BLOOD BASICS

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Blood Facts

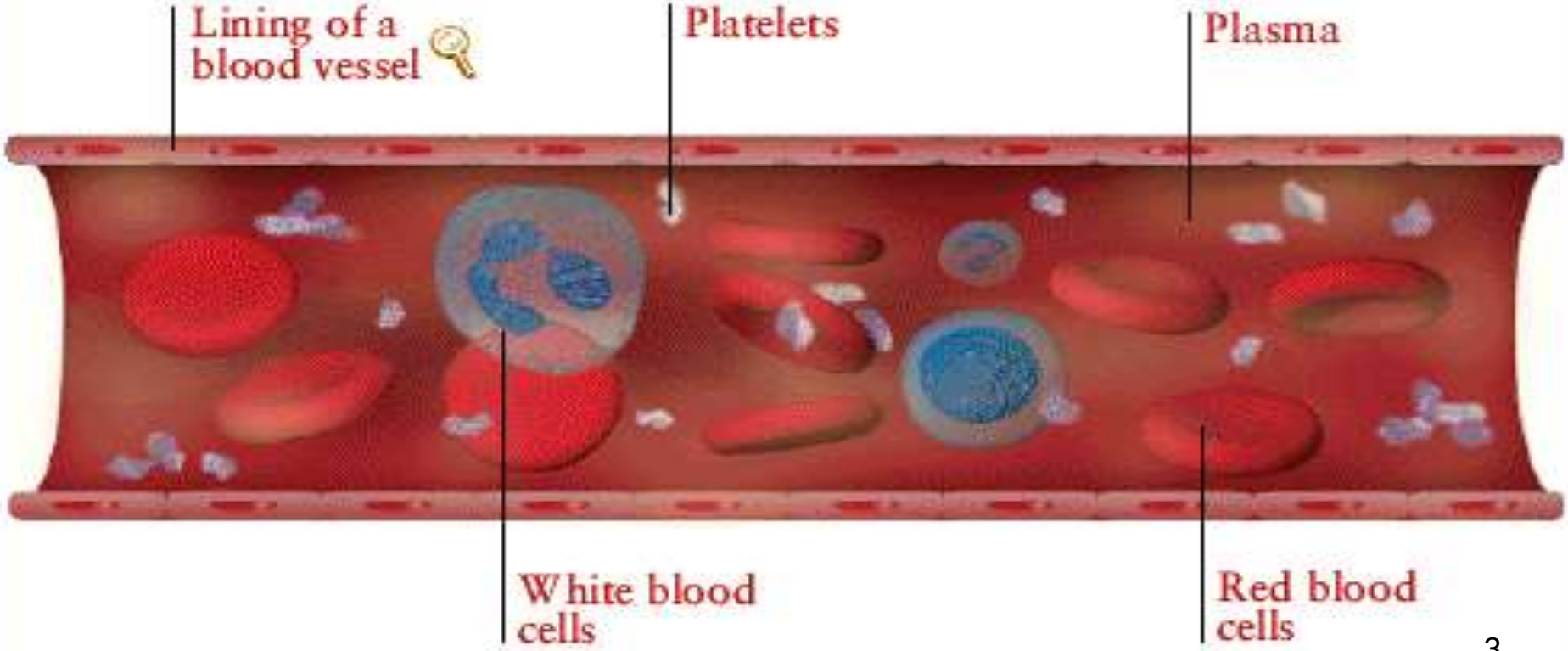
The average adult has about **FIVE** liters of blood inside of their body, which makes up 7-8% of their body weight.

This red liquid is living **tissue** that carries oxygen and nutrients to all parts of the body, and carries carbon dioxide and other waste products back to the lungs, kidneys and liver for disposal. It fights against **infection** and helps heal **wounds**, so we can stay healthy.

There are about one **billion** red blood cells in two to three drops of blood. For every **600** red blood cells, there are about **40** platelets and **one** white cell.

WHAT IS BLOOD MADE OF?

YOUR BLOOD is a complex mixture of solid parts floating in a liquid. The solids are the body's blood cells, which make up 45 per cent of the total volume of blood. Most of these cells are the red blood cells that give blood its colour; the remainder are white blood cells, and cell fragments called platelets. The liquid part of the blood, known as plasma, makes up the rest of the volume. Plasma is colourless and is made up mostly of water. It carries dissolved proteins, food, salts, waste products, and gases.

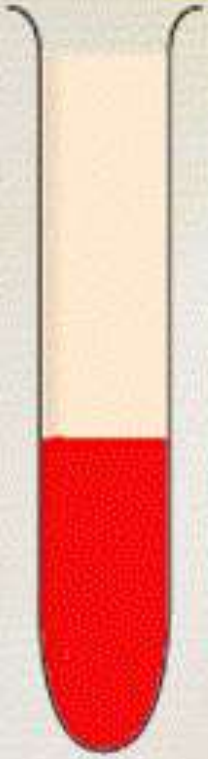


Composition of the blood

Our blood is made up of:

- plasma, which is a liquid made up mainly of water;
- formed elements, which consist of red blood cells, white blood cells and platelets.

The amount of blood we have in our body depends on our body size. Long term endurance training increases the amount of blood in our body.



55% plasma:

- 90% water;
- 7% plasma proteins;
- 3% other.

