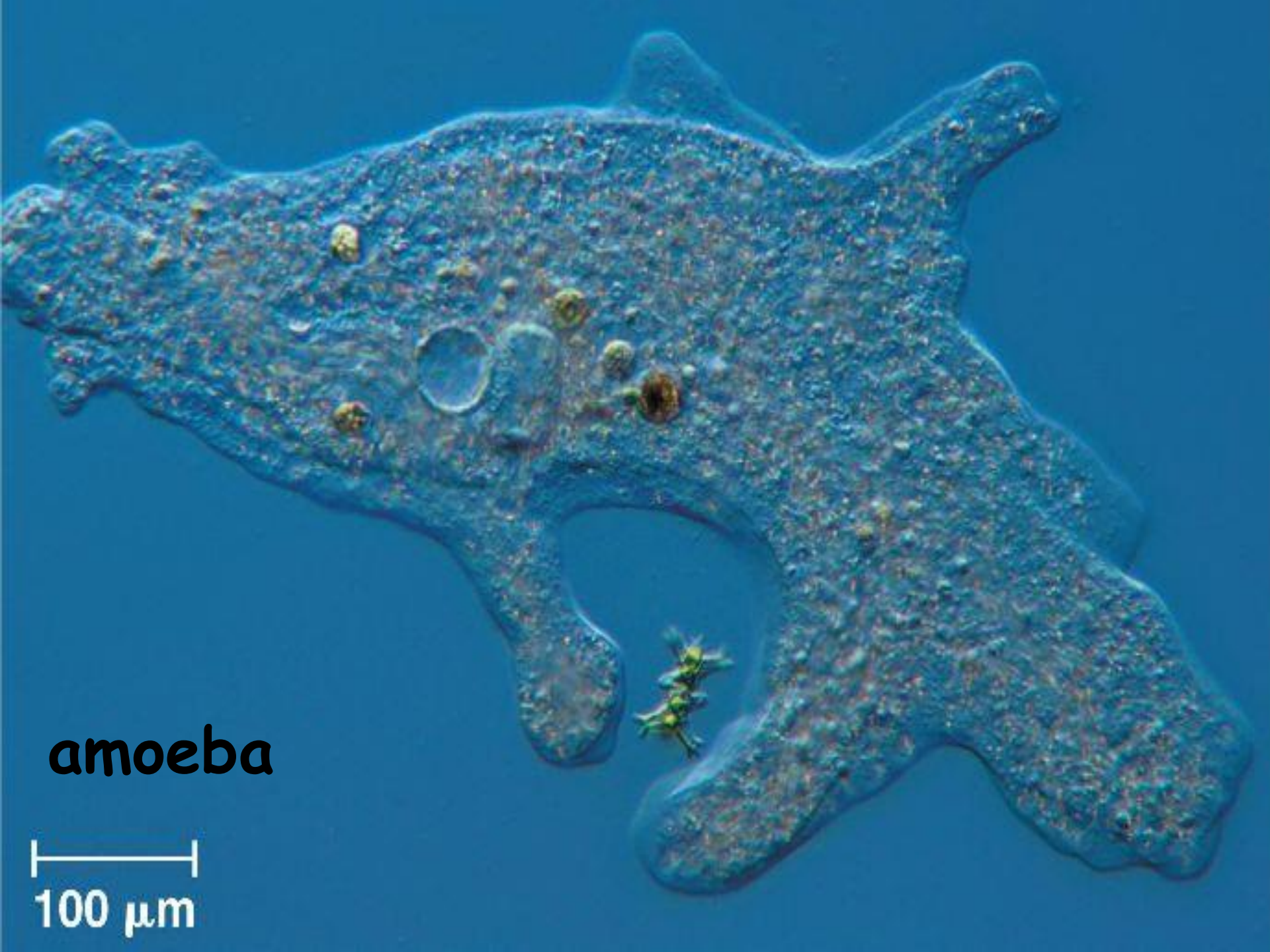
to transport substances and to communicate between cells

HIGHER TIER

starter activity

- View the amoeba, paramecium and daphnia under the microscope
- Jot down any similarities and differences between the 3 organisms


amoeba
100 µm


amoeba
100 µm

paramecium

paramecium


daphnia


daphnia

LEVELS OF ORGANISATION WITHIN ORGANISMS

card sort activity

CELL - the building block for all living things

TISSUE - containing similar cells all performing the same function e.g.muscle

ORGAN - made up of two or more tissues e.g.the heart

ORGAN SYSTEM - made up of two or more organs e.g. digestive system

ORGANISM - made up of all the different organ systems

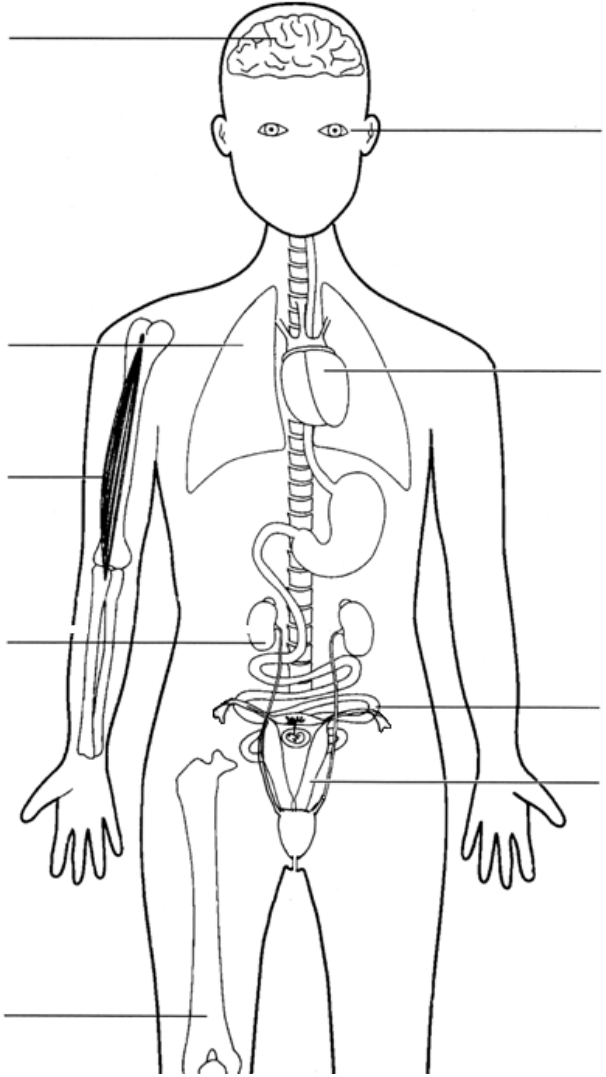
Organisms which are multi-cellular must have specialised tissues, organs and organ systems. It helps them to:

- exchange substances with the environment
- transport substances within their body
- communicate between cells

From cells to systems

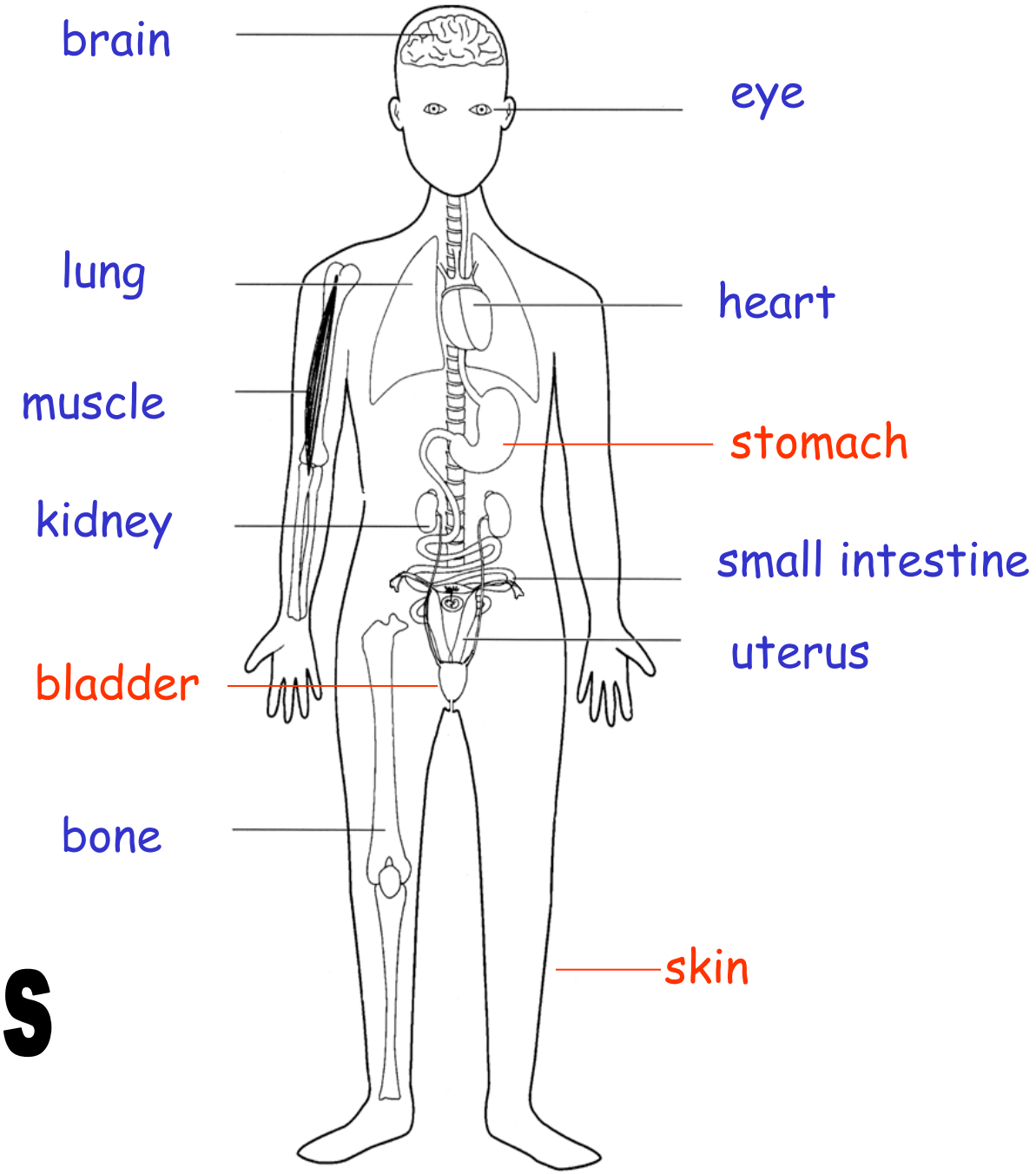
http://www.bbc.co.uk/education/guides/z9hyvcw/activity

organs



Label the diagram and add labelled arrows pointing to the bladder, stomach and skin.

