



# Theatre of Science Infection and Response 1: Pathogens!

**Today we'll be hearing about:**

- The definition of pathogen
- The four main types of pathogen
- The kinds of illnesses that pathogens cause
- How various pathogens evolved
- The structures of pathogens and how to tell them apart.

**To join in with the lesson bring:**

Any or none of the following. (Just for visual aids, we're not doing anything with them!)

Marmite, bread, mushroom, chocolate, soy sauce, piece of lichen, wine, beer. Feel free to eat marmite on toast during the lesson if you like of course! Don't consume the last three!).

## 1. **ALL** life on Earth falls into one of these categories.

**Archaea**

**Bacteria**

**Eukarya**




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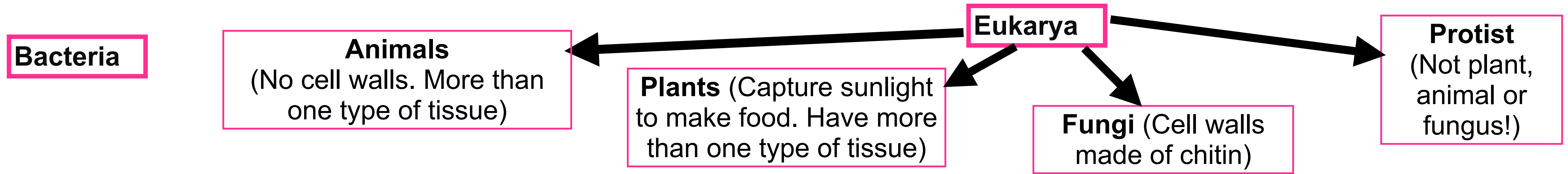
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Finished early? What three things do archaea and bacteria have in common and what did you just hear about Eukarya?

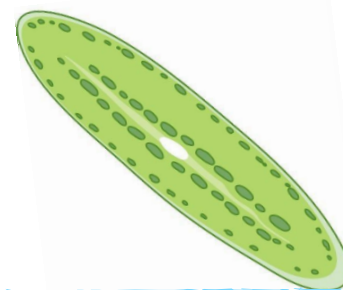
## 2. Draw lines to put these living things into the right categories. Which one doesn't fit into any?!



1. Single-celled, has cell wall made of chitin.

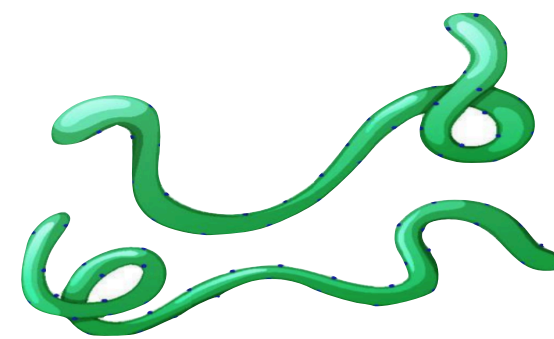


2. Single-celled, captures sunlight to make food. DNA is in a nucleus. More than one type of tissue.

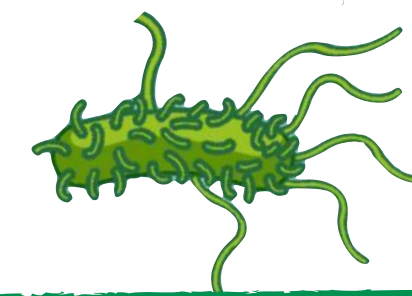


3. The same as 4. but it's not single celled, it has many cells.

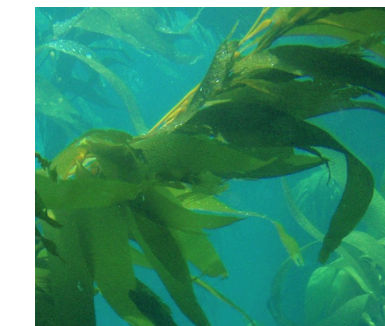
4. DNA not in nucleus. Not a living thing.



5. DNA not in nucleus. Has cell wall.



6. Captures sunlight to make food, DNA is in a nucleus. Only one type of tissue



7. DNA in nucleus. No cell walls. Made of multiple tissues.

# GCSE-style questions!

Bacteria...

- A. Have no cell wall
- B. Have no nucleus
- C. Are multi-cellular
- D. A and B.