45% formed elements:

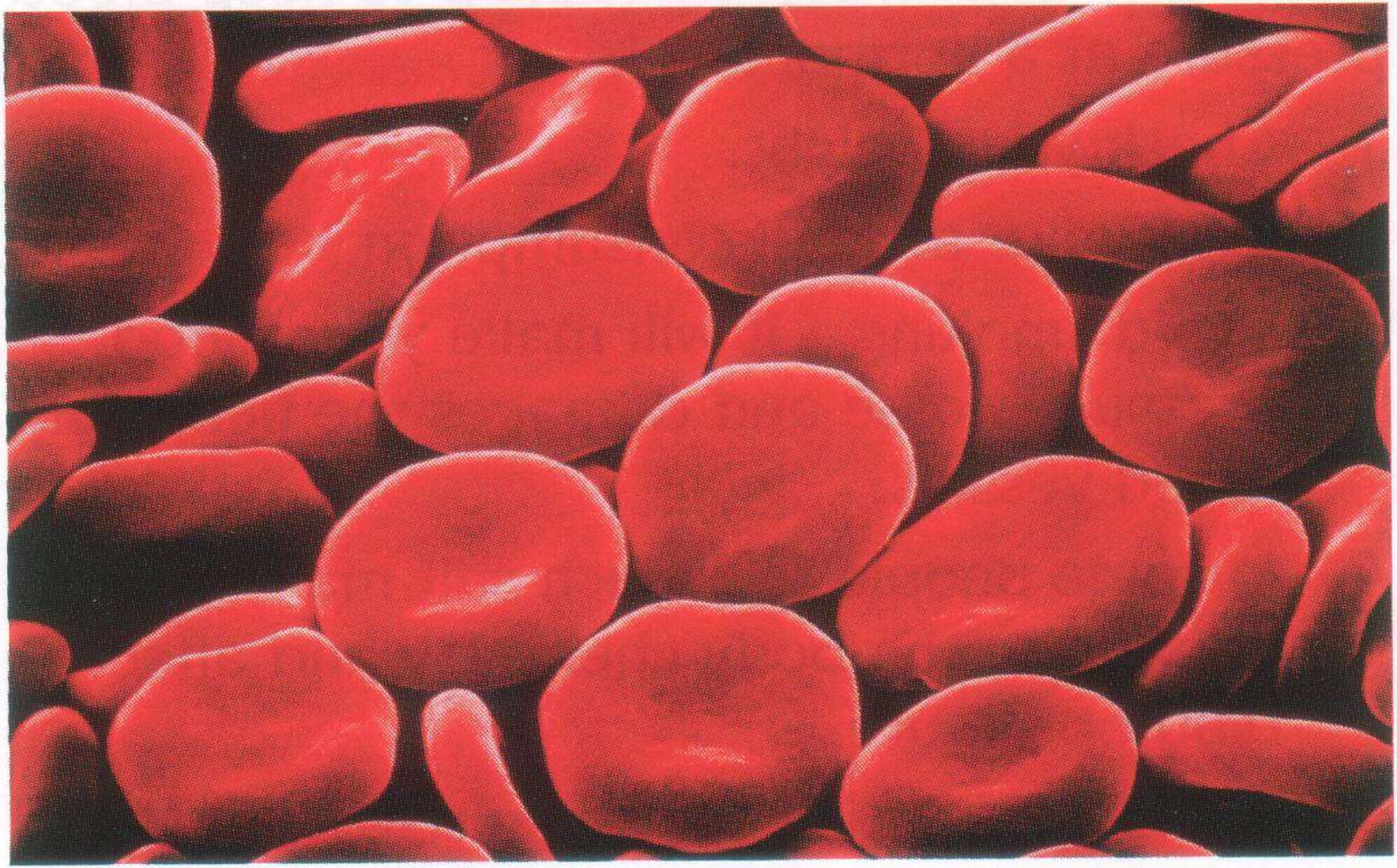
- 99% red blood cells;
- 1% white blood cells and platelets.

BLOOD COUNT

- **RBC** - adult males - 4.5-5.5 x 10^{12}/L & 3.8-4.8 x 10^{12}/L- adult females.
- **Haemoglobin (Hb)** level adult males – 13 -17 & 12-15 - adult females.
- **Total WBC**: 4,500 - 10,000
- **Platelets** Count - 150-400 x 10^{9}/L.

What makes up our blood?

- **RED BLOOD CELLS** (erythrocytes) – The most abundant cells in our blood; they are produced in the bone marrow and contain a protein called hemoglobin that carries oxygen to our cells.
- **WHITE BLOOD CELLS** (leukocytes*)* – They are part of the immune system and destroy infectious agents called pathogens.
- **PLASMA** – The yellowish liquid portion of blood that contains electrolytes, nutrients and vitamins, hormones, clotting factors, and proteins such as antibodies to fight infection.
- **PLATELETS** (thrombocytes*)* – The clotting factors that are carried in the plasma; they clot together in a process called coagulation to seal a wound and prevent a loss of blood.

