Learning Objectives

1. Explain blood biochemistry and blood typing
2. Describe the methods used in the identification and individualisation of blood
3. Identify the various blood spatter patterns
4. Conduct blood spatter analysis to find the source of blood and reconstruct past events

Blood

Fresh

→ Obvious

Old & dried

→ Obvious?

Blood

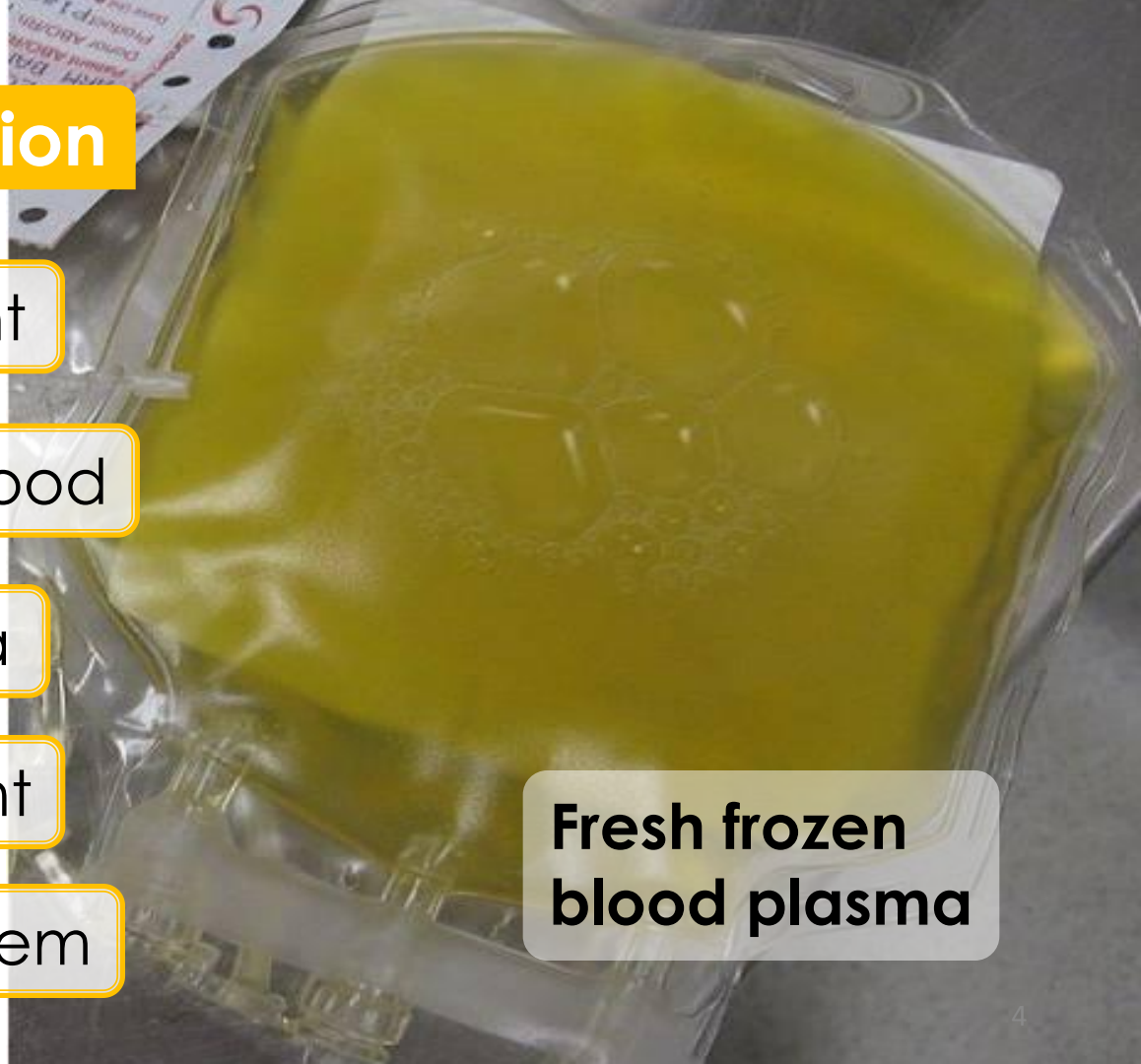
1. Is it blood? → Show up invisible stains
2. Is it human blood?
3. Whose blood is it?
4. Can we use blood spatter patterns to reconstruct events?

