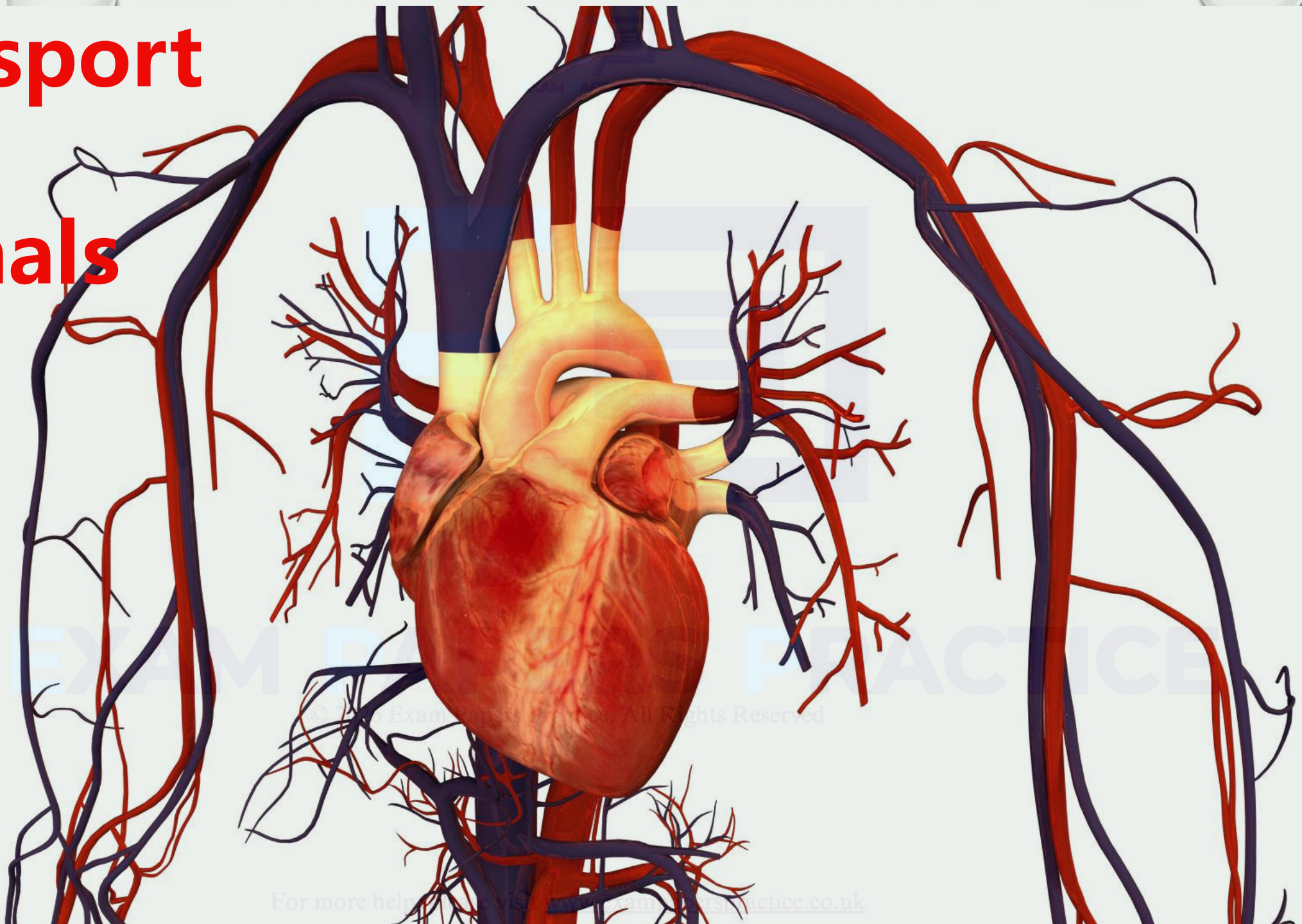


Transport in animals



Transport in animals

circula

Circulatory system

- » Network of tubes — **blood vessels**
- » Pump — **heart** (keep blood flowing through the vessels)
- » **valves** — make sure the blood flows in the one-way
- » **blood**