In which of the following is DNA NOT found in a nucleus?

- A. Plants
- B. Protists
- C. Fungi
- D. Archaea

Which of these is not true of plants?

- A. Their cells have a nucleus
- B. Can be made of multiple cells
- C. Have cell walls made of chitin
- D. Use sunlight to make sugars.

An living thing that becomes infected by a microbe is called a...

- A. Parasite
- B. Host
- C. Pathogen
- D. Protist

Which of these illnesses was caused by a pathogen?

- A. Scurvy - lack of vitamin C
- B. Broken wrist caused by tripping over a cat
- C. Broken leg while playing football
- D. Athlete's foot - caused by a fungus.
- E. B and D.

All fungi are...

- A. Plants
- B. Eukaryotes
- C. Pathogens
- D. Bacteria

THANKS FOR SUPPORTING ME ON KO-FI! I'll send you rainbow glasses, sticker and a magazine to say thanks a million for contributing towards my wages! It's ridiculous that this business model works, you are all lovely. Search 'THEATRE OF SCIENCE KOFI' online find my supporter page!





# Theatre of Science Infection and Response 2: Bacteria!

**Today we'll be hearing about:**

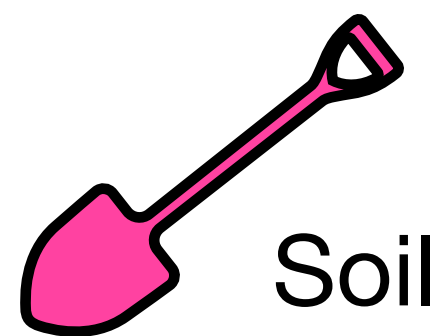
- Where bacteria are found
- The basic structure of bacteria
- Diseases caused by bacteria
- How bacteria make other organisms ill

**To join in with the lesson bring:**

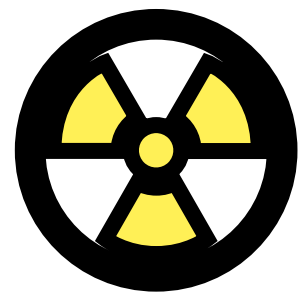
Play dough or salt dough (ideally two different colours but not essential!). Blue tack would do!

**Notes!**

## Starter: Where on Earth are bacteria NOT found?

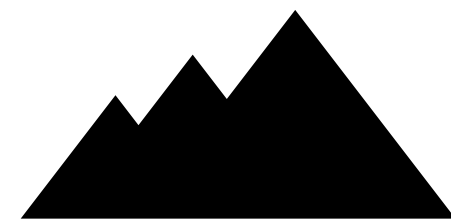


Soil



Radioactive waste

Mount Everest



In Earth's crust

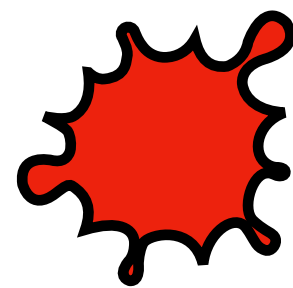


Molten lava

Arctic ice



Just-cooled lava



On your skin

In your guts

Deepest part of the ocean (Mariana Trench)





# 1. What ONE thing did I tell you last week that was wrong?!

Bacteria that cause disease are called pathogens

Not all bacteria cause disease

Bacteria have a cell wall

Bacteria are too small to be seen

Bacteria don't have their DNA in a nucleus

Bacteria were on Earth for 1.5 billion years before more complicated lifeforms evolved

**Notes!**

# 2. Drawing activity:

# GSCCE Questions

1. Which of the following diseases is NOT caused by bacteria?

- A: Pneumonia
- B: Chicken Pox
- C: Meningitis

2. The human stomach is lined with mucus that stops it being damaged by stomach acid. A species of bacteria called *Helicobacter pylori* can cause stomach ulcers. Explain how. (2 marks)