Blood Composition

8% of body weight

Fluid portion of blood

- Blood plasma
- 55% by weight
- Transport system



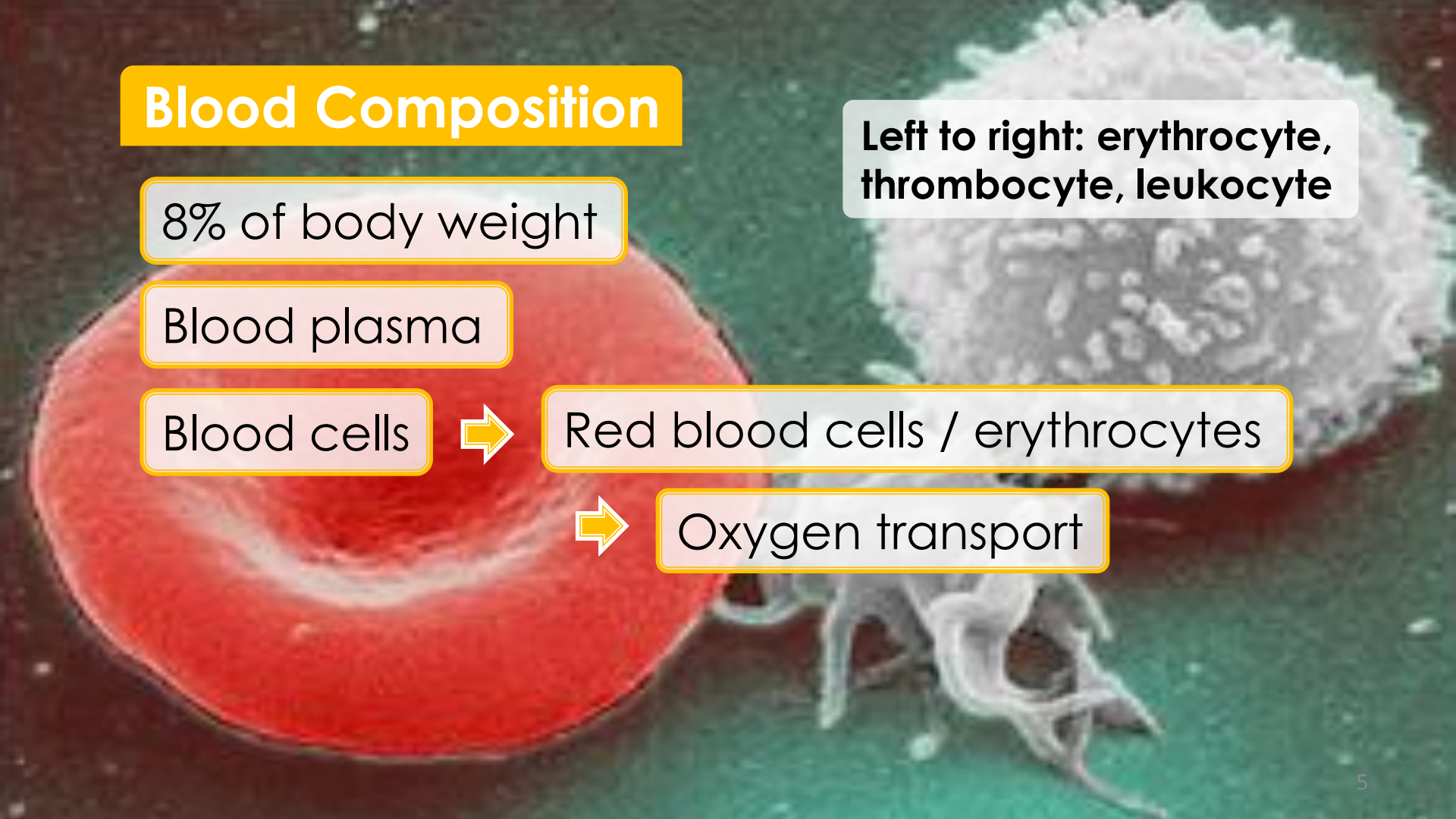
Fresh frozen blood plasma

Blood Composition

8% of body weight