organs


brain
eye
lung
heart
muscle
stomach
kidney
small intestine
uterus
bladder
bone
skin

BODY SYSTEMS SORT ACTIVITY

organ systems

Organ System	Main Organs	Main Function

Organ System	Main Organs	Main Function
Digestive	Stomach, small + large intestine, pancreas	Large insoluble to small soluble for absorption
Respiratory	lungs	Gas exchange
Skeletal	Bones + muscles	Support, movement, protection
Circulatory	Heart, blood vessels	Transport, protection
Excretory	Kidneys	Removal of toxic waste
Reproductive	ovaries/testes	Production of gametes + fertilisation
Nervous	Eye, ear, spinal cord, brain	Detect changes, conduct messages, produce response

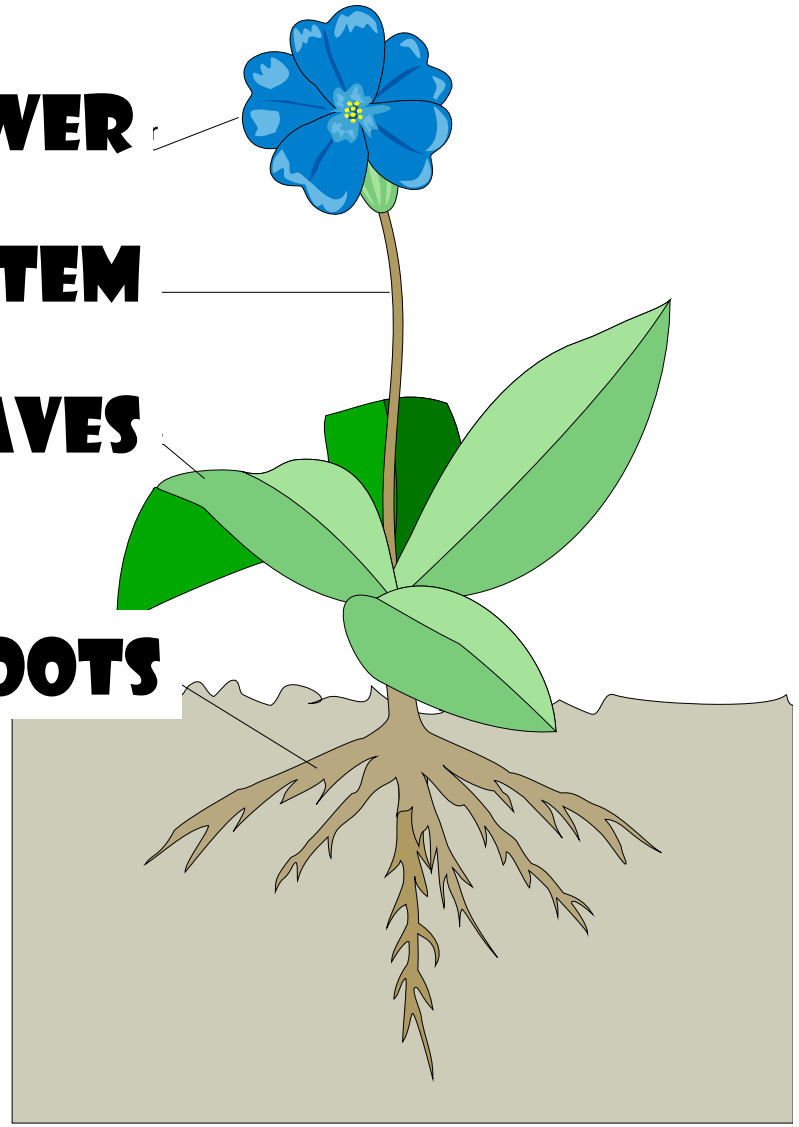
plant organs

reproduction — **FLOWER**

support + transport — **STEM**

photosynthesis — **LEAVES**

Anchorage + absorption of water + mineral salts — **ROOTS**

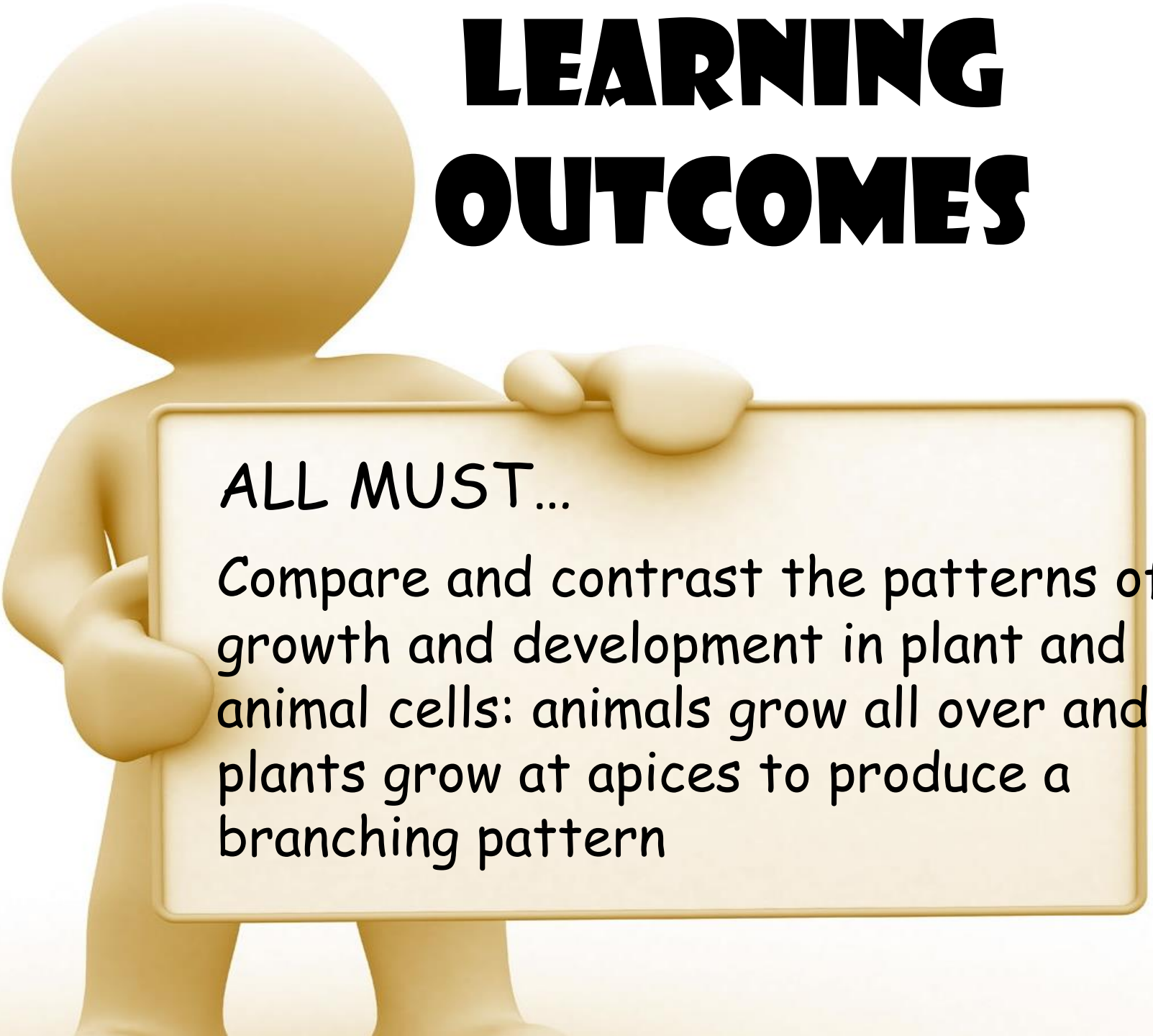


http://www.bbc.co.uk/education/guides/z9hyvcw/revision

Cells to systems


How do these organisms differ in the way that they grow?

LEARNING OUTCOMES



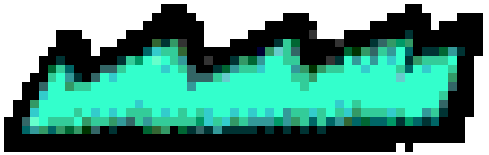
ALL MUST…

Compare and contrast the patterns of growth and development in plant and animal cells: animals grow all over and plants grow at apices to produce a branching pattern

Growth in Plants and Animals

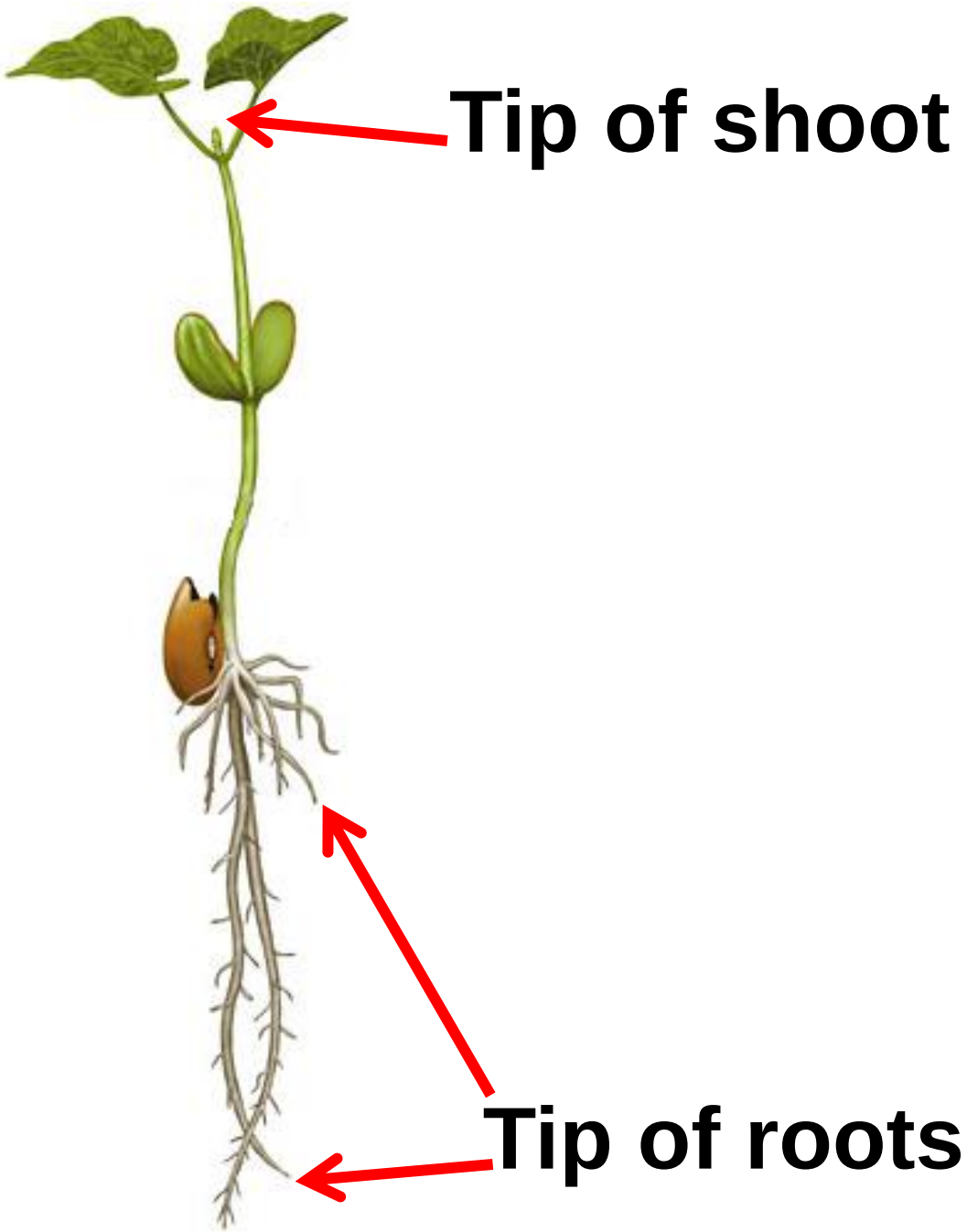
Growth is **a permanent increase in size**. This can be because **individual cells get bigger**, or because **cells divide to form more new cells**.

