

IGCSE Edexcel Biology

Lesson 19

Topic 2: Structures and Functions in Living Organisms

Learning Objectives

By the end of this lesson, you will be able to:

- Identify the components of blood and their primary functions.
- Explain how red blood cells are adapted for efficient oxygen transport.
- Describe the three ways white blood cells defend the body against pathogens.
- Understand the role of plasma in transporting various substances and heat energy.

Key Words

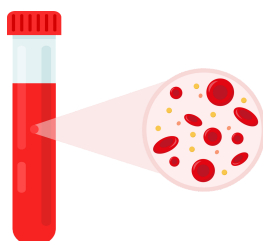
Plasma, Red Blood Cells, Haemoglobin, White Blood Cells, Phagocytes, Lymphocytes, Antibodies, Antitoxins, Pathogens, Biconcave.

Section A - Introduction to Blood Composition

Blood consists of **specialised cells** and fragments suspended in a liquid medium, acting as the primary **transport** system of the body.

Plasma

- The liquid which **carries** the **components** in the blood, e.g. cells, platelets, amino acids, hormones etc.
- Plasma is important for the **transport** of carbon dioxide, digested food, urea, hormones and heat energy.



Section B - Specialised Blood Cells

The cellular components of blood are highly **adapted** to perform **specific** biological roles:

Red blood cells:

- **Carry oxygen** molecules from the lungs to all the cells in the body.
- Contain **haemoglobin**: a **red** protein that combines with oxygen to allow **oxygen** transport.
- **No nucleus**: to create more space for haemoglobin.
- **Biconcave shape**: to maximise **surface area** for oxygen to be absorbed.
- **Flexible**: so they can fit through very narrow blood vessels.



White blood cells

They are a part of the **immune system**, which is the body's **defence** against **pathogens**.

There are 3 types of WBCs:

1. Phagocytic white blood cells

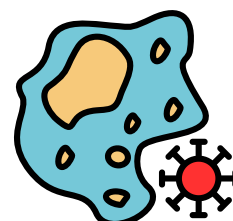
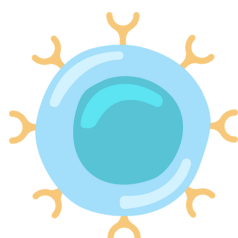
- These cells carry out **phagocytosis**, a process of **surrounding**, **engulfing**, and **digesting** pathogens.
- As phagocytosis can occur on any type of pathogen, they are considered to have a **non-specific** function.

2. Producing antibodies (lymphocytes)

- Each pathogen has an **antigen** on their surface. This antigen has a specific structure **complementary** to an **antibody**.
- Once antibodies begin to bind to the pathogen, the pathogens start to **clump** together, making it easier for white blood cells to find them.
- They provide **long-term immunity** because the body can produce these **specific antibodies** much faster if the same pathogen returns.

3. Producing antitoxins

- Some white blood cells release **chemicals** that **neutralise** the poisonous **toxins** produced by bacteria.



Section C - Comparison of Defense Mechanisms

Mechanism	Process	Specificity
Phagocytosis	Engulfing and killing pathogens.	Non-specific.
Antibody Production	Binding to antigens to cause clumping.	Highly specific.
Antitoxin Production	Binding to toxins to neutralise them.	Specific to the toxin.

Task 1 – Quick Quiz

1. What is the liquid part of the blood called?
2. Which protein is responsible for oxygen transport?
3. What is the specific shape of a red blood cell?
4. Which chemicals are produced by lymphocytes to clump pathogens?
5. What process involves a white blood cell engulfing a pathogen?

Recall From Previous Lessons

Task 1: The Path of Air

Rearrange the following structures into the correct order that an oxygen molecule would travel during inhalation, starting from the outside atmosphere:

- Alveoli
- Bronchioles
- Trachea
- Nasal Cavity
- Bronchi

Recall Task 2: Biological Molecules

Testing for Nutrients Fill in the blanks for the food tests used to identify different molecules:

1. Starch: Add Iodine solution; color changes from orange/brown to _____.
2. Glucose: Add Benedict's solution and heat; color changes from blue to _____.
3. Proteins: Add Biuret solution; color changes from blue to _____.
4. Lipids: Add Ethanol and water; a _____ emulsion forms.

Recall Task 3: Plant vs. Animal Cells

Key Differences:

Identify the three structures found in plant cells but not in animal cells.

- 1.
- 2.
- 3.

Exam Practice

- 1** Explain how the flexibility of a red blood cell helps it perform its function in the body. (2 marks)

- 2** Describe how lymphocytes help the body destroy pathogens using antibodies. (3 marks)

- 3** Explain how the structure of a red blood cell is adapted for the efficient transport of oxygen. (4 marks)

- 4** State two substances, other than carbon dioxide, that are transported by the plasma. (2 marks)