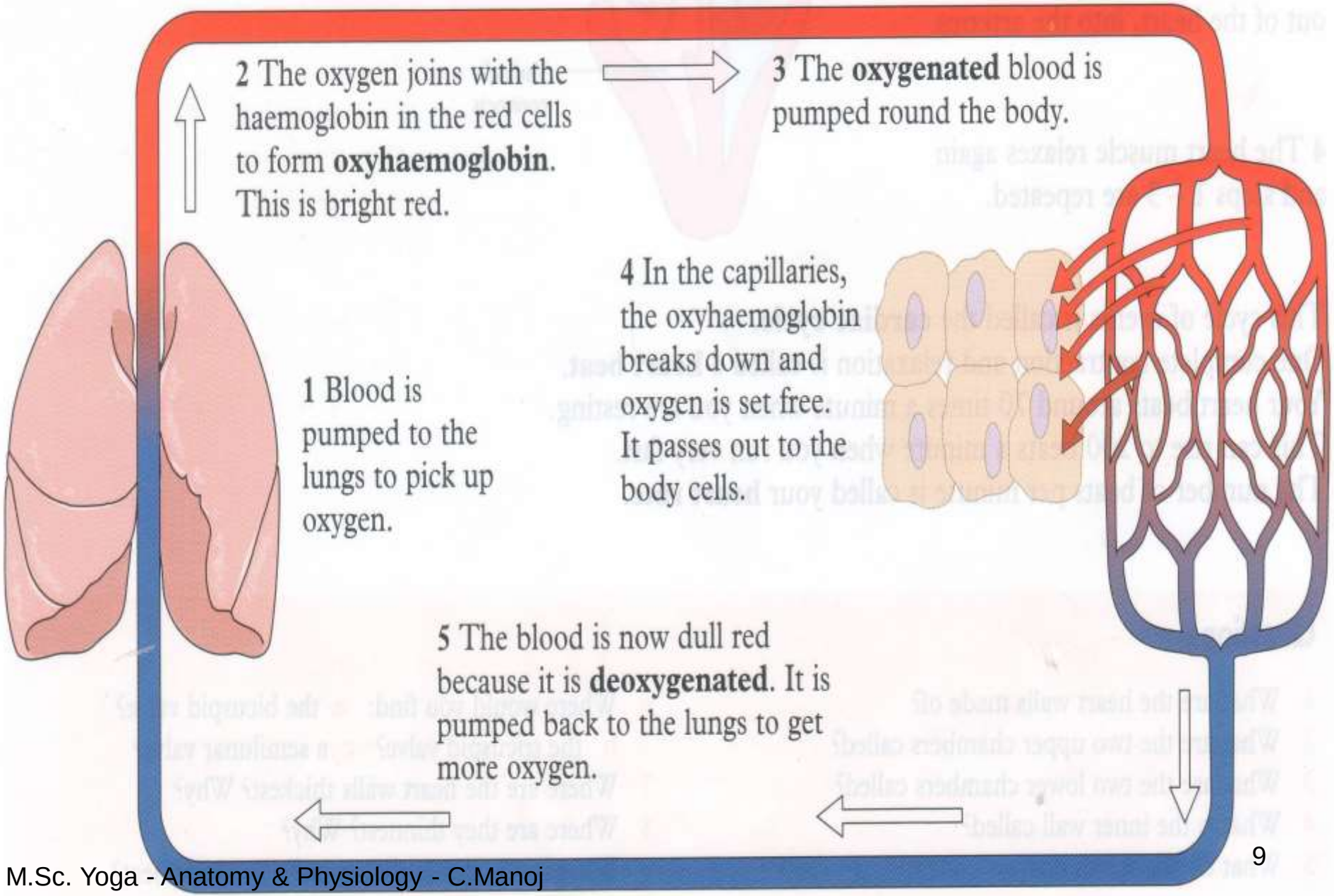


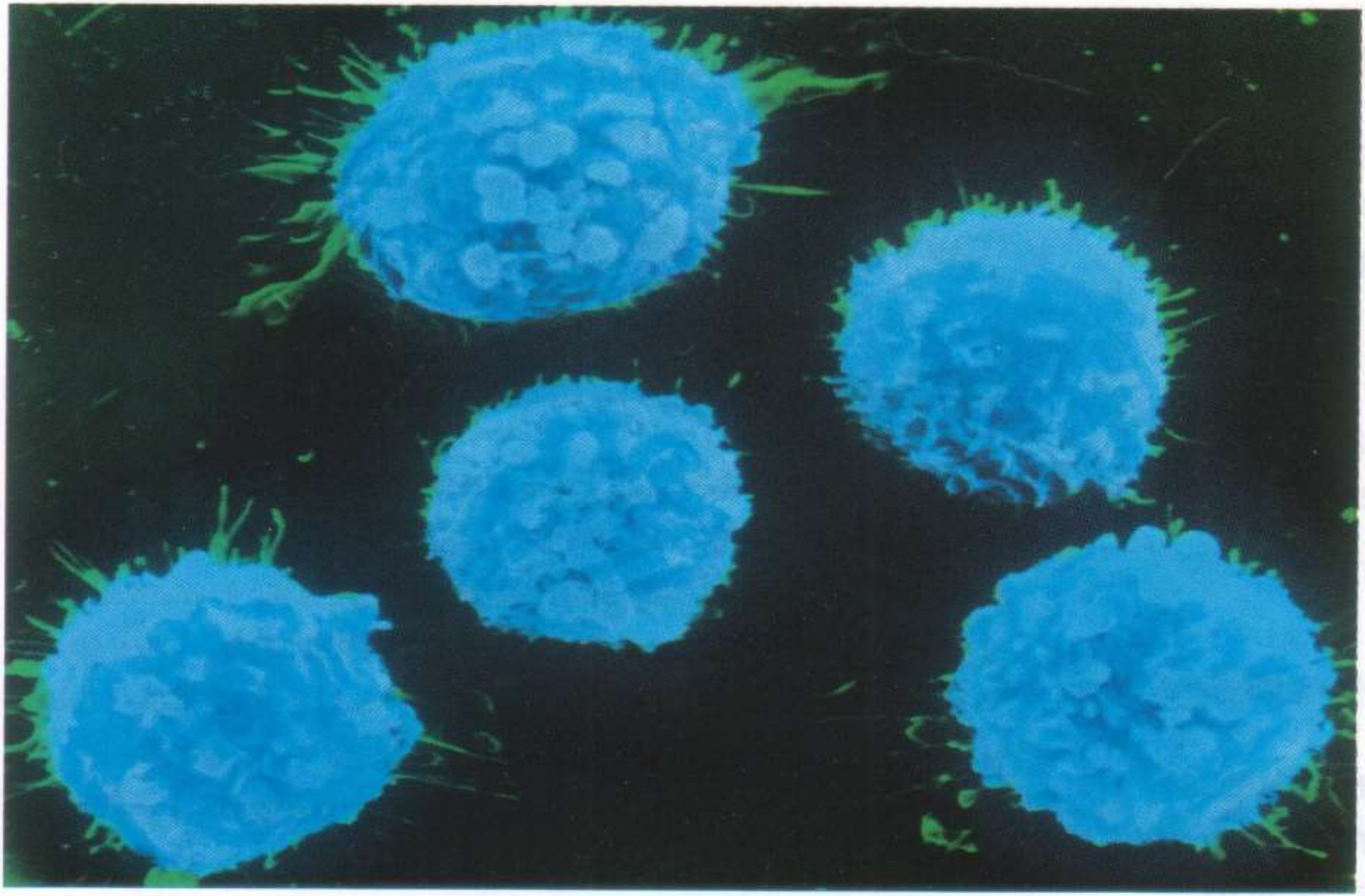
Red blood cells (erythrocytes) carry supplies around the body