oxygenated blood: contain oxygen; from lungs; bright red

deoxygenated blood: lack of oxygen; back heart from body;
bluish-red

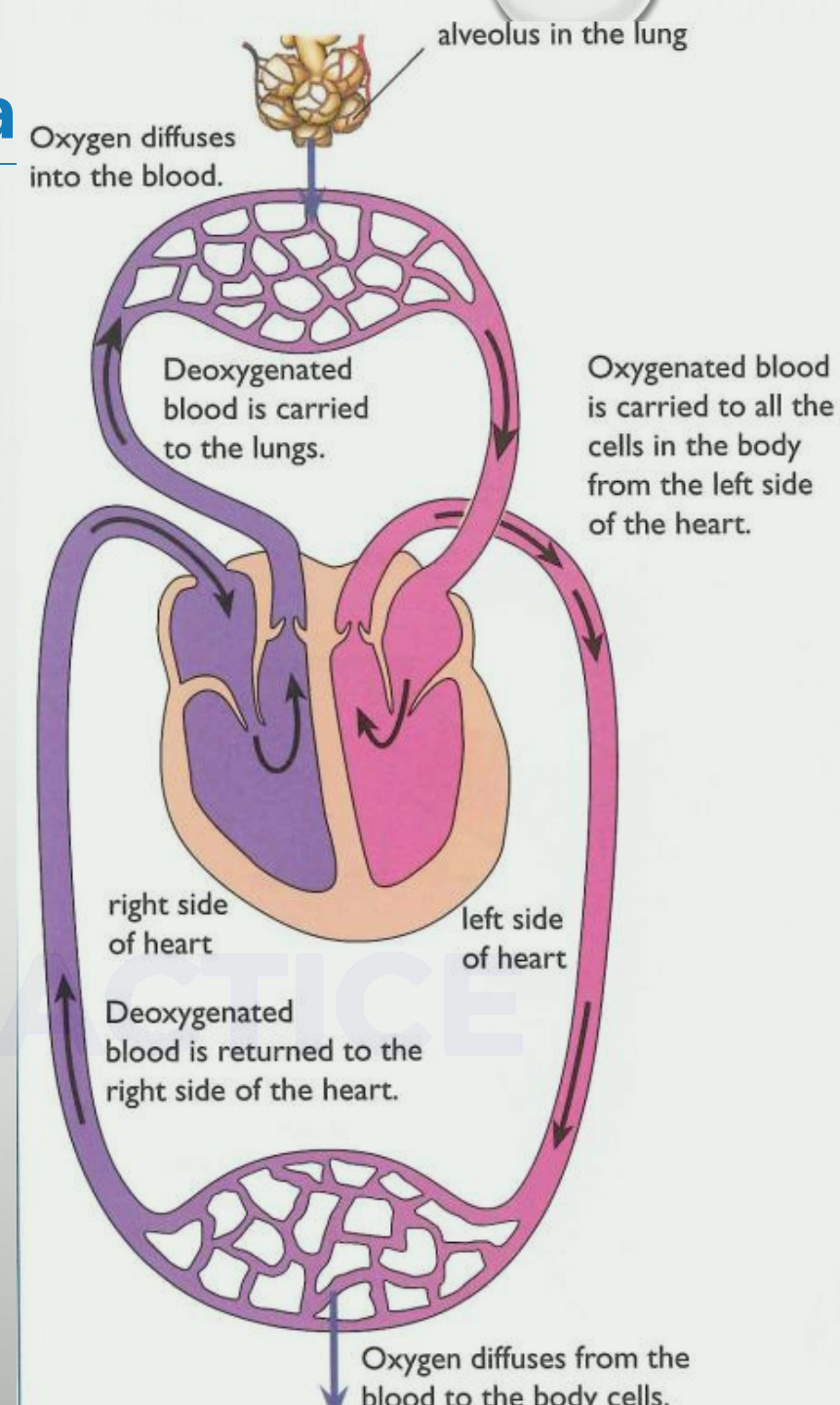
circulatory system 循环系统

valve 瓣膜

pump 泵

oxygenated blood 富氧血

deoxygenated blood 缺氧血



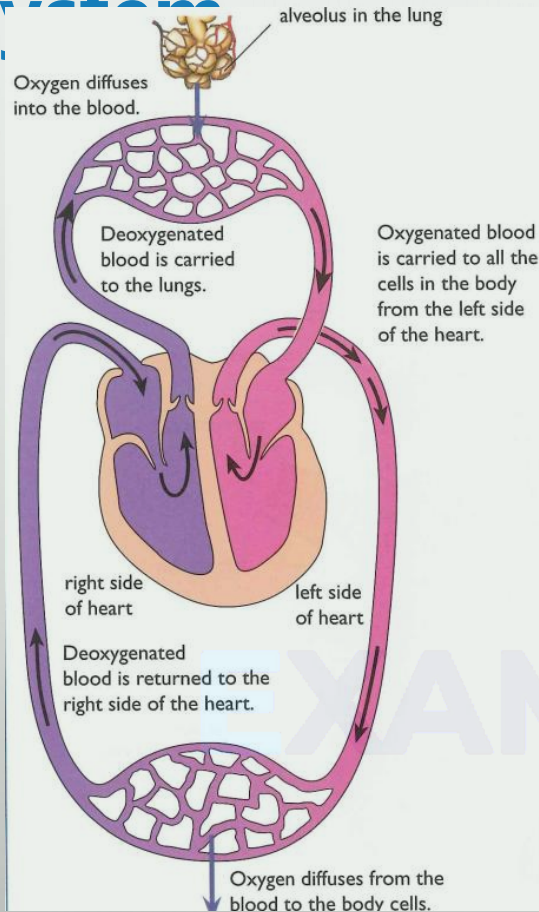