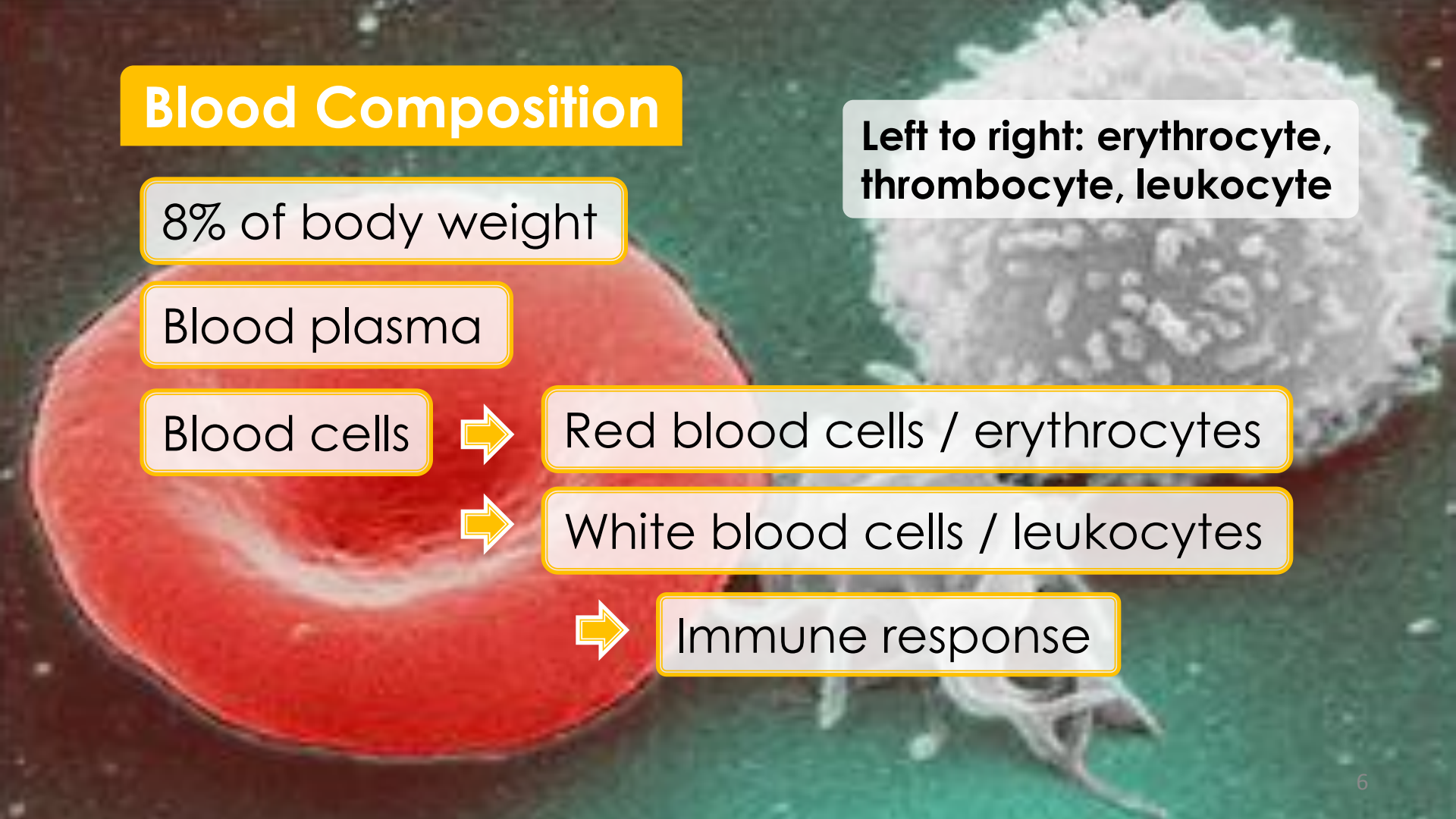
Blood plasma

Blood cells → Red blood cells / erythrocytes → Oxygen transport



Left to right: erythrocyte, thrombocyte, leukocyte

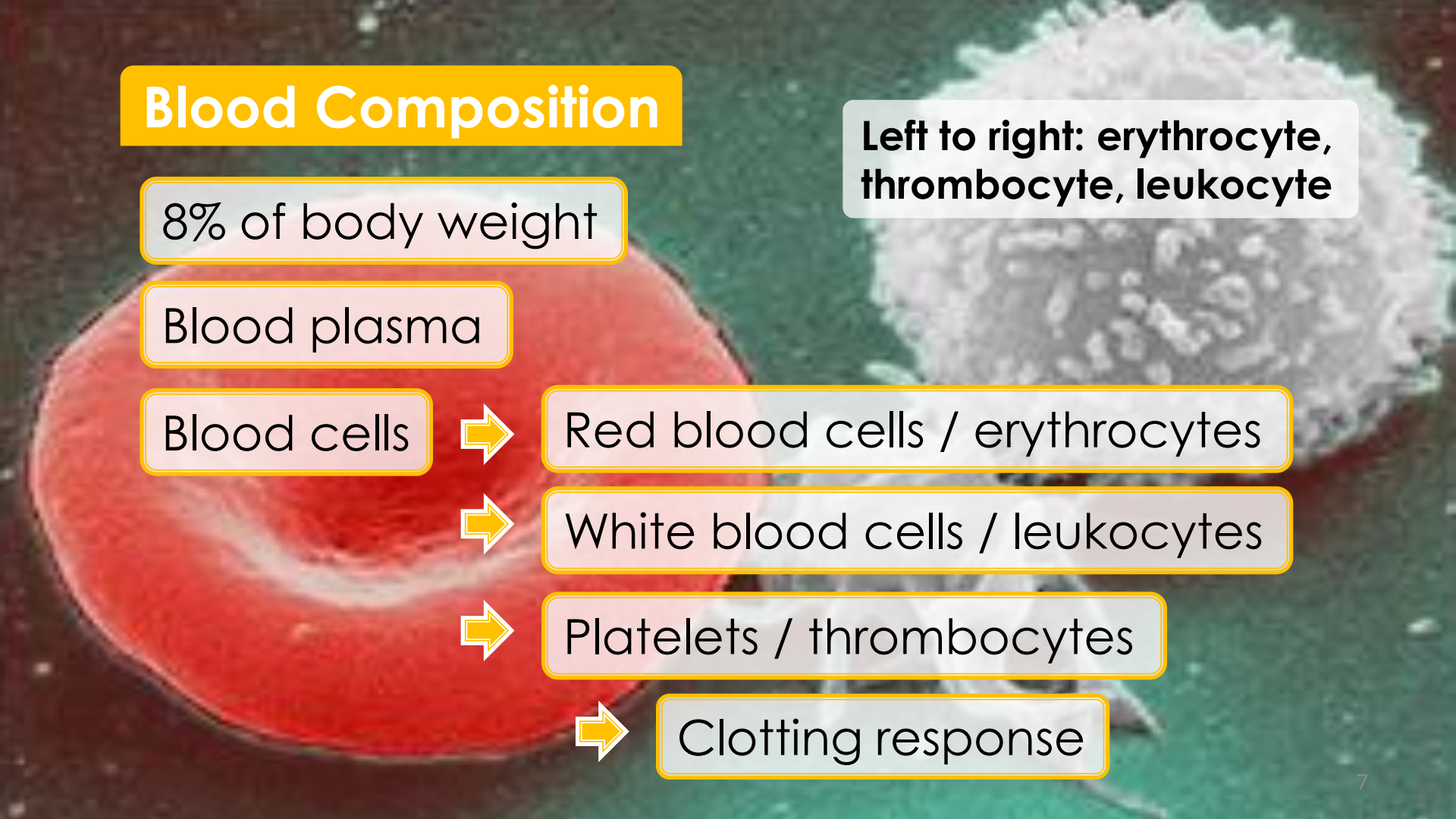
Blood Composition



Left to right: erythrocyte, thrombocyte, leukocyte

- 8% of body weight
- Blood plasma
- Blood cells
  - Red blood cells / erythrocytes
  - White blood cells / leukocytes
    - Immune response