Plants and animals grow in different ways.

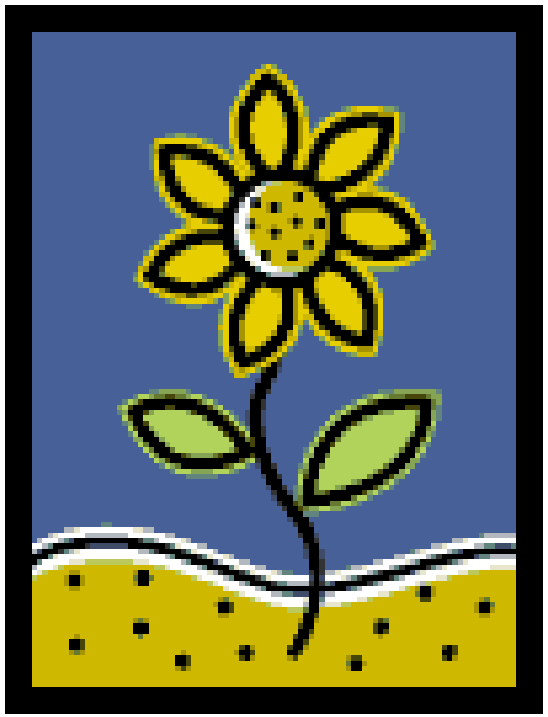


Most animal cells in an organism can reproduce to form new cells. This results in growth occurring all over the organism's body giving a rounded shape.

In plants growth is restricted to the tips of roots and shoots. These areas are called apices. This causes plants to grow in a branching pattern.