## Summary tasks!

1. State two facts you learned today that surprised you:

2. Explain how some pathogenic bacteria can live in your nose and not hurt you!



# Theatre of Science Infection and Response 3: Viruses!

## Today we'll be hearing about:

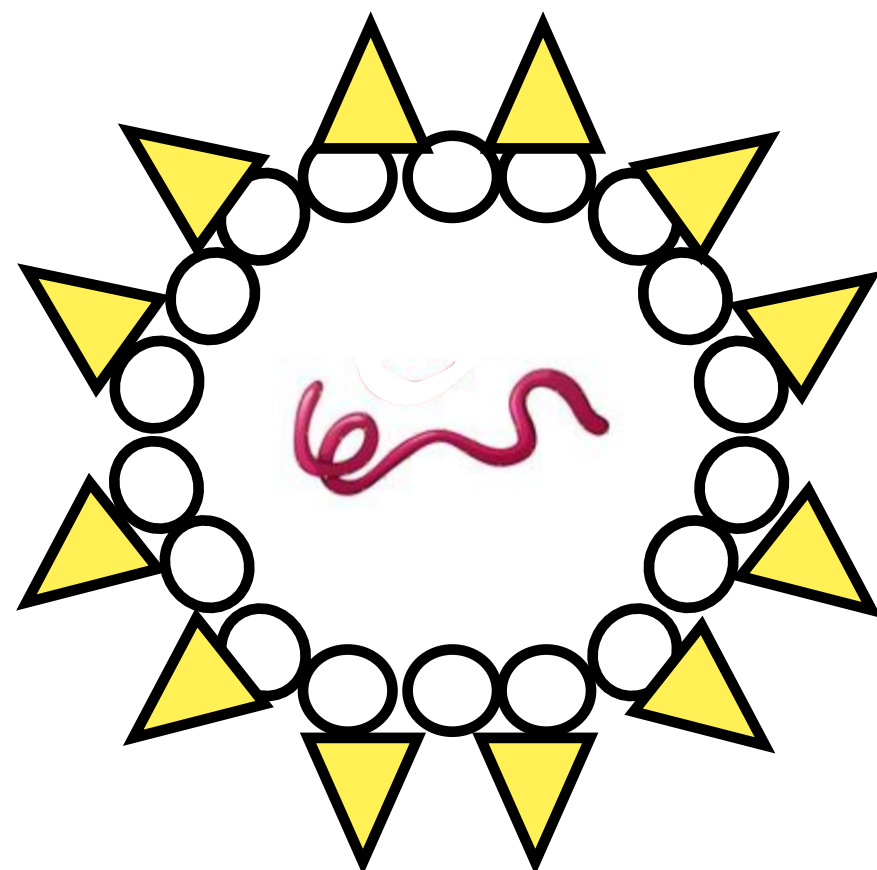
- How the sizes of viruses compare to bacteria
- The structure of viruses and how they are affected by soap
- Whether or not viruses can be considered 'living things'.
- The diseases that viruses cause

## To join in with the lesson bring:

Play dough (ideally two colours but not essential!). Blue tack would do! A tablespoonful of rice / hundreds & thousands / couscous on a plate. Teaspoon butter / marg. Teaspoon. Small bowl of soapy water.