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Transport in animals

circulatory systems

double circulatory system

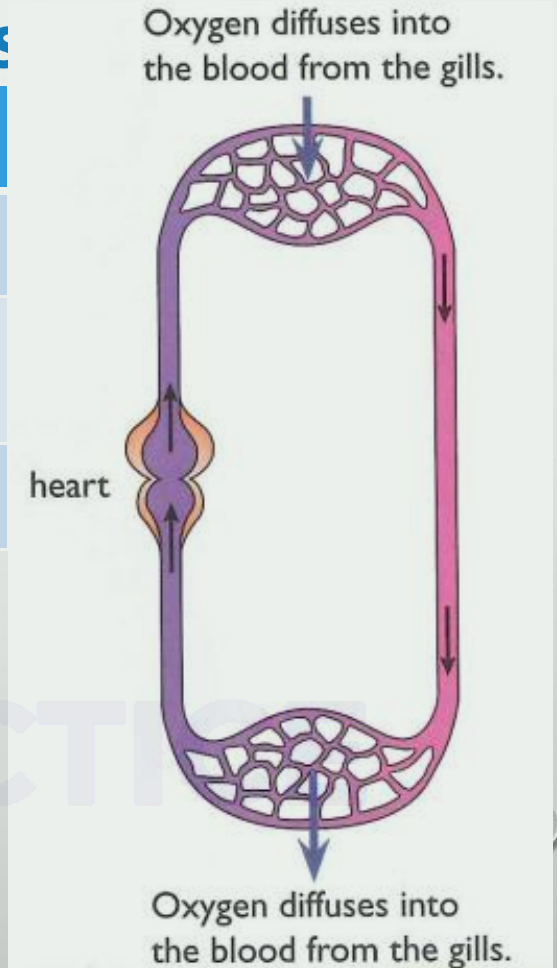


Double circulatory system	Single circulatory system
Four chambers	Two chambers
Blood absorb oxygen in lungs	Blood absorb oxygen in gill
Pass through heart twice	Pass through heart once