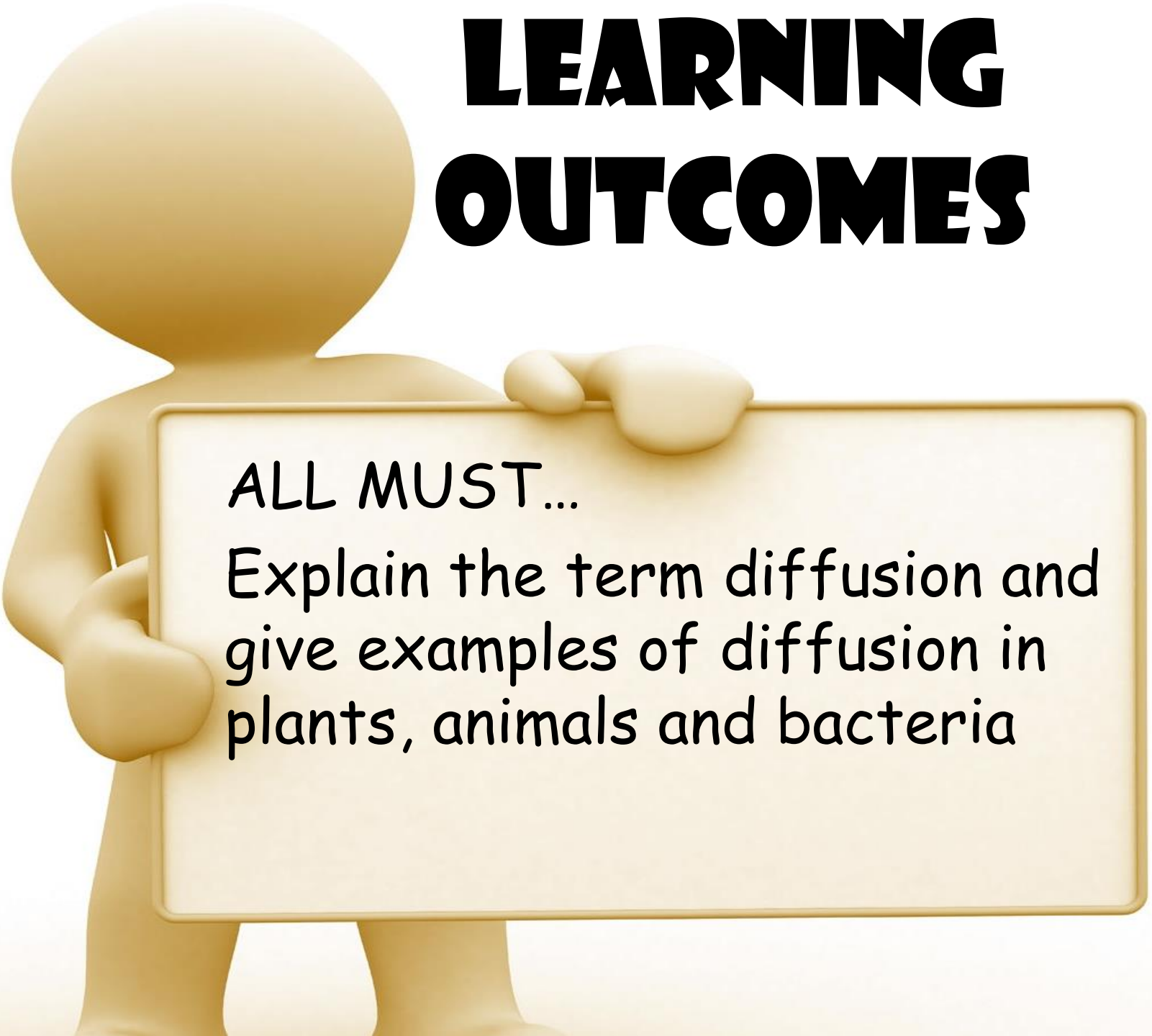

Tip of shoot
Tip of roots

bbc learning zone

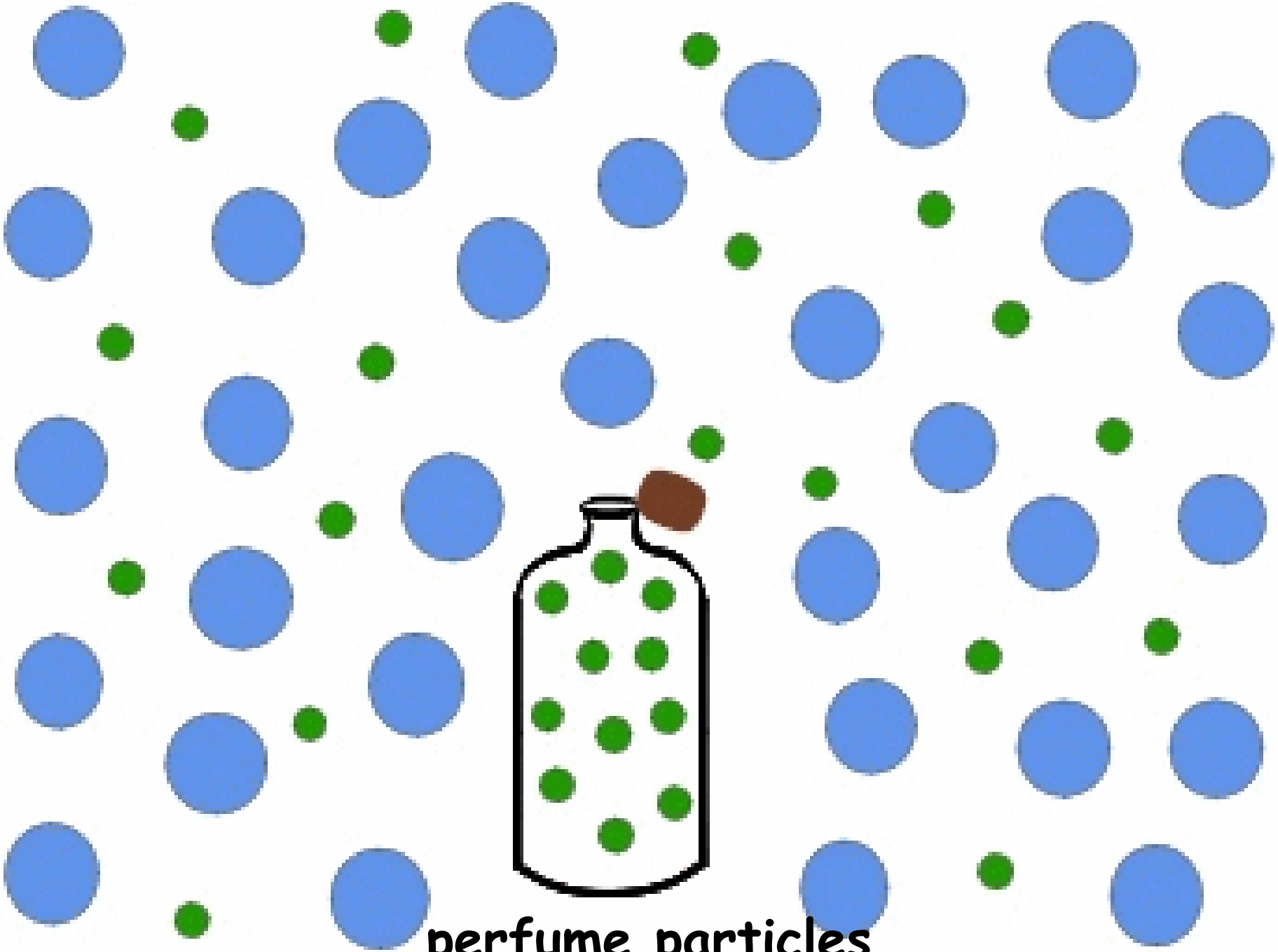


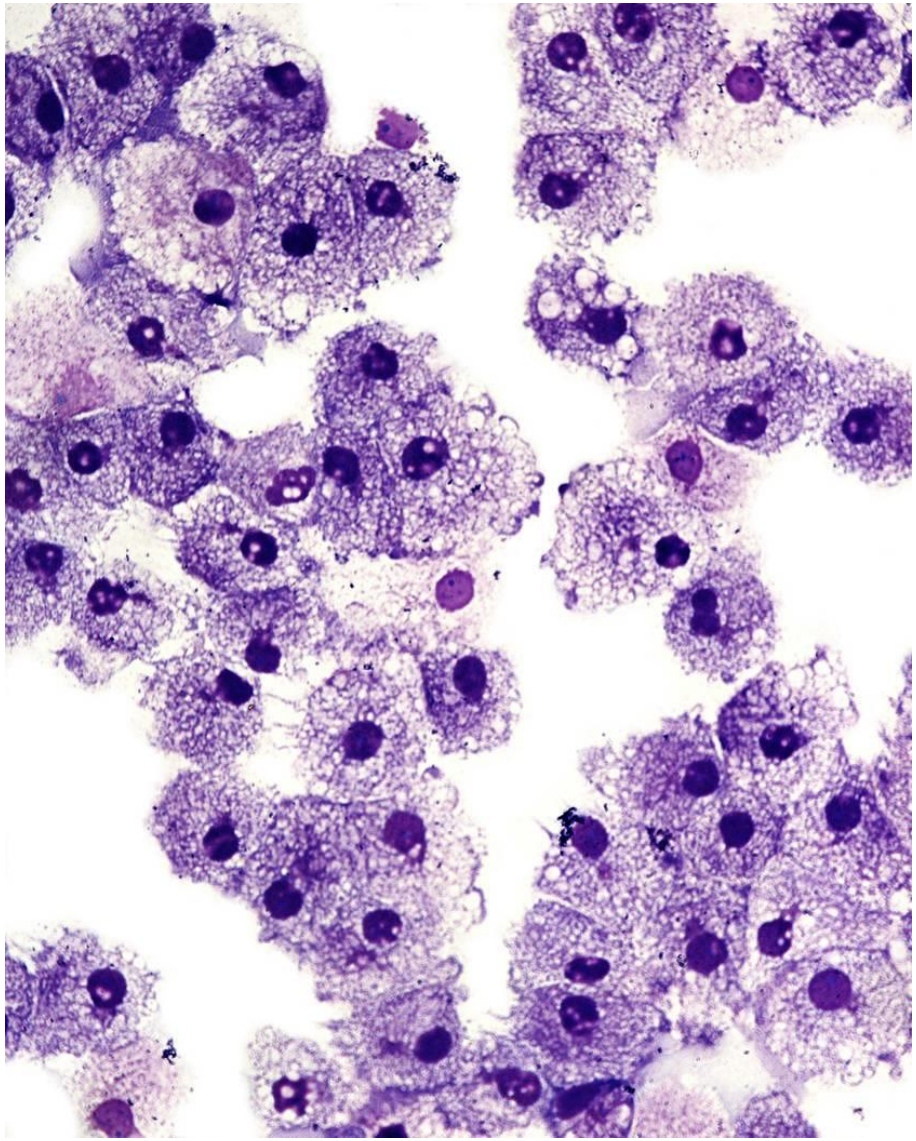
HOMEWORK FRONTER

LEARNING OUTCOMES

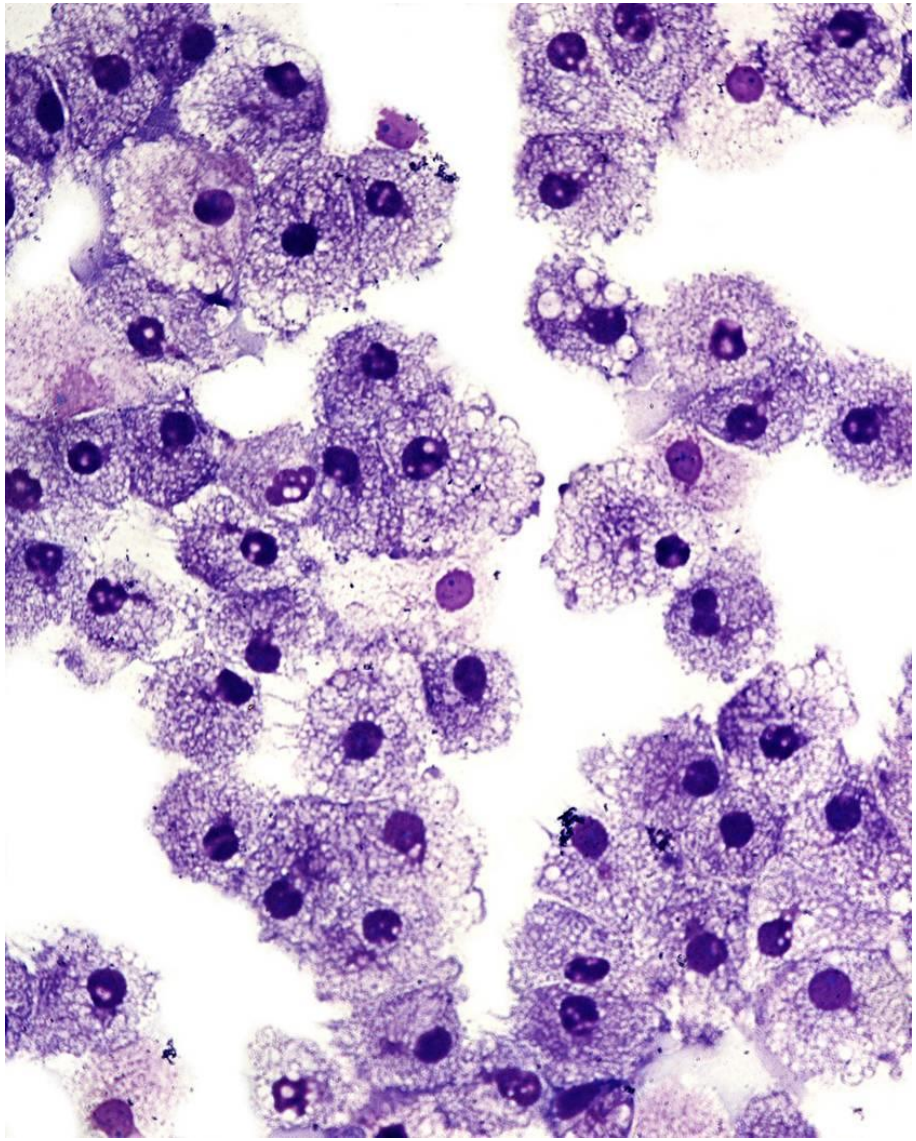


TRANSPORT IN AND OUT OF CELLS


perfume particles



Body cells need **oxygen** and **glucose** to release energy in the process of cell respiration.
They also need nutrients such as **amino acids**, **fats**, **vitamins** and **minerals** for healthy growth.



And waste materials such as **carbon dioxide** and **water** must be removed.

Plants also need **carbon dioxide** and **water** to make glucose during photosynthesis and need to remove excess **oxygen**.

HOW DO THESE SUBSTANCES MOVE IN AND OUT OF CELLS?

SUBSTANCES MOVE IN AND OUT OF CELLS IN ONE OF 3 WAYS

diffusion

osmosis

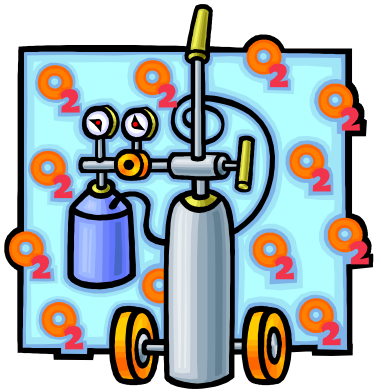
active transport

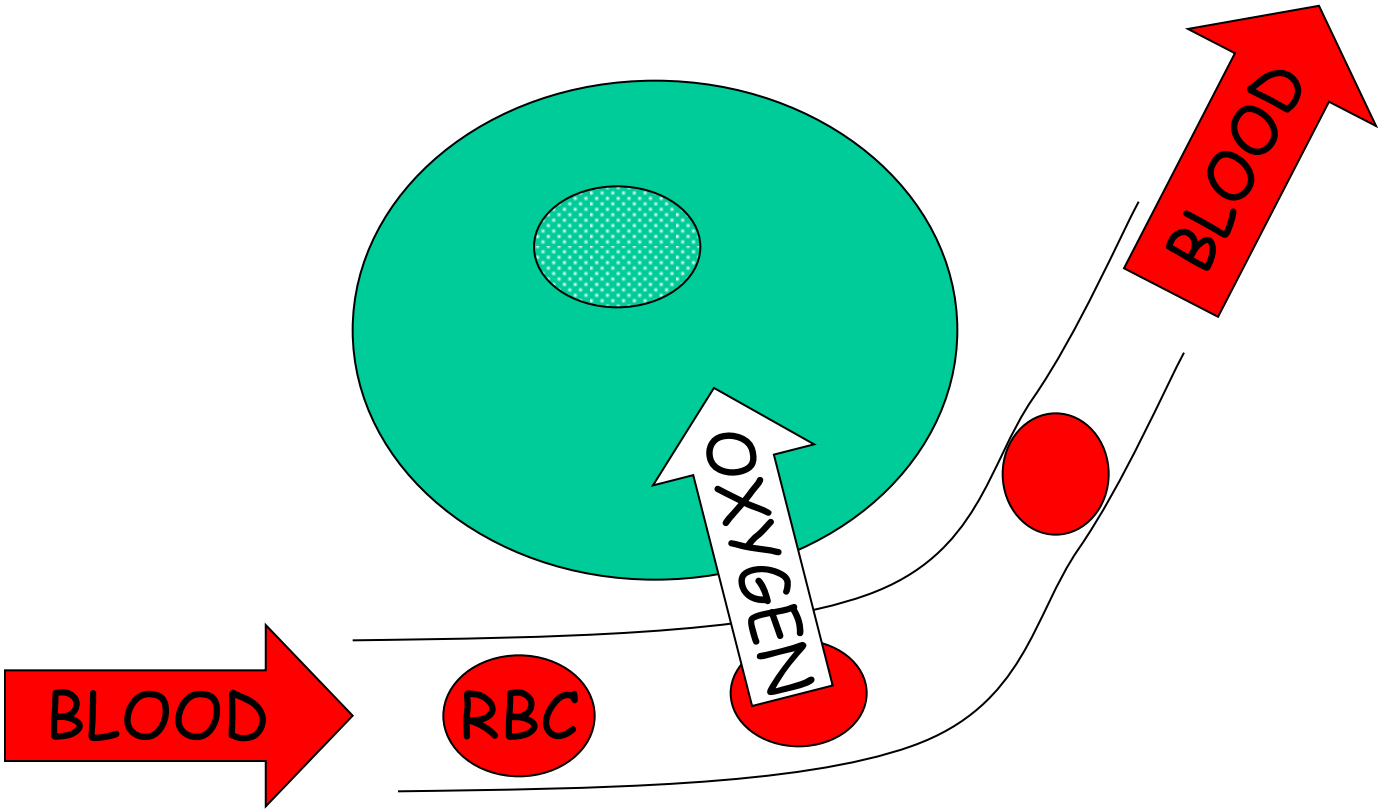
diffusion is

the movement of particles from an area of high concentration to an area of low concentration