RBC

- Red cells, or **erythrocytes** are relatively large microscopic cells without nuclei.
- Red cells normally make up 40-50% of the total blood volume.
- They transport oxygen from the lungs to all of the living tissues of the body and carry away carbon dioxide.
- The red cells are produced continuously in our bone marrow from stem cells at a rate of about 2-3 million cells per second.
- **Hemoglobin** is the gas transporting protein molecule that makes up 95% of a red cell.
- Each red cell has about 270,000,000 iron-rich hemoglobin molecules.
- People who are anemic generally have a deficiency in red cells.
- The red color of blood is primarily due to oxygenated red cells.

How red cells carry oxygen

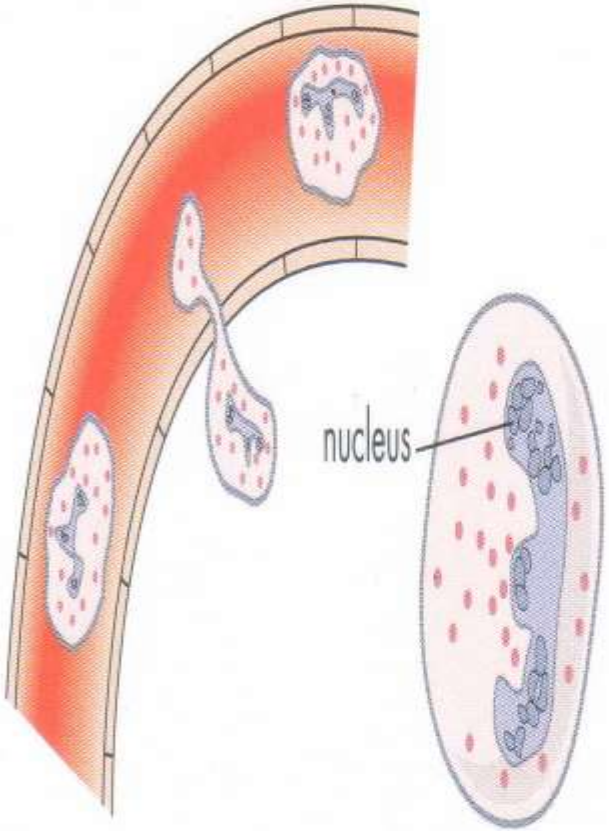


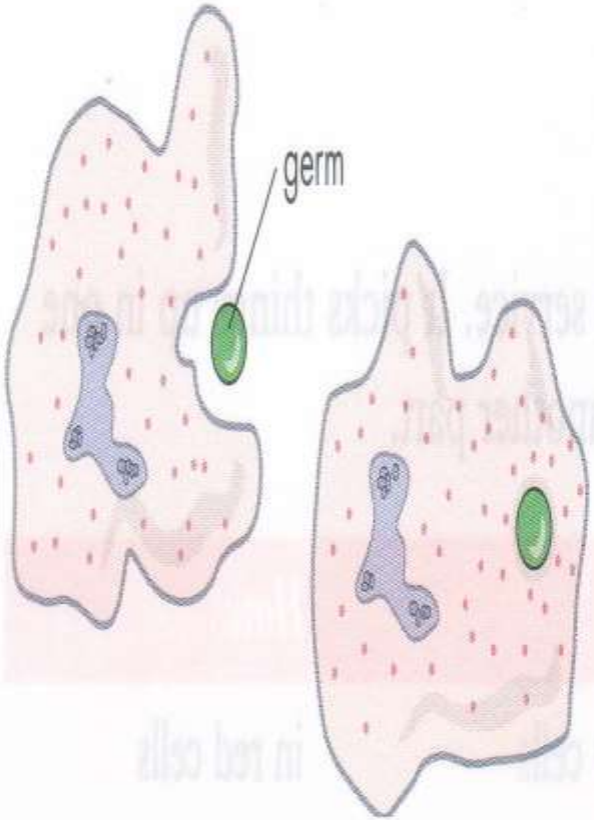


White blood cells (leukocytes) form part of the body's defence system

WBC

- White cells, or **leukocytes** exist in variable numbers and types but make up a very small part of blood's volume--normally only about 1% in healthy people.
- Leukocytes are not limited to blood. They occur elsewhere in the body as well, most notably in the spleen, liver, and lymph glands.
- Most are produced in our bone marrow from the same kind of stem cells that produce red blood cells.
- Others are produced in the thymus gland, which is at the base of the neck.
- Some white cells (called **lymphocytes**) are the first responders for our immune system. They seek out, identify, and bind to alien protein on bacteria, viruses, and fungi so that they can be removed.
- Other white cells (called **granulocytes** and **macrophages**) then arrive to surround and destroy the alien cells. They also have the function of getting rid of dead or dying blood cells as well as foreign matter such as dust and asbestos.
- Red cells remain viable for only about 4 months before they are removed from the blood and their components recycled in the spleen.
- Individual white cells usually only last 18-36 hours before they also are removed, though some types live as much as a year.