Blood Composition



Left to right: erythrocyte, thrombocyte, leukocyte

- 8% of body weight
- Blood plasma
- Blood cells
  - Red blood cells / erythrocytes
  - White blood cells / leukocytes
  - Platelets / thrombocytes
    - Clotting response

Erythrocytes

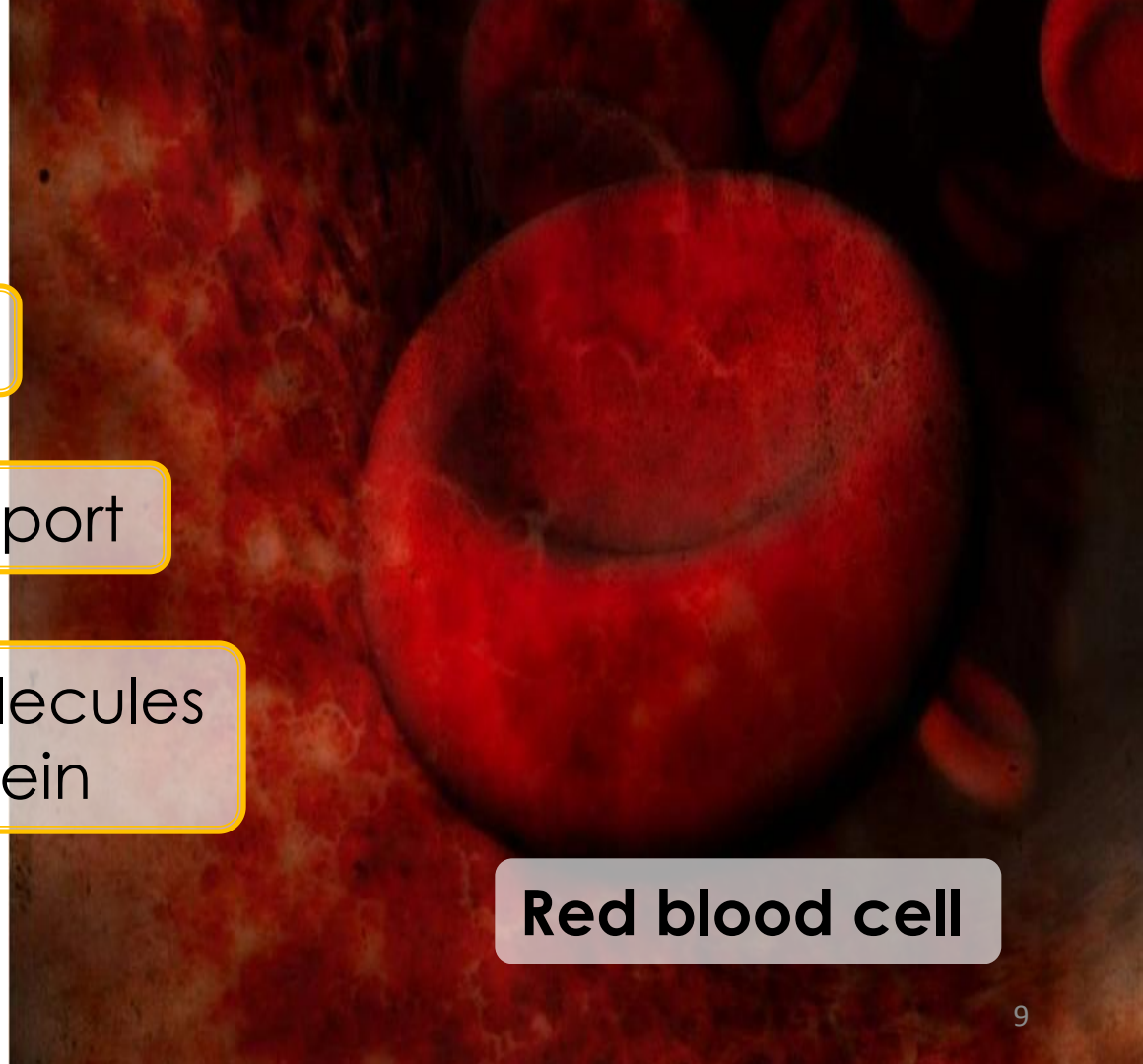
- 7.8 microns in diameter
- Biconcave
- No nucleus
- ➡ No DNA