Double circulatory system deliver blood more effectively

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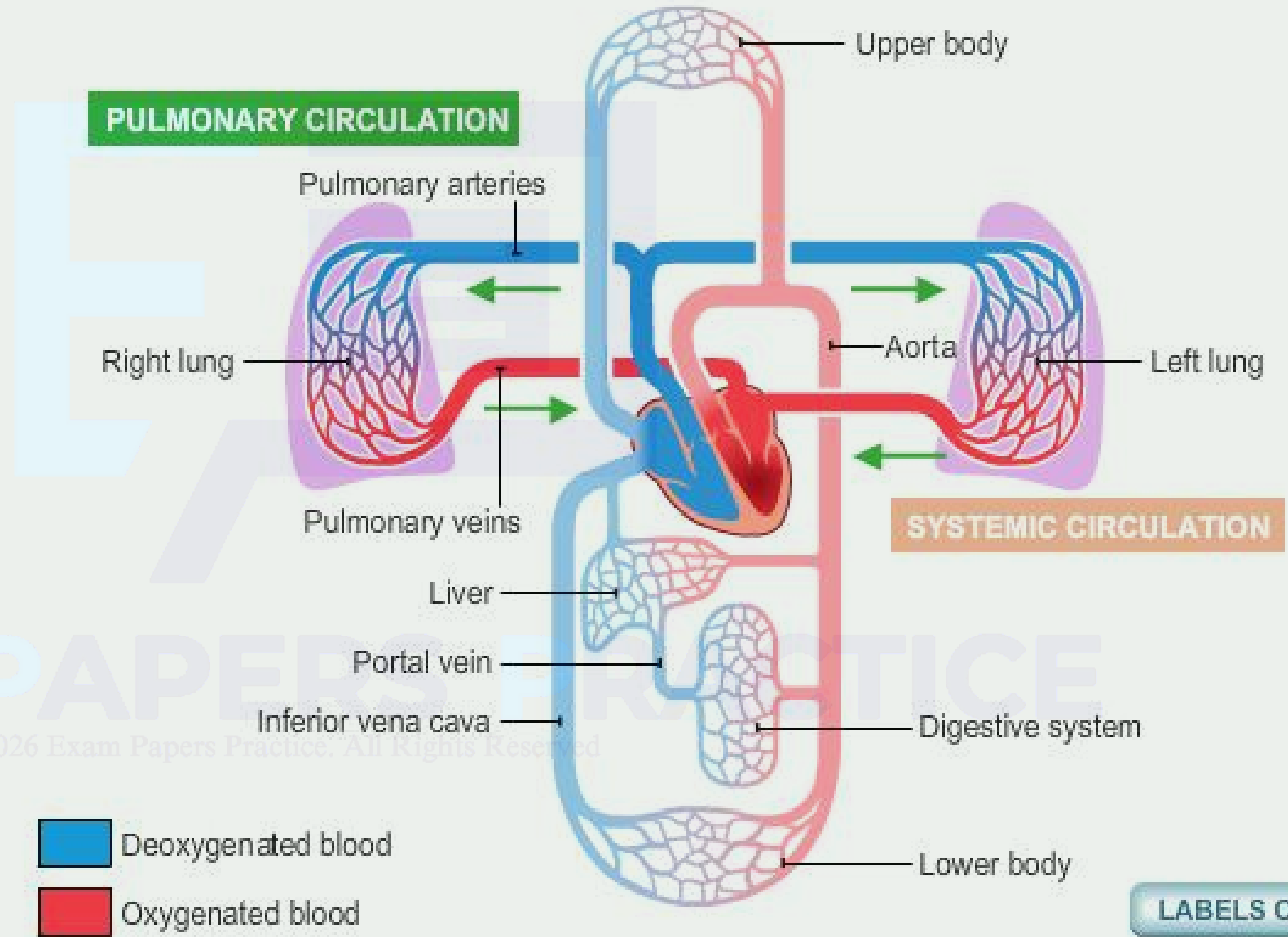
single circulatory sys