**On each virus, draw lines to label the parts. Some parts only belong to one virus!**

## Non-enveloped virus



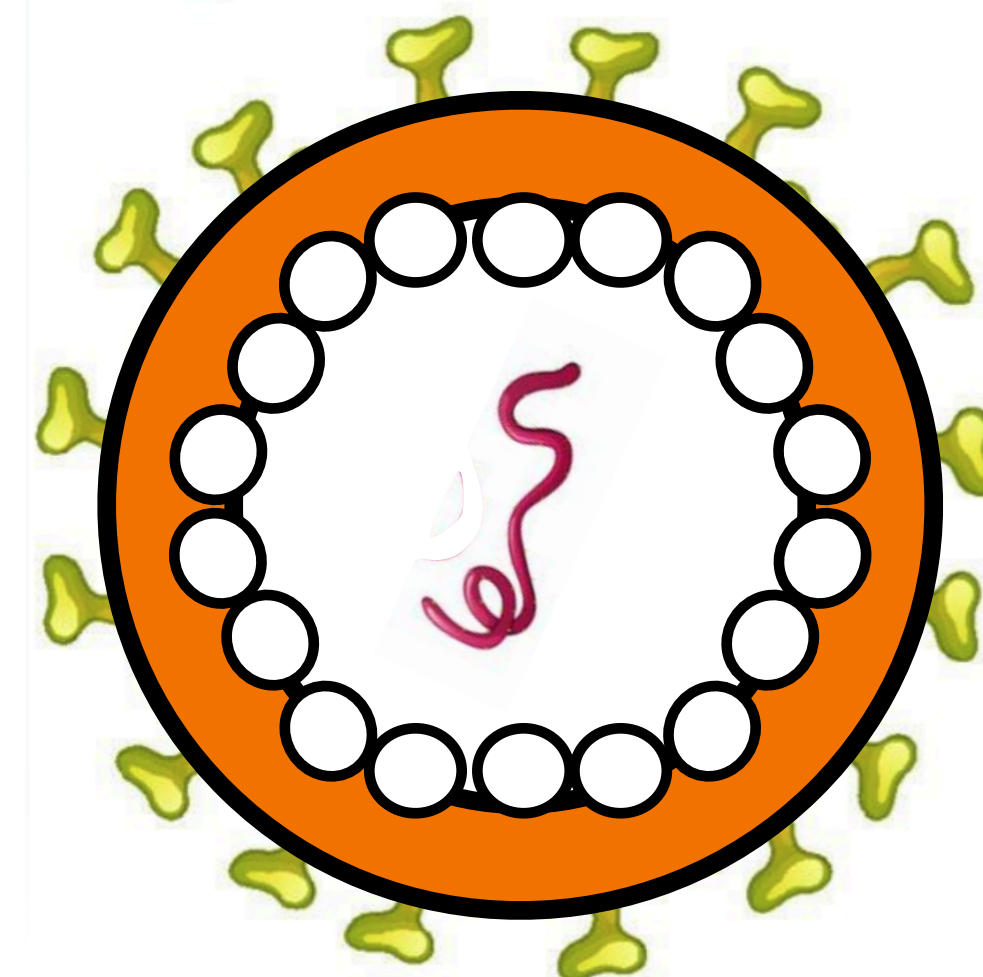
Attachment proteins

Genetic material

Protein shell

Lipid membrane envelope

## Enveloped virus





# Are viruses alive?

Write 'Y' next to the arguments for, and 'N' next to the arguments against.  
Then make up your own mind!

Contain genetic material  
(RNA or DNA)

They can't survive without other living things

They have some of the same genetic material as bacteria

Bacteria and viruses might have evolved from the same thing

Are active inside cells

They can reproduce inside cells

But humans can't survive without bacteria!

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Notes



# Theatre of Science Infection and Response 4: How germs spread and how to stop them!

**To join in:** Be near a sink if possible! With some washable paint, soap and an old towel. Or use a bowl of water instead of the sink.

**Today we'll be hearing about:**

Why we wash our hands in the way we do post-Covid!  
How various pathogens spread disease

How different pathogens are affected by soap  
Steps humans take to prevent the spread of disease.

When hand washing...	I think:	It turns out:
<b>Why</b> is using soap better than just water?		
Is it better to use antimicrobial soap? (See picture)		
Is it better to use a paper towel to turn off the tap?		
In a public toilet: what are the problems with filling the sink to wash your hands instead of using running water?		

Dettol Anti-Bacterial Original Soap is the gentle, hygienic way to cleanse and protect your skin. The unique anti-bacterial agents from Dettol help to rid your skin of the germs and bacteria that can't be removed by water alone.





# Theatre of Science

## Infection & Response 4:

# How germs spread and how to stop them!

### Today we'll be hearing about:

Why we wash our hands in the way we do post-Covid!

How different pathogens are affected by soap

How various pathogens spread disease

Steps humans take to prevent the spread of disease.

**To join in:** Be near a sink if possible! With some washable paint, soap and an old towel. Or use a bowl of water instead of the sink.



Dettol Anti-Bacterial Original Soap is the gentle, hygienic way to cleanse and protect your skin. The unique anti-bacterial agents from Dettol help to rid your skin of the germs and bacteria that can't be removed by water alone.

**Write down what you think, then what turned out to be right!**

When hand washing...	I think:	It turns out:
<b>Why</b> is using soap better than just water?		
Is it better to use antimicrobial soap? (See picture)		
Is it better to use a paper towel to turn off the tap?		
In a public toilet: what are the problems with filling the sink to wash your hands instead of using running water?		



How might you get ill if you came into this kitchen for a snack?! Be as precise as you can!



# GSCCE Questions

1. Salmonella can cause vomiting and diarrhoea. State **two** ways that a person infected with salmonella could prevent spreading the bacteria to other people. (2)
2. Malaria is spread by mosquitos.
  - a) What is the name for an organism that spreads disease? (1)
  - b) State one method for controlling the spread of malaria. (1)

## Summary tasks!

1. An adult says to you "I didn't get exposed to any bacteria during lockdown so my body won't cope as well with getting ill now". Explain why they're wrong in as much detail as you like (there are a few ways!)