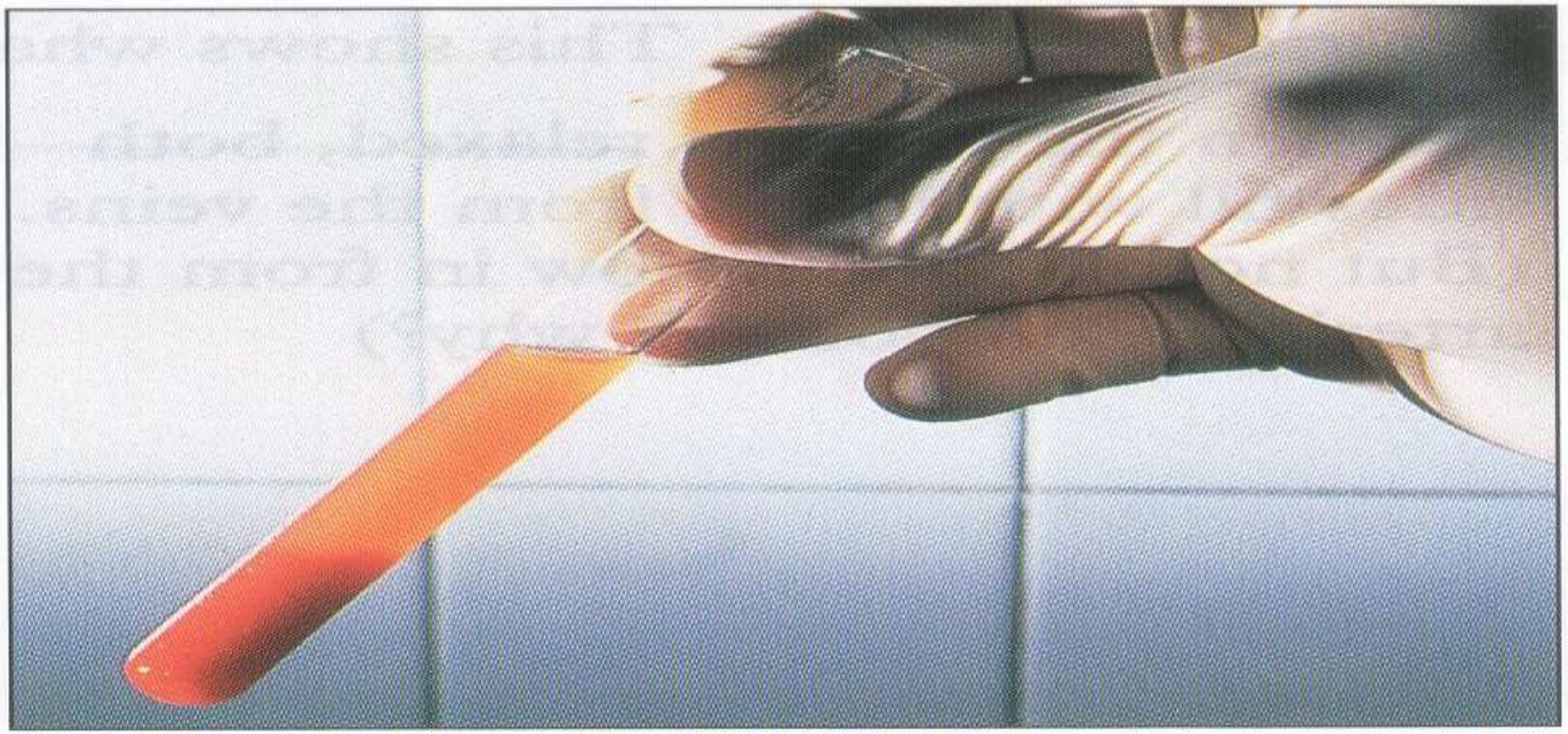




1 The phagocytes pass out through capillary walls and into the infected tissue.

2 They change shape to surround the germs. They produce enzymes to kill and digest them.

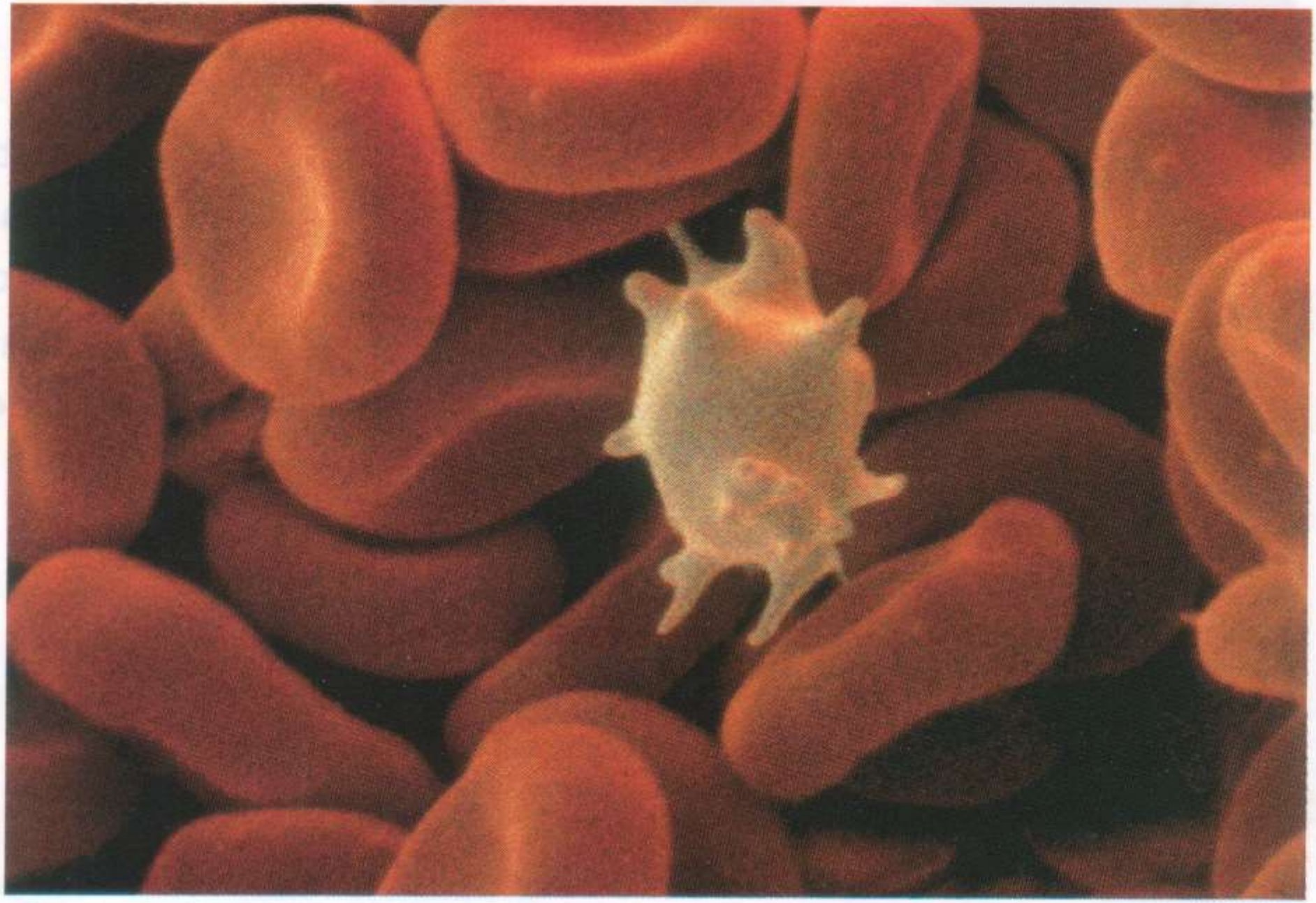
3 Phagocytes live for only a short time. Dead phagocytes, dead germs and liquid form **pus** in the infected area.



This blood sample has just been centrifuged. The yellow liquid is plasma. The red cells have collected at the bottom of the tube.

PLASMA

- Plasma is the relatively clear liquid water (92+%), sugar, fat, protein and salt solution which carries the red cells, white cells, platelets, and some other chemicals.
- Normally, 55% of our blood's volume is made up of plasma.
- About 95% of it consists of water.
- As the heart pumps blood to cells throughout the body, plasma brings nourishment to them and removes the waste products of metabolism.
- Plasma also contains blood clotting factors, sugars, lipids, vitamins, minerals, hormones, enzymes, antibodies, and other proteins.
- It is likely that plasma contains some of every protein produced by the body.