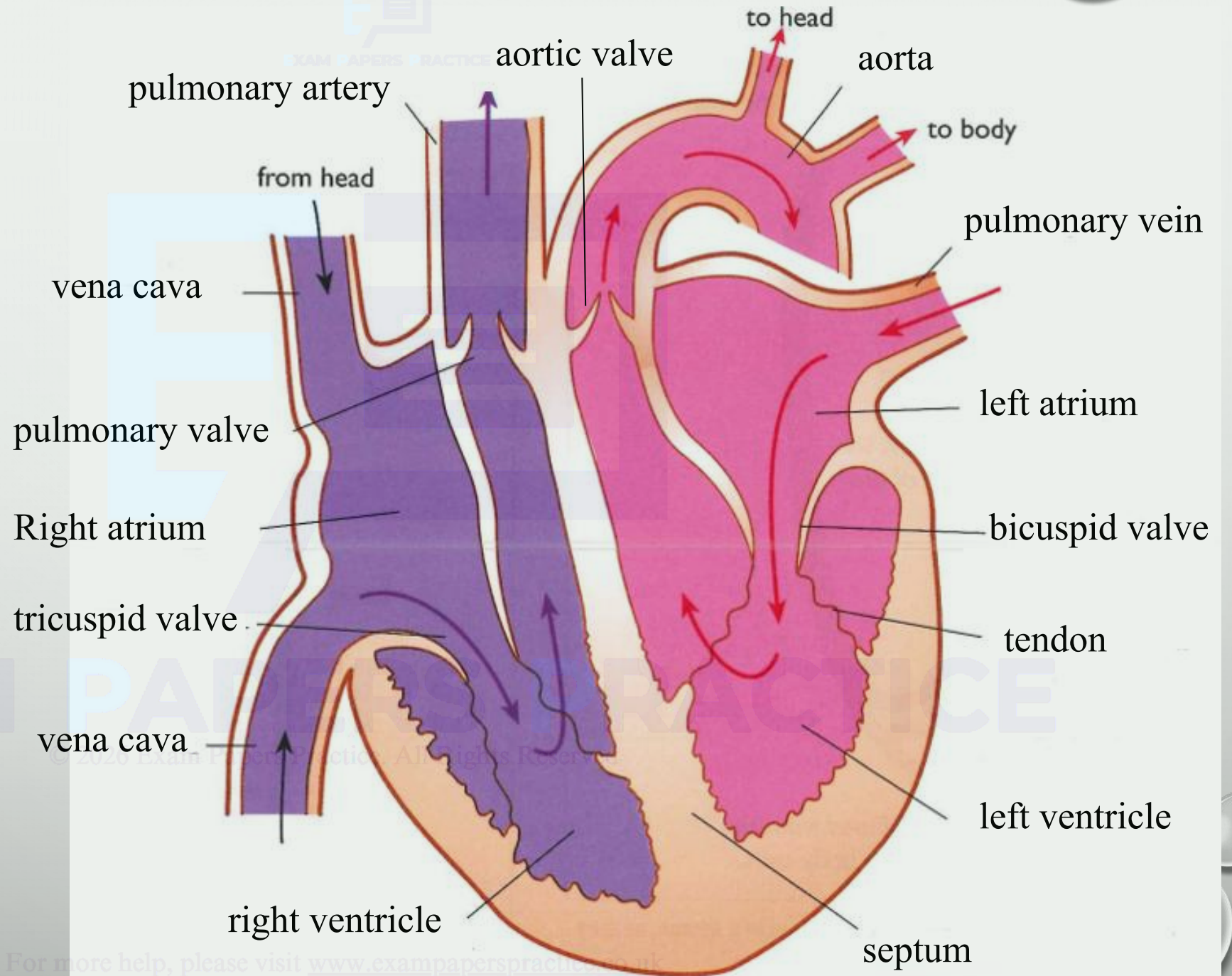
double circulatory system 双循环系统
single circulatory system 单循环系统

pulmonary circulation systemic circulation

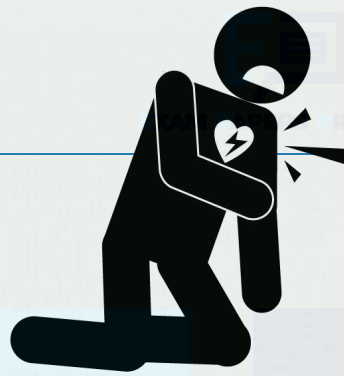
pulmonary artery 肺动脉
pulmonary vein 肺静脉
aorta 主动脉



atria 心房
 ventricle 心室
 valve 瓣膜
 cardiac muscle 心肌
 septum 隔膜
 tricuspid valve 三尖瓣
 bicuspid valve 二尖瓣
 artery 动脉
 vein 静脉
 Pulmonary valve 肺动脉瓣
 Aortic valve 主动脉瓣
 atrioventricular valve 房室瓣
 semilunar valve 半月瓣
 vena cava 腔静脉