until they are evenly distributed

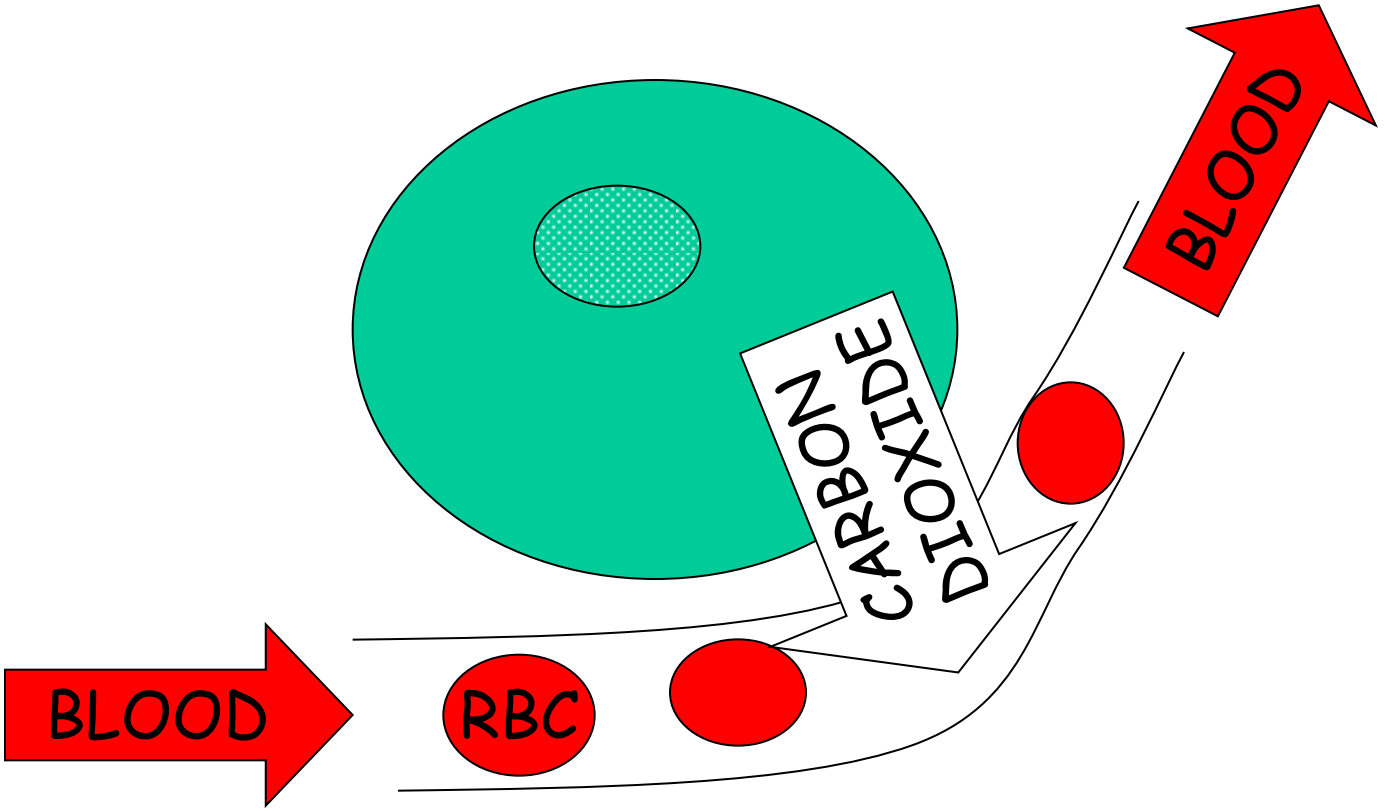
Diffusion is important in the movement of **GASES** in and out of cells





When the cell respires it uses up oxygen. Blood brings red blood cells carrying lots of oxygen to the body cells.

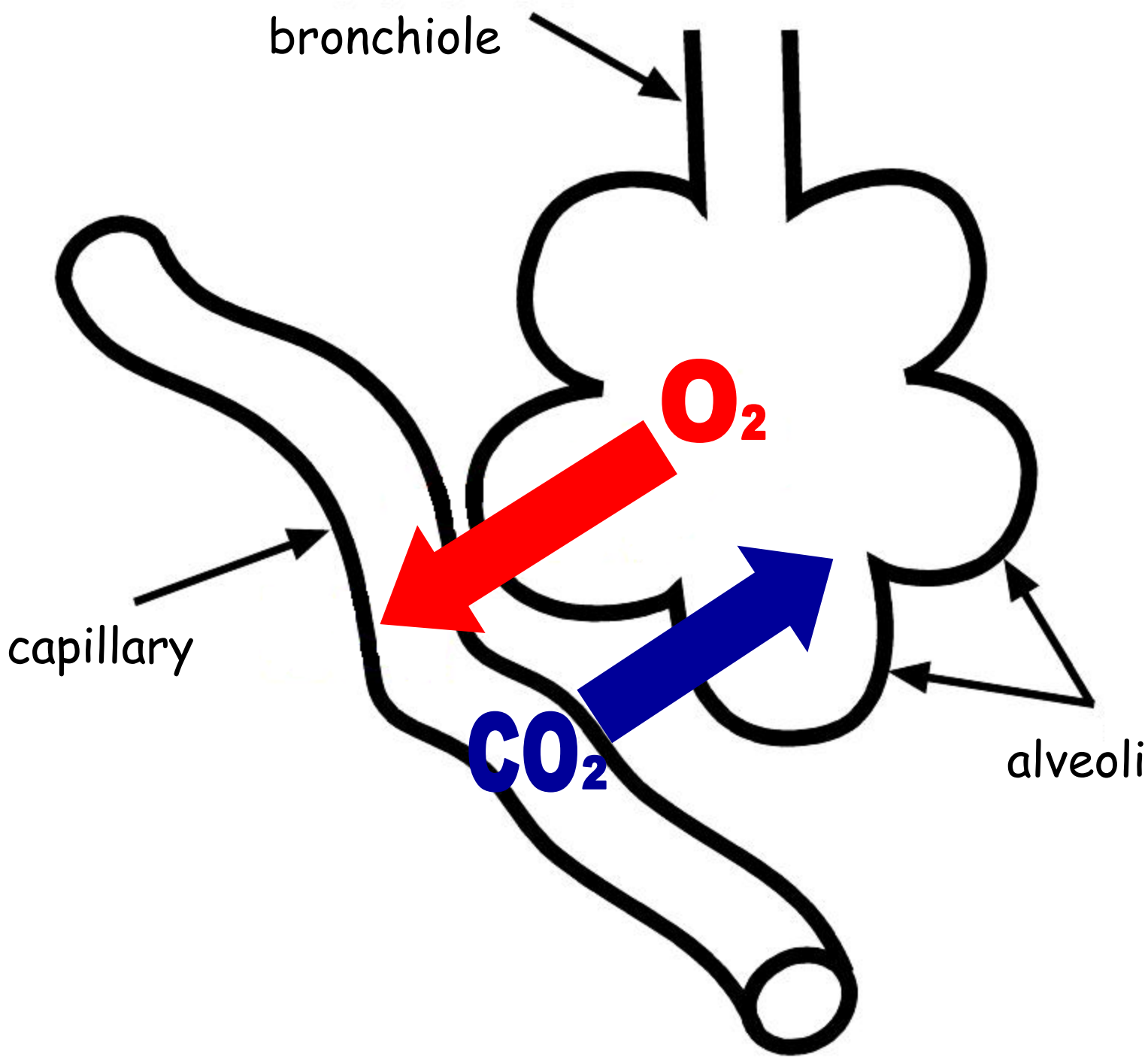
Oxygen moves **from a high concentration in the blood to a low concentration in the body cells by diffusion**.



When the cell respires it makes carbon dioxide. Carbon dioxide **moves from a high concentration in the body cells to a low concentration in the blood by diffusion.** The blood carries the carbon dioxide away. This **maintains a concentration gradient for movement of carbon dioxide.**

homework

- Google an image of a cross section of an alveolus. Print and stick in your notes.
- Draw on labelled arrows to show the movement of oxygen and carbon dioxide.
- Write sentences to explain the movement of oxygen and carbon dioxide.

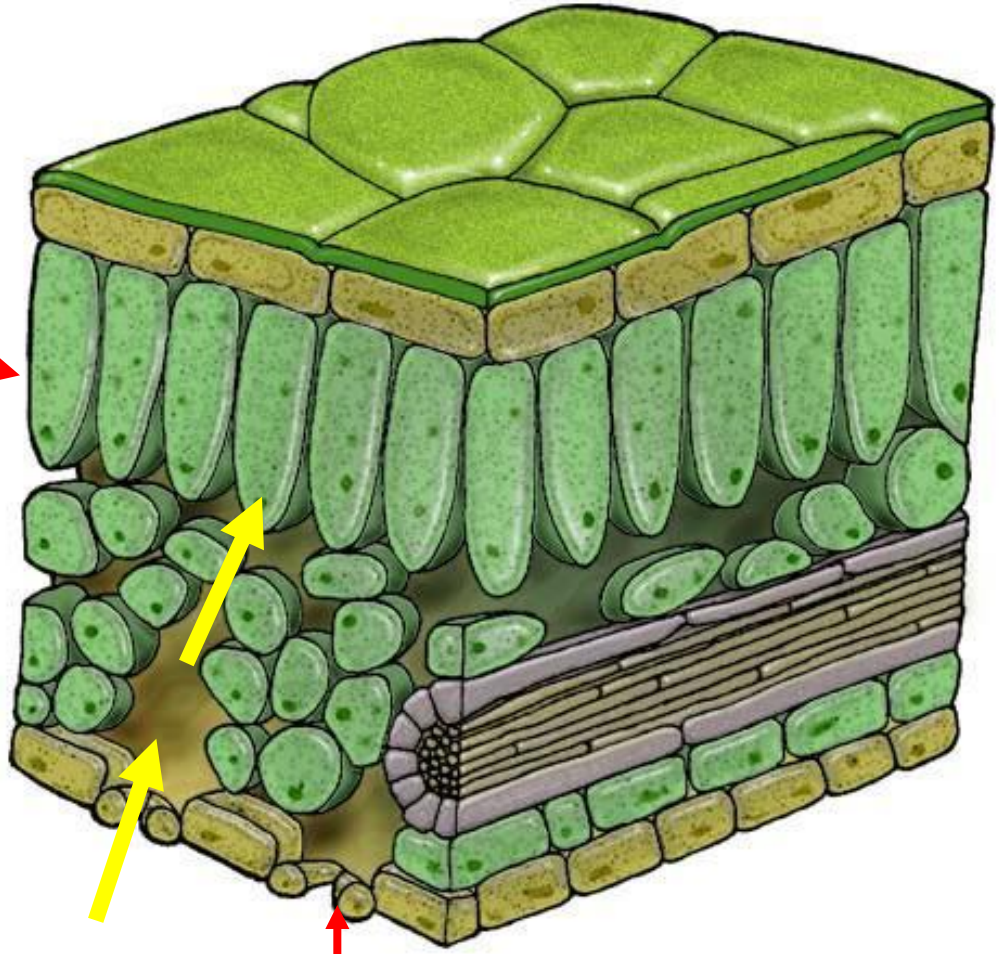

bronchiole
O_2
capillary
CO_2
alveoli

Gas exchange in the lungs

Oxygen (O_2) diffuses from a high concentration in the alveoli to a low concentration in the blood.