Red blood cell

Erythrocytes

Principal function

- Oxygen transport
- 4 oxygen molecules on each protein



Red blood cell

Antigens

Proteins on surface of red blood cells

- Responsible for blood typing
- 30 commonly occurring antigens
- Over 100 rare antigens

Blood transfusion

Must be given blood of the right type

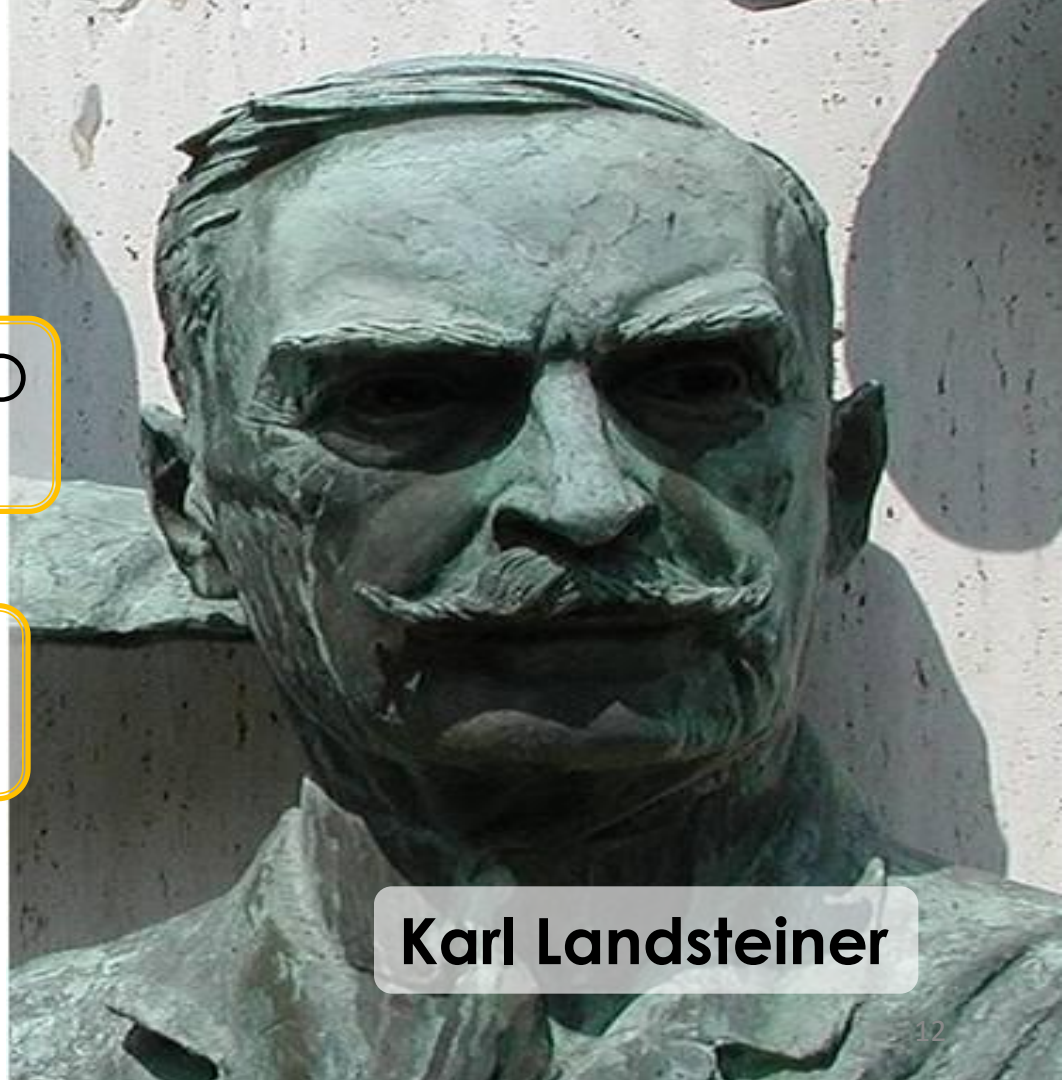
Early days → Some people fine after a blood transfusion