# Complete what you can!

## We're imagining things are 10 000 x bigger than they are!

The relative sizes of bacteria, viruses and yeast  
How our bodies protect us from pathogens  
The meaning of 'non specific' defences  
The difference between a physical and chemical barrier

### To join in with the lesson bring:

About 3m of string, wool or cotton. A4 card or paper. Scissors, sellotape, ruler, coloured pens.

### 1. Cut string to these lengths & stick on your sheet:

- 10mm** (0.001mm - 1 $\mu$ m - in real life)
- 0.15mm** (0.000015mm - 0.15 $\mu$ m- in reality)
- 20mm** (0.002mm - \_\_\_\_\_? - in real life)
- 80mm** (0.008mm - \_\_\_\_\_ - in real life)

Yeast cell

Coronavirus

Ecoli bacteria

Width of spider silk

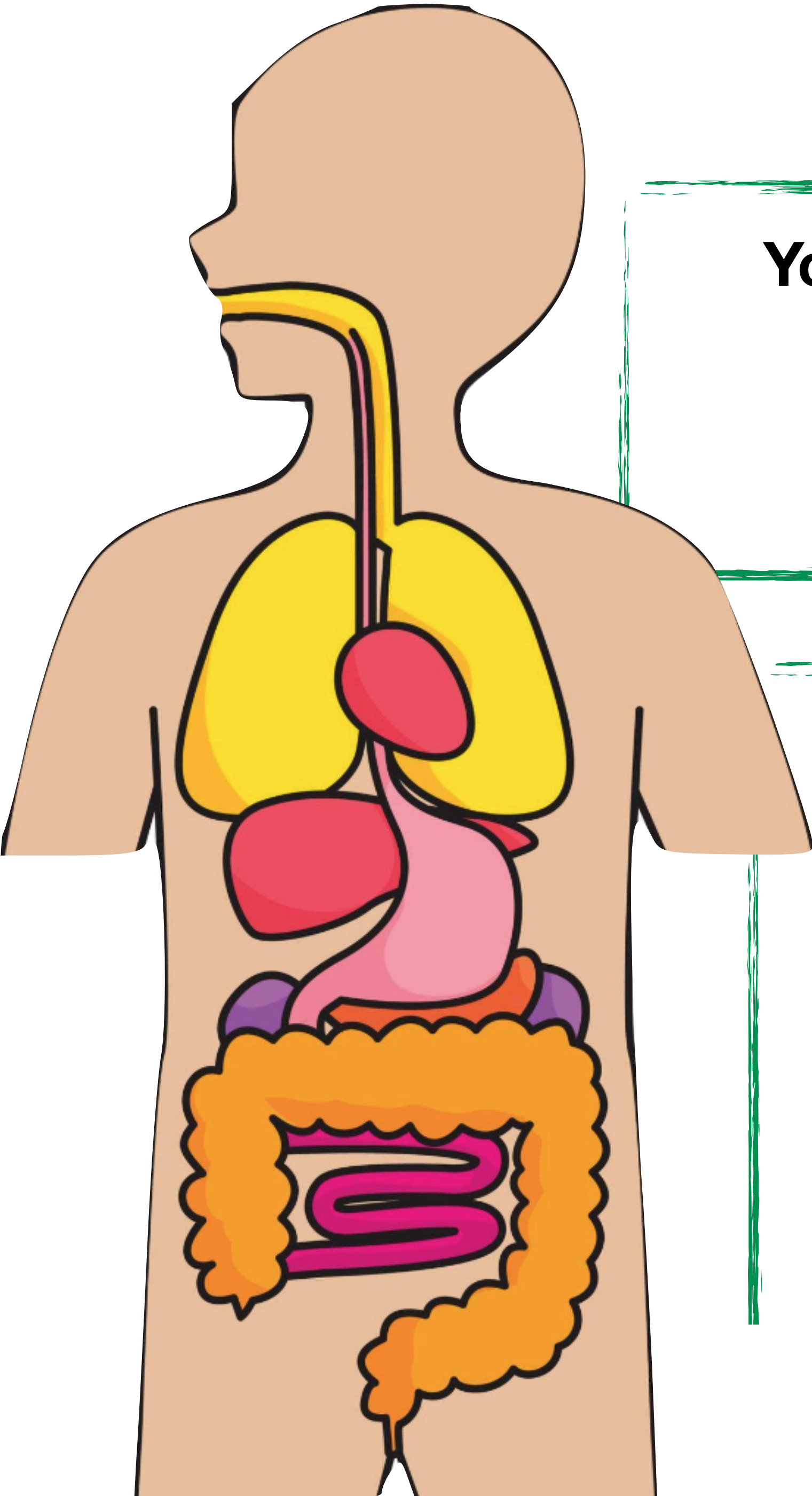
### 2. Which piece represents..?