Carbon dioxide (CO_2) diffuses from a high concentration in the blood to a low concentration in the alveoli.

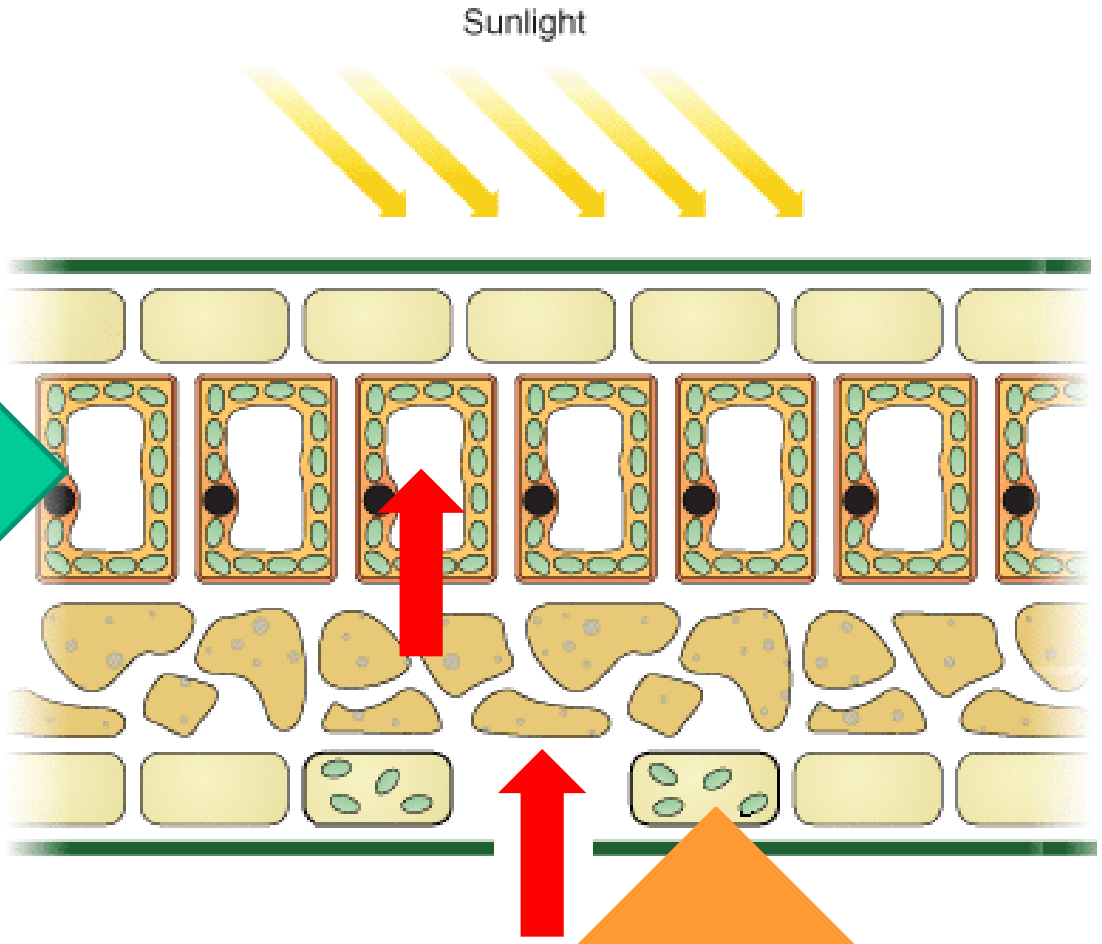
1. These palisade mesophyll cells need carbon dioxide for photosynthesis



3. Carbon dioxide moves from a high concentration in the air to a low concentration in the mesophyll cells by diffusion

2. These guard cells surround pores called stomata which allow carbon dioxide into the leaf

1. These palisade mesophyll cells need carbon dioxide for photosynthesis



2. These guard cells surround pores called stomata which allow carbon dioxide into the leaf

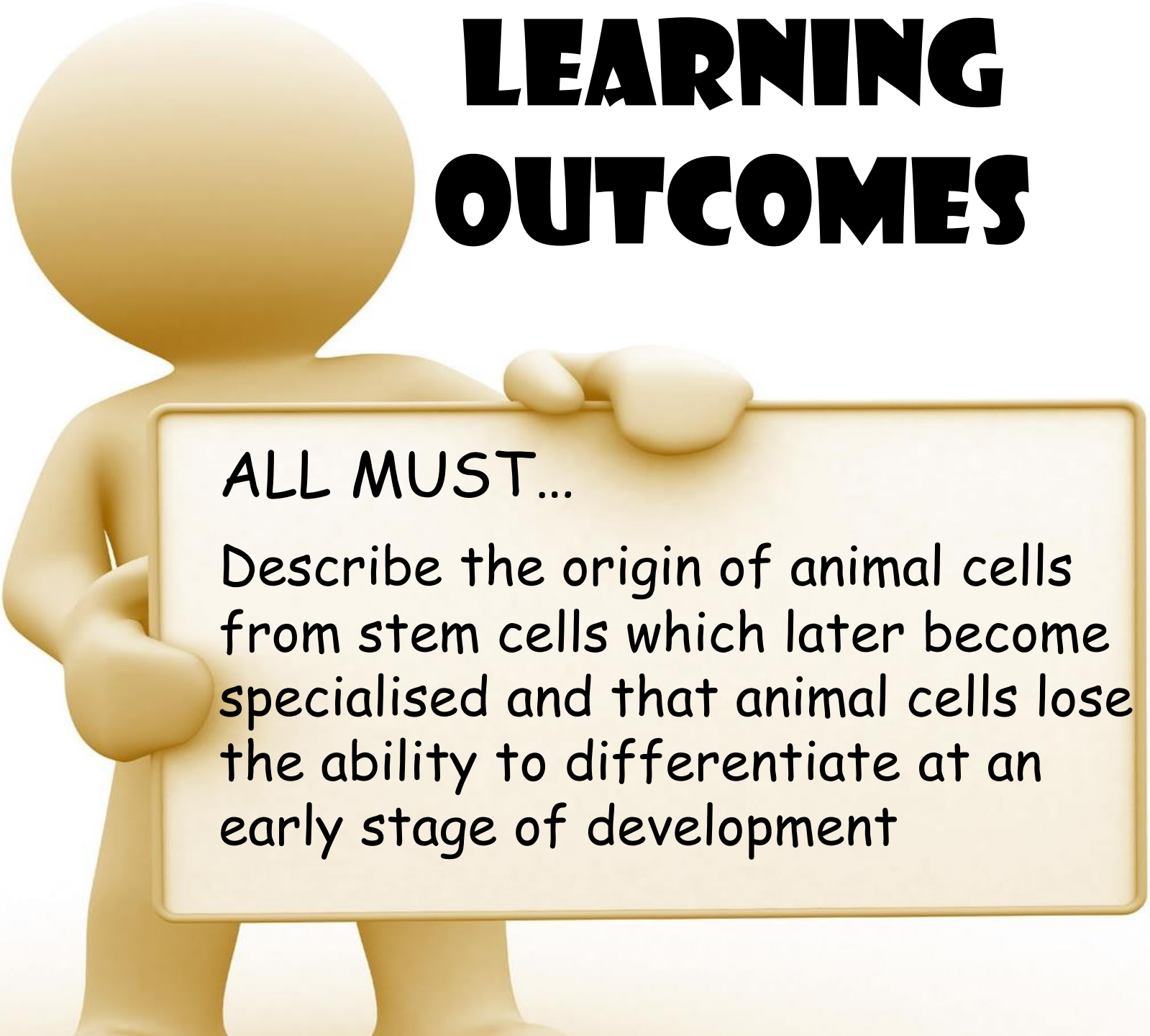
3. Carbon dioxide moves from a high concentration in the air to a low concentration in the mesophyll cells by diffusion

http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/

Chose: cells

MIND MAP

LEARNING OUTCOMES



ALL MUST…

Describe the origin of animal cells from stem cells which later become specialised and that animal cells lose the ability to differentiate at an early stage of development

STEM CELLS

- **VIDEO**: How Do Stem Cells Work?
  BANG GOES THE THEORY
  WATCH to 1min 17s

- **DISCUSSION**
  - WHY ARE STEM CELLS UNIQUE?
  - WHERE CAN YOU GET THEM?