→ Some people fell ill or died after a blood transfusion

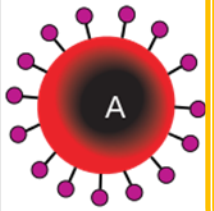
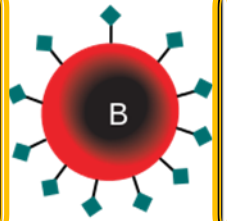
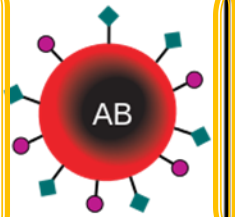
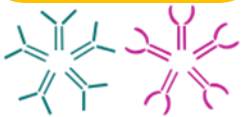
Karl Landsteiner

Developed the A-B-O blood typing system

Won the 1930 Nobel Prize in Medicine



A-B-O Blood Types

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in Red Blood Cell	 A antigen	 B antigen	 A and B antigens	None

A-B-O Blood Types

Occurrence of blood types vary

Blood Type	Percentage (%)
O	40
A	25
B	30
AB	5

Blood Types & Personality

Is your blood type the key to true love?

➡ No

Blood Types & Personality

"I am type B and have the tendency to be simplistic and straightforward at times."
- Ryu Matsumoto

Antibodies

Immunoglobins

20% of blood plasma volume

Produced as part of immune response

Antibodies

Bind to “alien” objects

Antigen binding sites

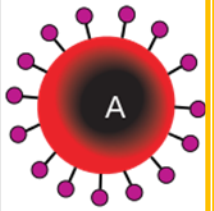
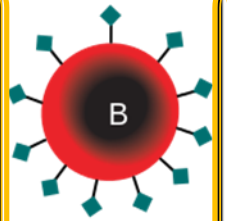
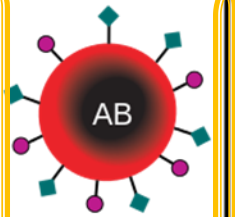
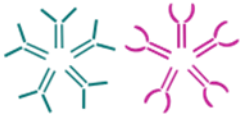
Extremely specific

Serum Antibodies

Antibodies corresponding to surface antigens

- Anti-A antibodies
- Anti-B antibodies

A-B-O Blood Types

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in Red Blood Cell	 A antigen	 B antigen	 A and B antigens	None

Blood typing system

Many different antigens

- A-B-O system based on A and B antigens

Less common antigens

- D antigen / rhesus antigens

Rhesus antigens

Rhesus positive

With D antigen

85% of population

Rhesus negative

Without D antigen

15% of population

Blood Type Distribution in Singapore

Blood Type	Percentage (%)
O+	34
O-	6
A+	21
A-	4
B+	25.5
B-	4.5
AB+	4
AB-	1

Want to individualise evidence

Blood types are not individualised

Bio-Identification

More complex blood typing

- Individualisation of blood type?
- Extensive research before 1990

Inferior to DNA fingerprinting

- Blood sample → Individualise it

Bio-Identification

Blood type not individualised

- Cannot be used to prove guilt
- Can be used to establish innocence

Bio-Identification

Crime scene → Type A blood found

Suspect is type B blood

→ Established innocence

Bio-Identification

Crime scene → Type A blood found

Suspect is type B blood

Suspect is type A blood

→ Does not prove guilt

→ Require further evidence