(Remember in our model 0.1mm is 1m!)

3. Find two tiny things to measure. What do they measure in real life? How big would they be in our model?!



# How does the human body stop germs getting in?!



**Your ideas:**

**Physical barriers**

**Chemical barriers**

# GSCE Question

1. Describe how the human body prevents pathogens from entering. (6 marks)

2. Mark your work! What advice would you give to someone doing a 6 mark question in an exam?



# Theatre of Science Infection and Response 6: The Immune System!

**Today we'll be hearing about:**

The different white blood cells in our bodies including lymphocytes and phagocytes.

How these different white blood cells respond to pathogens

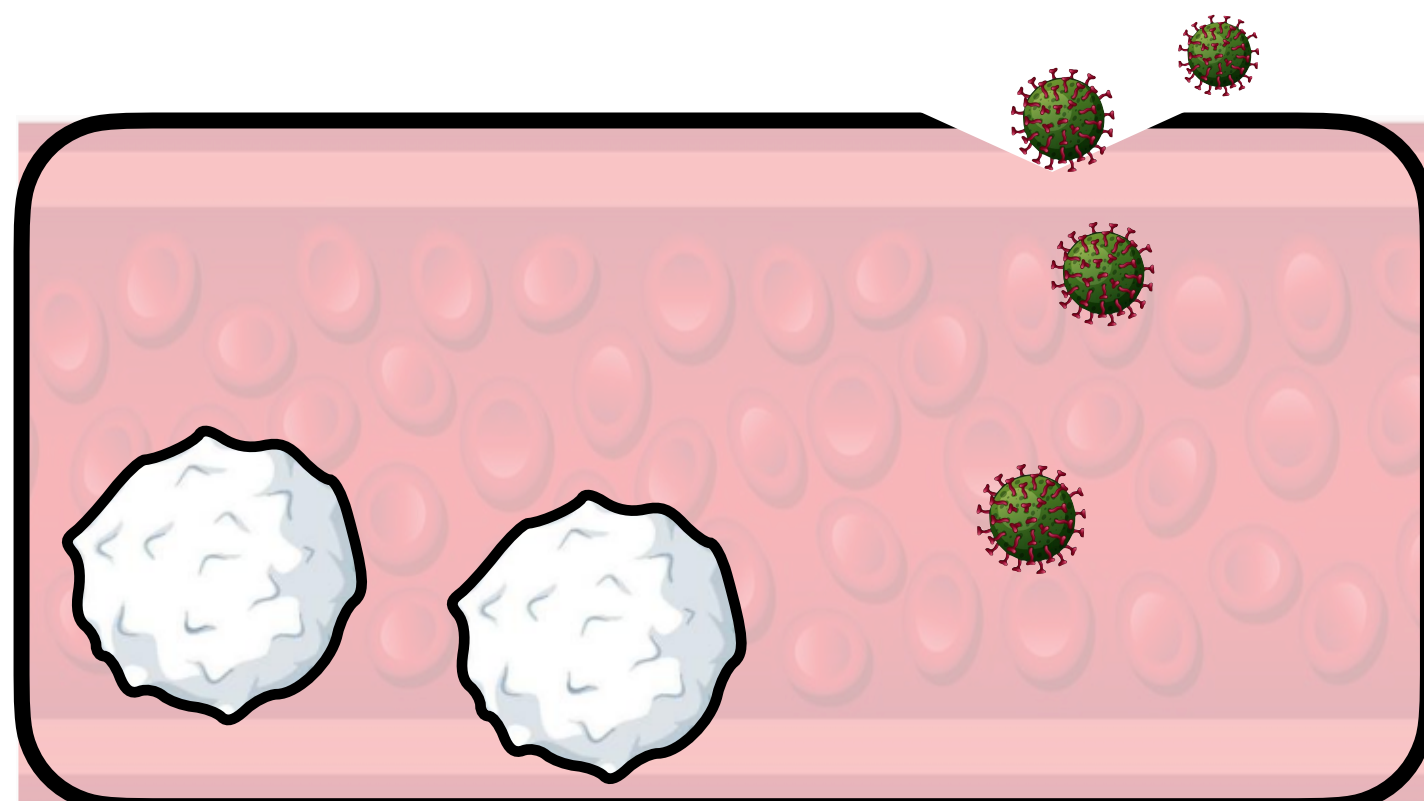
How memory cells help our immune systems respond to pathogens quickly.

