

# Key Stage 3

## Cell Structure and Structural Adaptations

### Student worksheet

#### Introduction

Cells are the basic building block of all life. While cells can appear complex, they are all made from a handful of basic “ingredients”. Scientists refer to these as cell structures and each performs a specific job that helps the cell to function.

Even though cells are all made from the same basic ingredients, there are a huge variety of cells in biology. This variety is brought about because different cells have different numbers and combinations of these ingredients (cell structures). This is much like different types of cake which all share the same basic ingredients of flour, egg, butter and sugar.

By cells having different combinations of ingredients, they can become efficient at performing specific tasks. Such cells are known as specialised cells.

Some of the most specialised cells in the human body are those found in the immune system. In the following activity, you will



consider the function of the immune system and how cells are specialised to carry out their important functions.



#### Video comprehension

The immune system is packed with specialised cells that all work together to fight off harmful microorganisms (pathogens). What are the specialised cells mentioned in the animation? Those students paying close attention may even be able to jot down their job in the immune system!

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## Cell structures

Even though they each perform very different functions, like all cells, each of the cells of the immune system are made from the same basic cell structures. Complete the table below to review the function of each cell structure.

Cell structure	Function
	<i>Jelly-like substance where most chemical processes happen.</i>
<i>Cell membrane</i>	
<i>Nucleus</i>	
<i>Vacuole</i>	
	<i>Part of the cell where energy is released from food molecules.</i>
	<i>Strengthens the cell. In plant cells it is made of cellulose.</i>
<i>Chloroplast</i>	

[www.oxfordsparks.ox.ac.uk/content/our-immune-system-battle-within](http://www.oxfordsparks.ox.ac.uk/content/our-immune-system-battle-within)

## Designing immune and blood cells

As you have seen, cells of the immune system are highly specialised. Each has a different number and combination of cell structures that make them efficient at carrying out specific jobs.

Using the information below about the tasks that different immune system cells must carry out, and the information about the functions of cell structures opposite, make your own design for these cells.

1. Read the information about a given immune cell.
2. On a blank piece of paper draw a diagram to show what you think this cell might look like and what cell structures it is likely to have. Remember to carefully consider how these cell structures may make it more suited to its job.
3. Annotate your diagram to explain your choice of cell structures and how they help the cell to perform its function. If you have deliberately left out a cell structure as you think it would hinder the action of the cell, you should write a sentence next to your diagram to explain why.



## White blood cell

*The role of phagocytes is to catch, eat and kill harmful microorganisms using special chemicals.*

- Requires lots of energy to keep producing poisonous chemicals capable of destroying harmful microorganisms (pathogens).
- Must be able to prevent harmful toxins released from the pathogen from entering while still being able to absorb useful chemicals such as oxygen.
- Must be able to change shape easily to engulf pathogens
- Must contain the information required to divide and produce copies of itself quickly if harmful pathogens enter the body.
- Must be able to store poisonous chemicals in a way that stops them from getting out and into the rest of the cell.
- Must be able to carry out many chemical reactions in order to recognise pathogens and produce the chemical weapons to destroy them.

## Red blood cell

*The role of the red blood cell is to carry oxygen around the body. It collects oxygen from the lungs and carries it around the body.*

*This cell is not in fact involved in the body's immune system but has many interesting structural adaptations that make it good at its role.*

- These cells do not need to divide and produce copies of themselves – they simply carry oxygen until the day they die. New red blood cells are produced by another type of cell found in the bone marrow.
- They need as much free space as possible to carry oxygen.
- Must be able to change shape easily to fit through very thin blood vessels.
- They require very little energy.
- They must be smooth to prevent them getting snagged while travelling through blood vessels.
- They must be able to control what is coming in and out. They need to be able to absorb oxygen but not any other substances found in the blood.