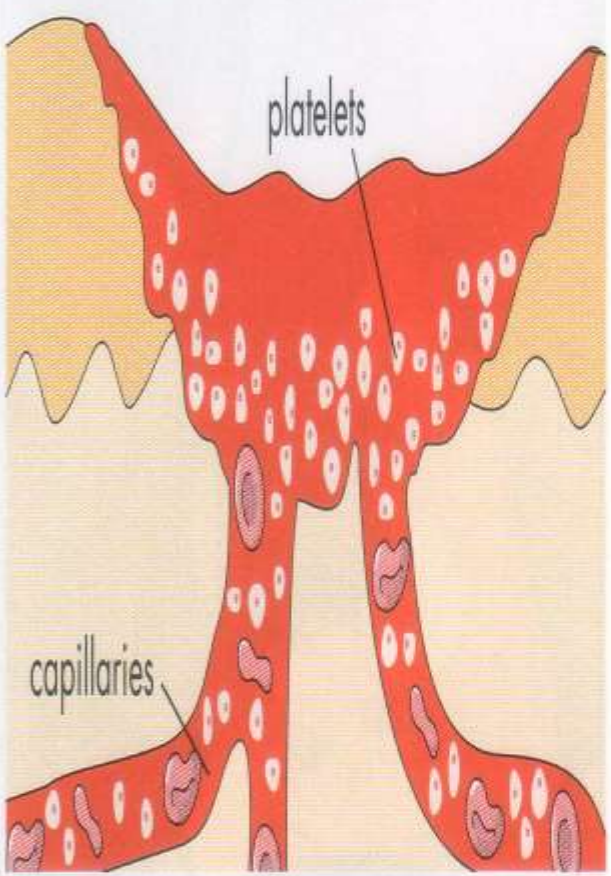


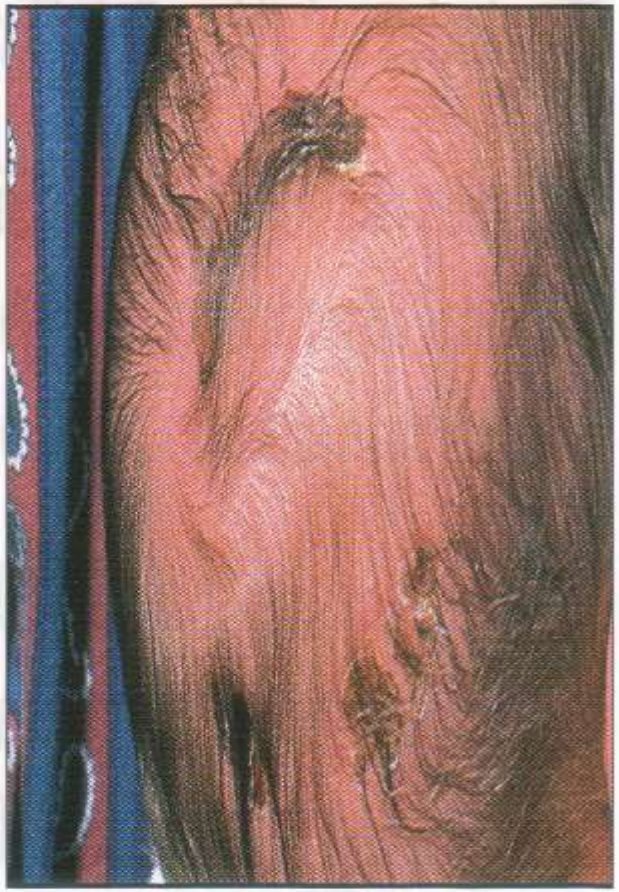
A blood platelet

PLATELETS

- Platelets or **thrombocytes** are cell fragments without nuclei that work with blood clotting chemicals at the site of wounds.
- They do this by adhering to the walls of blood vessels, thereby plugging the rupture in the vascular wall.
- They also can release coagulating chemicals which cause clots to form in the blood that can plug up narrowed blood vessels.
- There are more than a dozen types of blood clotting factors and platelets that need to interact in the blood clotting process.
- Recent research has shown that platelets help fight infections by releasing proteins that kill invading bacteria and other microorganisms. Platelets can stimulate the immune system.
- Individual platelets are about 1/3 the size of red cells.
- They have a lifespan of 9-10 days. Like the red and white blood cells, platelets are produced in bone marrow from stem cells.

Platelets stick together to block cuts





1 When you cut your hand, platelets stick to the surface of the wound and to each other.

2 They produce a substance that makes tiny fibres grow. Red cells get trapped in these. A clot forms.

3 The clot hardens to a scab, like on this head wound. It will drop off when new skin grows.

What blood carries

Your blood is like a non-stop delivery service. It picks things up in one part of the body and carries them to another part.

Blood carries	How
1 oxygen from the lungs to all your body cells	in red cells
2 carbon dioxide from the cells to the lungs for excretion	mainly in plasma
3 other waste, and excess water, from cells to the kidneys for excretion	in plasma
4 glucose and other nutrients from the gut to the cells	in plasma
5 hormones from the hormone glands to the parts that use them	in plasma
6 white blood cells to infected places	floating in plasma
7 heat from warmer to cooler parts of the body and to the skin for removal	all parts of the blood

Functions of the Blood

- Blood helps to transport food nutrients to various tissues for utilization.
- Blood also helps in the transportation of waste products of metabolism such as urea, uric acid, etc from tissues where there are produced to the kidney for excretion.
- The Red Blood Cell, which is a cellular part of the blood help to transport respiratory gases such as oxygen from the lungs to actively metabolizing tissues.
- Hormones secreted by the endocrine glands are transported to target organs via the blood.

Functions of the Blood

- The White Blood cells help to protect out body against foreign agents such as bacteria and viruses.
- The blood helps in the evenly distribution of heat generated by actively metabolizing tissues such as the liver and muscles to cooler parts of the body.
- The plasma proteins, helps to maintain the pH of the body fluid.
- The oncotic pressure of the plasma proteins helps to control the exchange of fluids between the capillaries and the tissues.