**To join in with the lesson bring:**

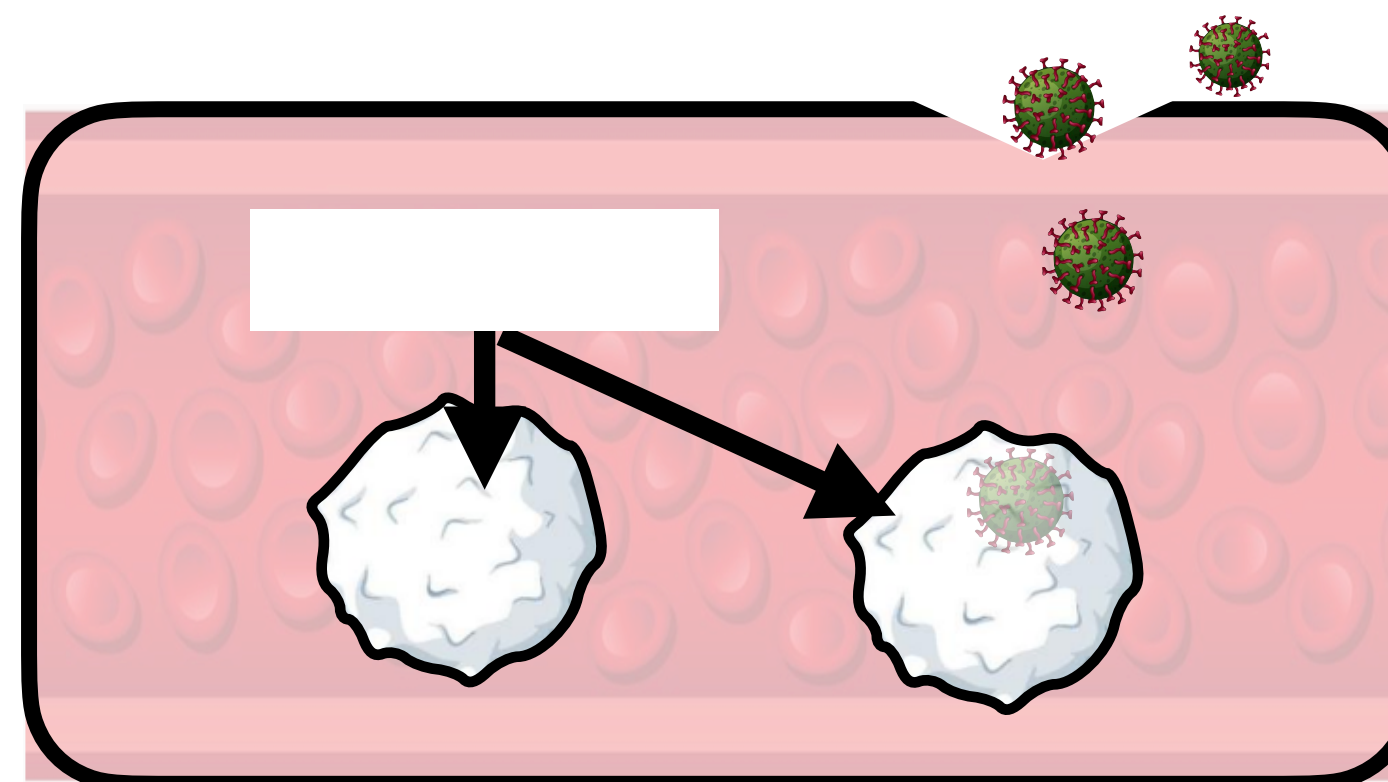
A4 paper, scissors, pens.