STEM CELLS

- A stem cell is **a cell that can divide into any type of cell, it is not specialised**
- All animal cells originate from **embryo stem cells.** During the development of an *embryo*, most of these cells become **specialised.** They cannot later change to become a different type of cell. This process is called **cell differentiation**.
- **Adult stem cells** are found in organisms at all stages of their lives, not just adults. Adult stem cells are restricted to develop into the types of tissues in which they are found **skin, blood & bone marrow stem cells**

STEM CELLS

- **VIDEO**: How Do Stem Cells Work?
  BANG GOES THE THEORY
  WATCH remaining video

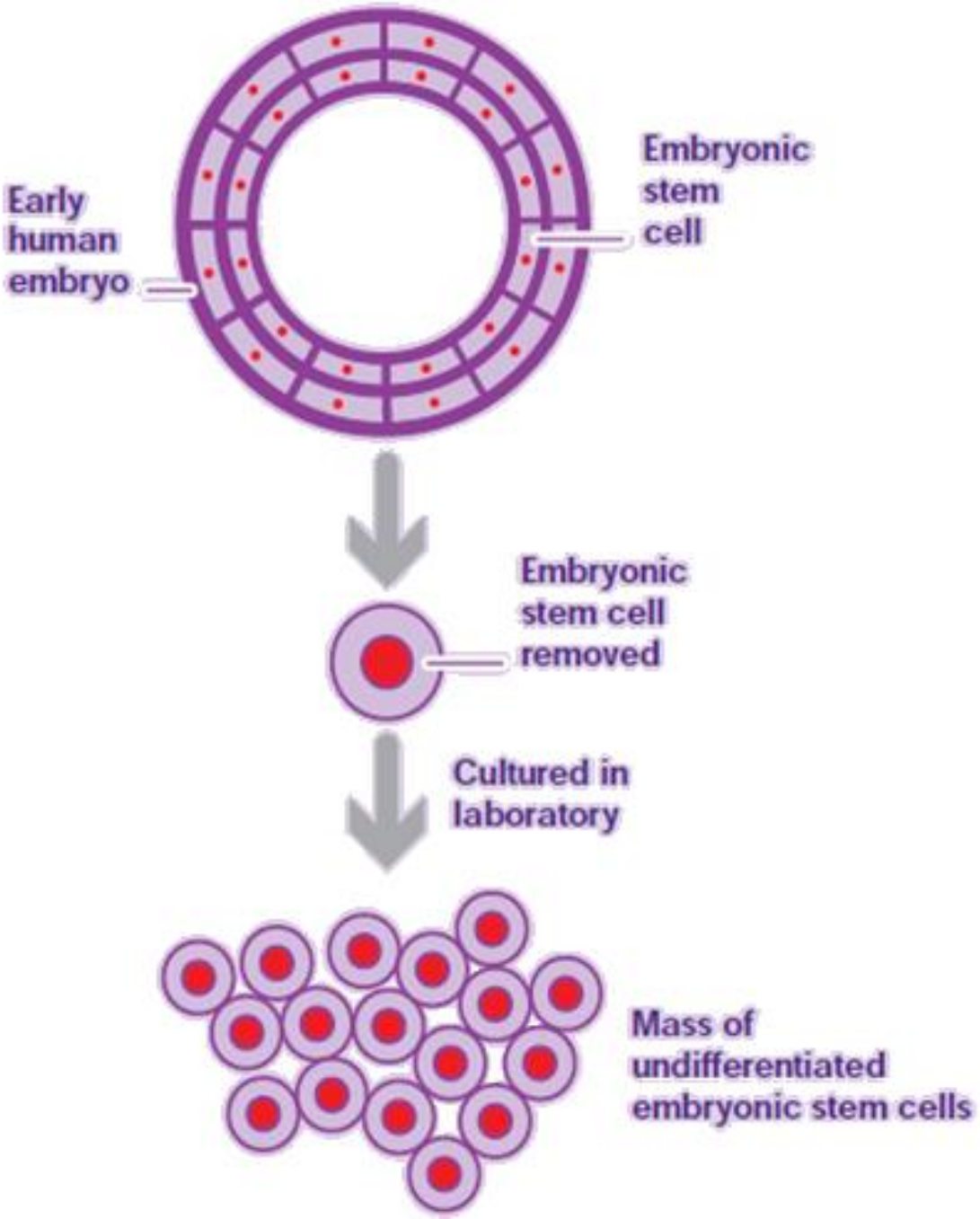
- **DISCUSSION**
  - WHY ARE STEM CELLS USEFUL?
  - WHAT IS A PLACEBO?

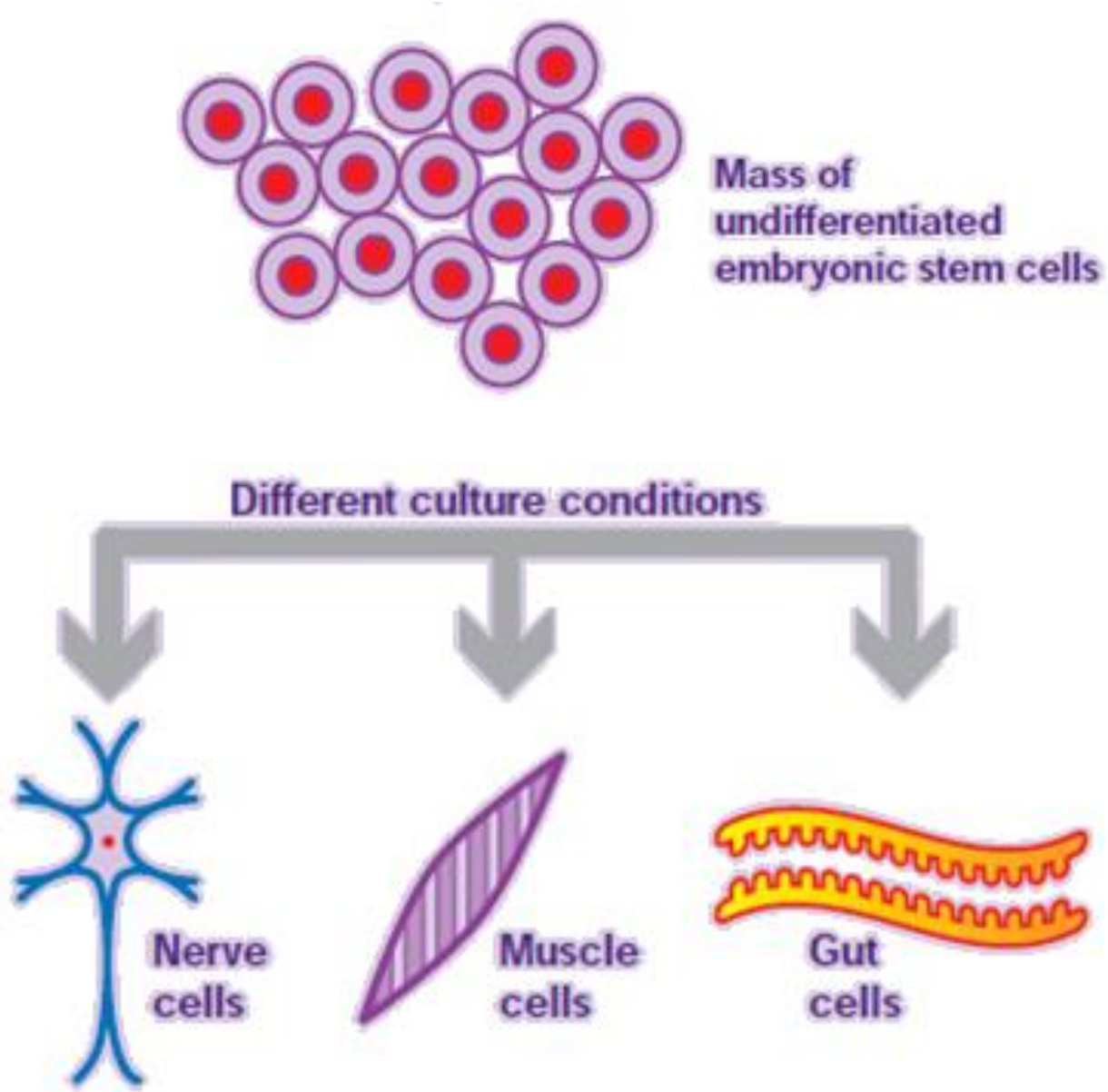
COLLECTING STEM CELLS

- **Embryonic stem cells** can be removed from human embryos that are a few days old, for example, from unused embryos left over from fertility treatment.

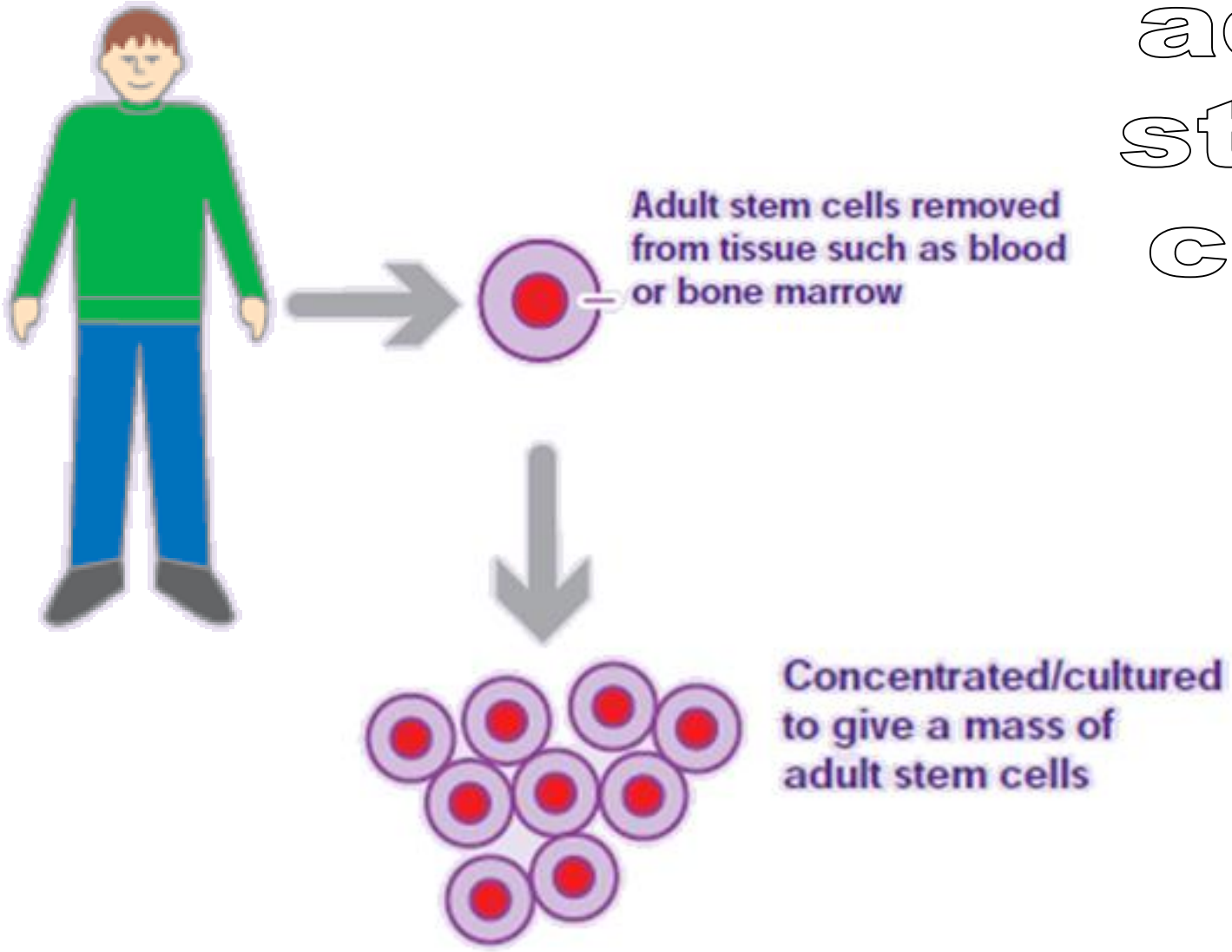
- **Adult stem cells** can be collected from most tissues e.g. blood, bone marrow, and skin tissue.