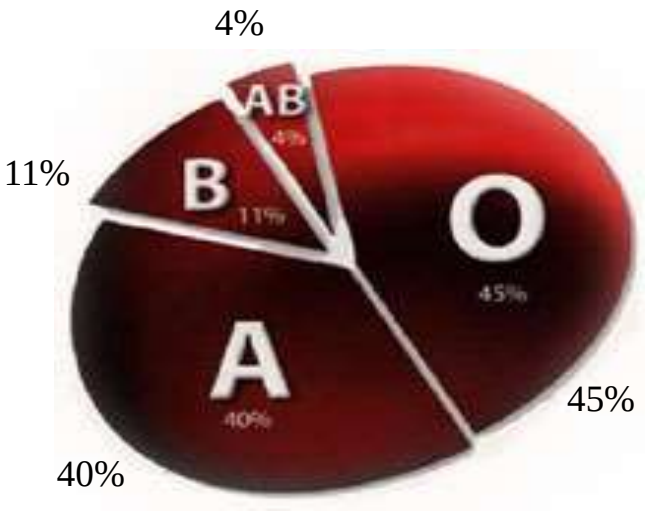
What are blood types?

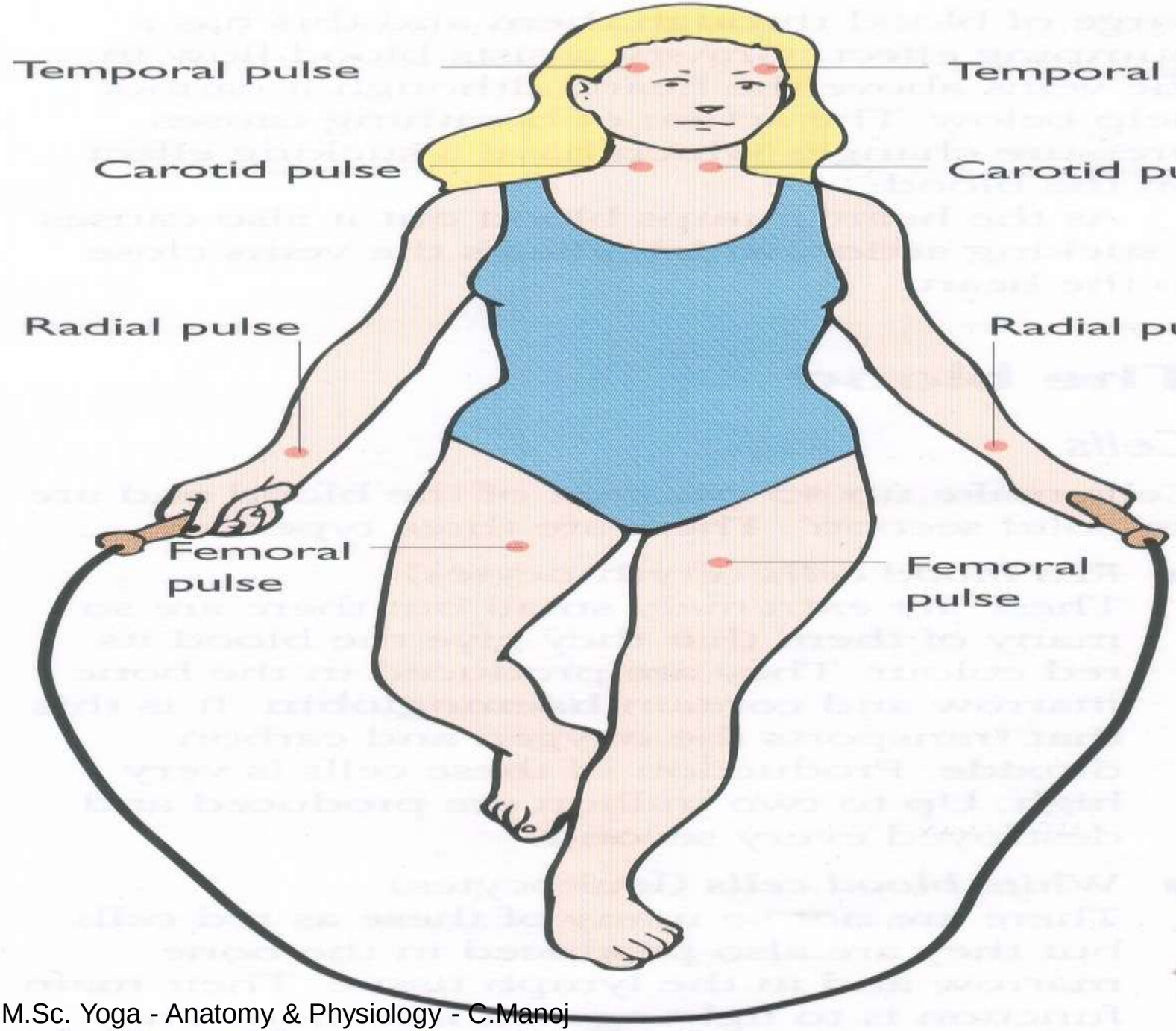
There are 3 alleles or genes for blood type: A, B, & O. Since we have 2 genes, there are 6 possible combinations.

Blood Types

AA or AO = Type A
BB or BO = Type B
OO = Type O
AB = Type AB

How common are the 4 blood types?





The four pulse points of the body

THANK YOU