## 1) Can you improve any words in the sentences below?

When you get a cut,  
germs enter your body



Cells called white blood cells  
swallow the germs and kill them!



**2) Some white blood cells die after they've done their job. Guess what they're called after they die?!**



# Tick how you feel about each word

Beginning of lesson

Word	Heard of it	Know vaguely what it is	Know what it is	Not heard of it	Said I vaguely knew but now I think about it I haven't a clue
Antibiotic					
Antibody					
Antigen					

End of lesson

Antibiotic					
Antibody					
Antigen					

If you know or vaguely know what any of them are, write down some thoughts, even if it's just a word or two!

End of lesson  
Try to write down what you know now. It'll help you realise how much you've understood!

**Circle the correct word to complete the sentences when we get to this part of the lesson!**

On the surface of pathogens there are antigens  
antibiotics  
virals. B lymphocytes are made in the bone marrow  
brain  
bottom. They have antigens  
antibodies  
pathogens

stuck in their membranes. These bind to the antigens and tell the immune system where the pathogen is!

The antibody does not actually flag up  
destroy  
bind to the \_\_\_\_\_ itself.

*Notes*



# Theatre of Science Infection and Response 7: Recap and Quiz

## Round One: Pathogens!

1. Which of these could be a pathogen?      2. \_\_\_\_\_ bacteria make people ill.
- A. **Plant**   B. **Animal**   C. **Fungi**      A. **All**   B. **Some**   C. **No**

3. Pathogens \_\_\_\_\_ diseases.      4. What can viruses infect?

- A. **Cause**   B. **Carry**   C. **Have**      A. **Plants**   B. **Animals**   C. **Humans**  
D. **Bacteria**   E. **All of the above**

Three types of pathogen are mentioned in the above questions. Write them down from largest (on average) to smallest (2 marks).

## Round Two: Spread!

1. Which of these illnesses can you catch?      2. Diseases can spread through...
- A. **Broken leg**   B. **Sunburn**      A. **Water**   B. **Air**   C. **Touching**  
C. **Chicken Pox**      D. **All of the above**

3. What type of diseases do pathogens spread?      4. How does Cholera Spread?
- A. **Genetic**   B. **Communicable**      A. **Water**   B. **Air**   C. **Touching**  
C. **Hereditary**      D. **All of the above**

State two diseases caused by a viruses (2 marks)

## Round Three: Prevention!

1. It's most important to wash your hands before...      2. How should you wash them?
- A. **Bed**   B. **Eating**   C. **Going out**      A. **In a bowl**   B. **Fill the sink**  
C. **Under running water**

3. Science suggests antibacterial soaps are better than:      4. How can washing up liquid damage bacteria?
- A. **Normal soap**   B. **Scented soap**      A. **Breaks nucleus**   B. **Poisons**  
C. **Neither**   D. **Both**      them   C. **Breaks cell wall**

How does washing your hands properly make them germ-free? (3 marks)



## Round Four: Bacteria!

1. Which of the following is only a physical barrier, not a chemical one?  
A. **Stomach acid** B. **Hairs in nose**  
C. **Tears**

3. Which of the following is acidic?  
A. **Skin** B. **Stomach acid**  
C. **Both**
4. Which physical barrier is produced by platelets?  
A. **Scab** B. **Mucus** C. **Enzymes**

Name a barrier not mentioned on this page!

## Round Five: The Immune System!

1. Name the white blood cells that engulf germs.  
A. **Fudgocyte** B. **Phagocyte**  
C. **Philocyte**
2. What is pus?  
A. **Dead skin cells** B. **Dead white blood cells** C. **Damaged platelets**
3. Where are white blood cells made?  
A. **A medicine that kills bacteria** B. **A particle that binds to germs** C. **Part of a pathogen**
4. What is an antibody?

Make your whole, or a bit of your body, into the shape of a B Cell. (3 marks)

Christmas Round! If you're watching in May you might want to skip this bit.

Which famous scientist was born on Christmas Day?

How many points does a snowflake have?

4 6 8 Different amounts

What are stars mostly made of?

Hydrogen  
Helium  
Neon

What animal can you tell if it's a male or female by its poo?

Robin Turkey Reindeer

How far back in time would you have to travel to meet an animal that is the ancestor (great-great-great- times a lot grandma) of humans and reindeer?

**100 years** **1000 years**

**1 million years** **100 million years**