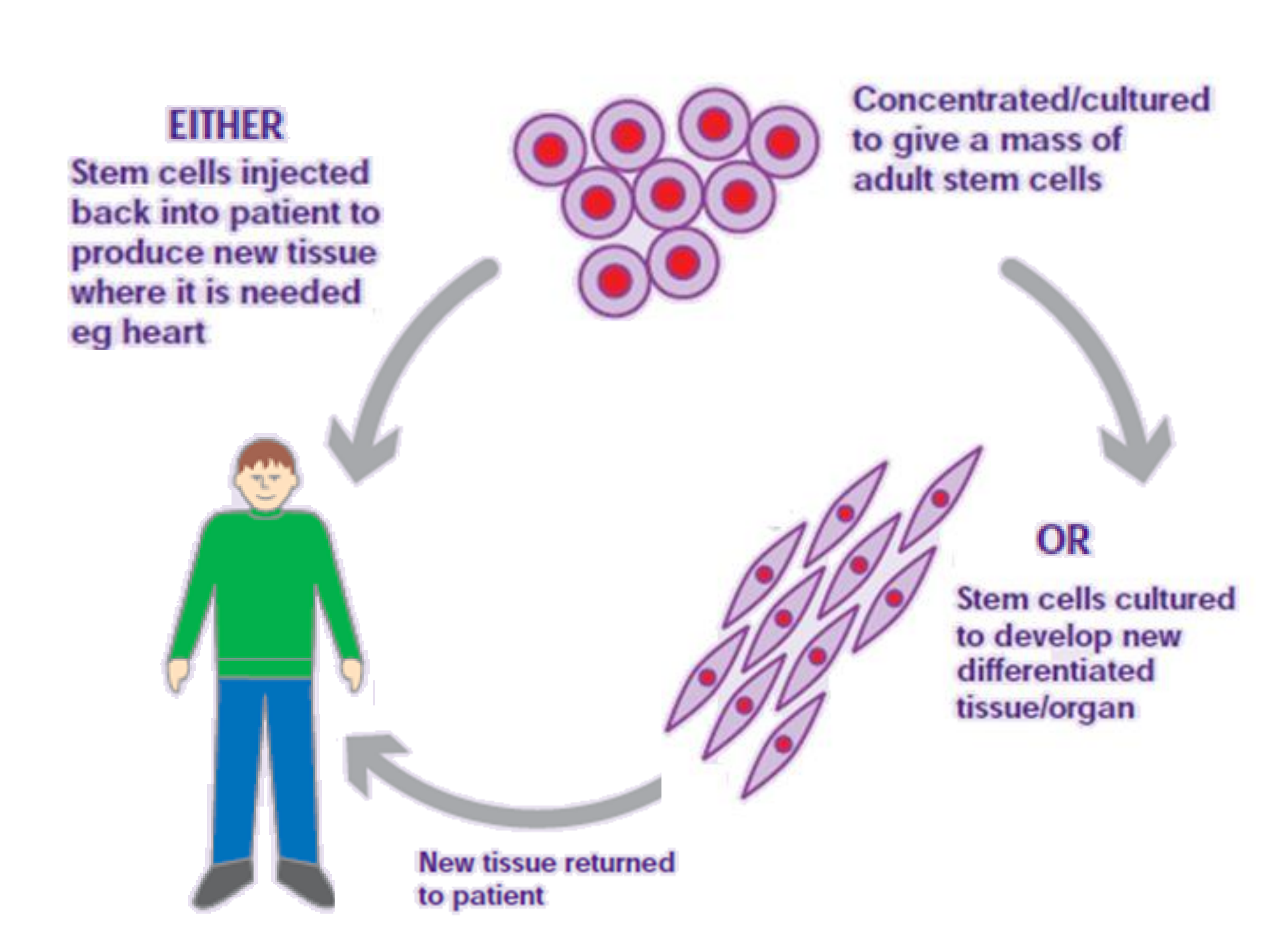
embryonic stem cells



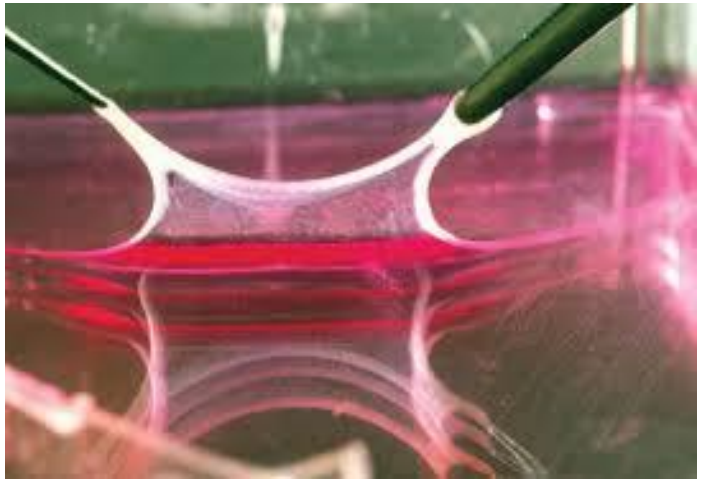

Mass of undifferentiated embryonic stem cells
Different culture conditions
Nerve cells
Muscle cells
Gut cells

adult stem cells



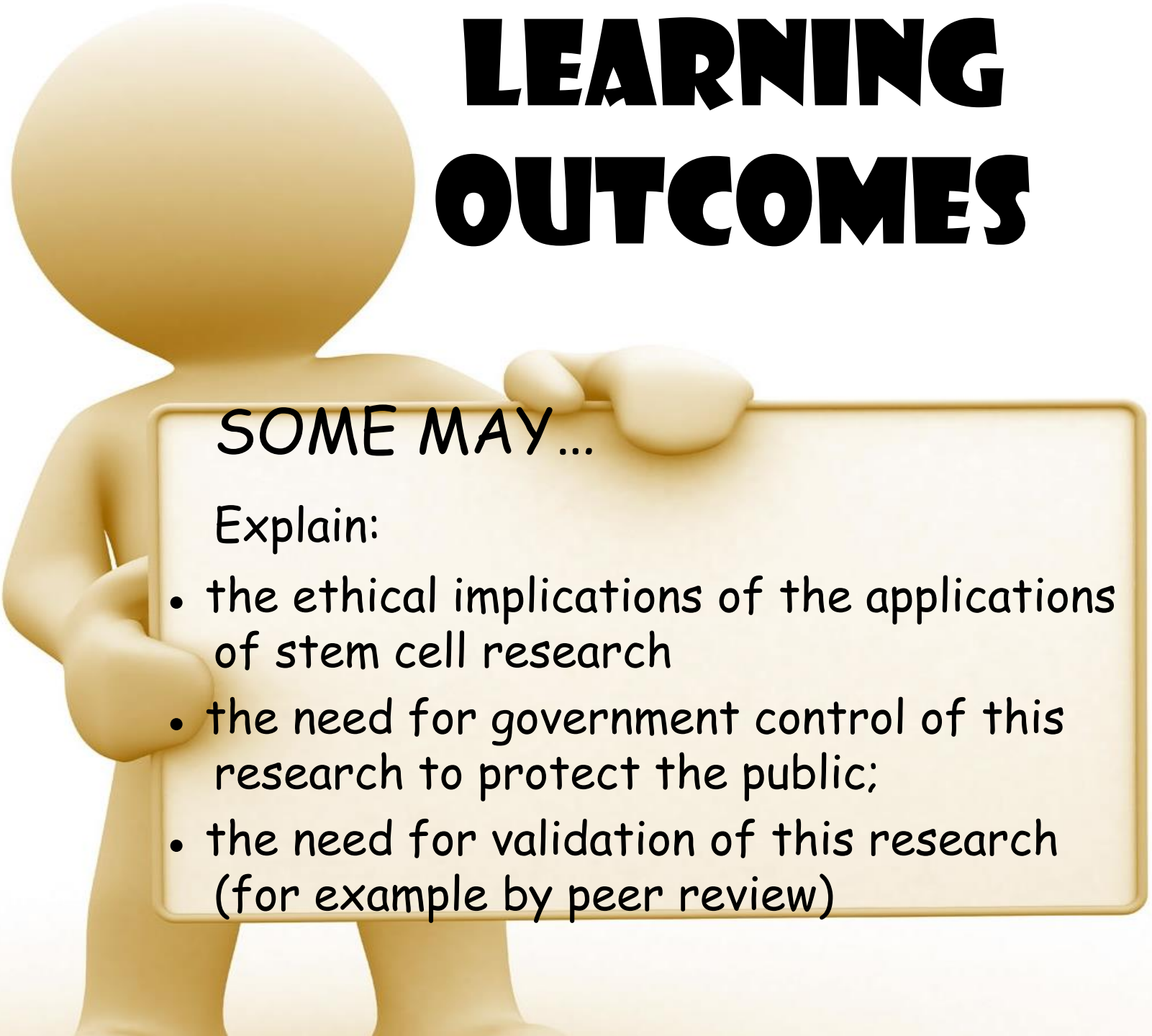

EITHER
Stem cells injected back into patient to produce new tissue where it is needed eg heart
Concentrated/cultured to give a mass of adult stem cells
OR
Stem cells cultured to develop new differentiated tissue/organ
New tissue returned to patient

Growing a trachea from stem cells



Growing skin from adult stem cells

LEARNING OUTCOMES



SOME MAY…

Explain:

- the ethical implications of the applications of stem cell research
- the need for government control of this research to protect the public;
- the need for validation of this research (for example by peer review)

USES OF STEM CELLS

Stem cells can be used for:

Growing tissue

- making new brain cells to treat Parkinson's disease
- rebuilding skin, bones and cartilage
- repairing damaged immune systems
- making replacement heart valves

Growing organs

- growing trachea

VIDEO LINK: Spinal Injury: 3 mins

Ballyclare

DEBATE CARDS ACTIVITY

ETHICS

- Principles
- Morals
- Beliefs

- **Ethics are the principals by which we live.**

Ethical Implications of Stem Cell Research

- Removing cells from an embryo that could grow into a new individual, even if that embryo has been produced by IVF and is no longer required, **is opposed for religious reason.**
- The embryo is killed and will not develop into a human.
- Embryo has human rights

Stem cell research is under strict control in most countries. This involves:

- The need for **government control** of this research to protect the public

- The need for **validation** of this research by **peer review** (review by other researchers working on stem cell research)

Advantages of using embryonic stem cells over adult stem cells

- Easier to grow or culture
- More plentiful and easier to extract
- Can develop into a wider range of different cell types and tissues
- There are more in the placenta and umbilical cord than in adult bone marrow

http://www.bbc.co.uk/schools/gcsebitesize/science/21c/

Chose: you and your genes< cloning and stem cells<