Transport in animals



Heart disease - coronary heart disease

Coronary artery

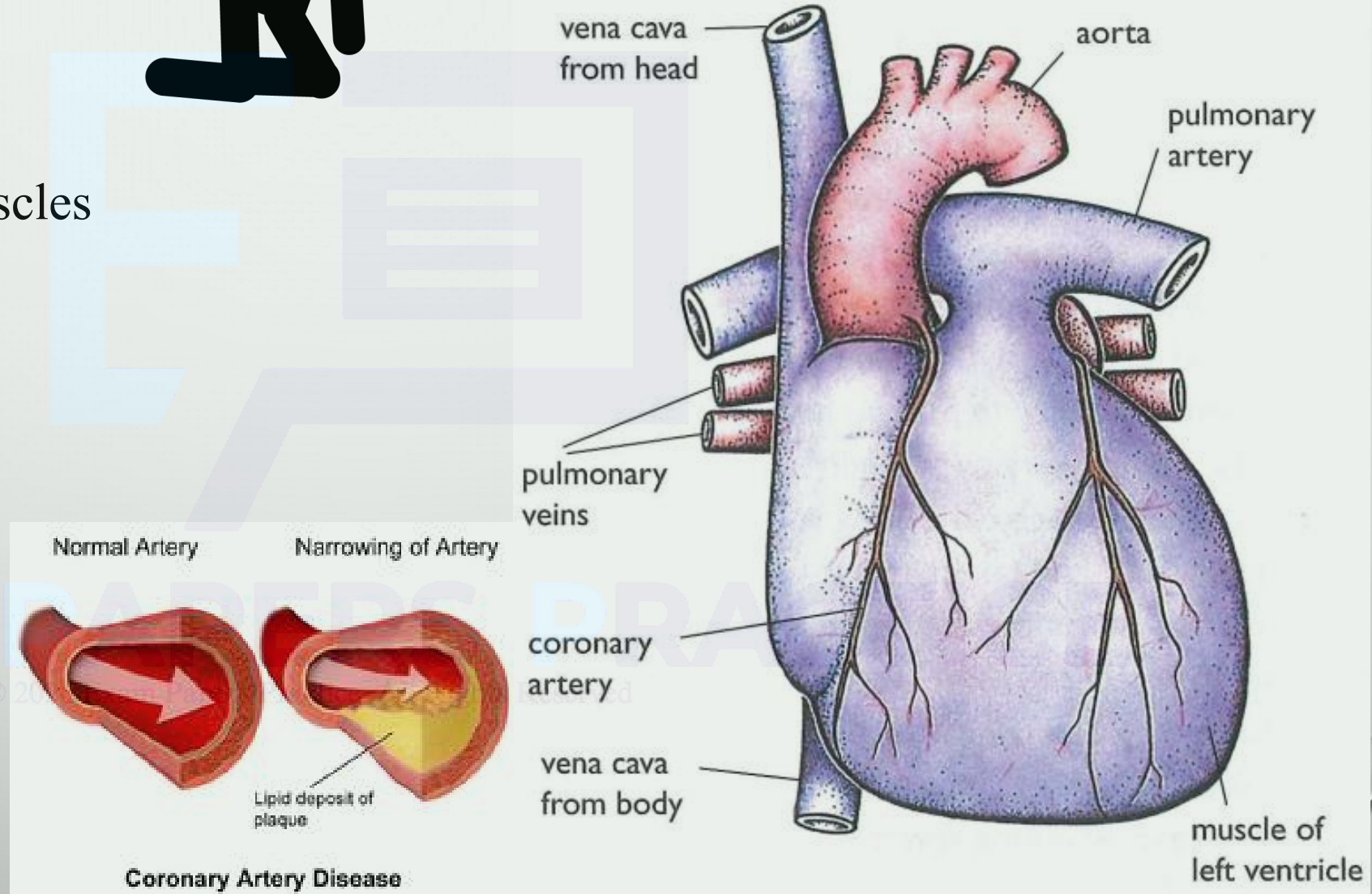
Supply blood to the heart muscles

Coronary heart disease

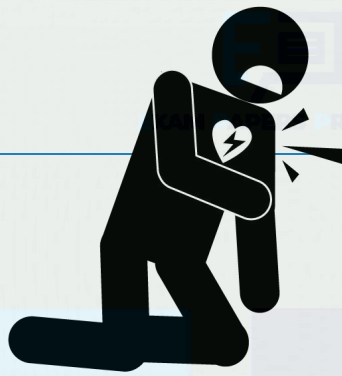
Blockage of the coronary arteries

→ the cardiac muscle run short of oxygen, so they cannot respire and obtain energy to allow them to contract

Coronary artery 心冠状动脉
Coronary heart disease 冠心病
Cardiac muscle 心肌



Transport in animals



Heart disease - coronary heart disease

Factors that increase a person's risk of getting coronary heart disease

- ♠ Smoking cigarettes
- ♠ diet
- ♠ obesity
- ♠ stress
- ♠ genes
- ♠ age
- ♠ **gender**

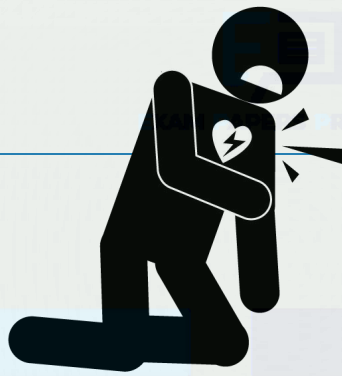
man more likely to develop CHO

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Transport in animals



Heart disease - coronary heart disease

Factors that increase a person's risk of getting coronary heart disease

♠ Smoking cigarettes

some components (**nicotine**) cause damage to the circulatory system

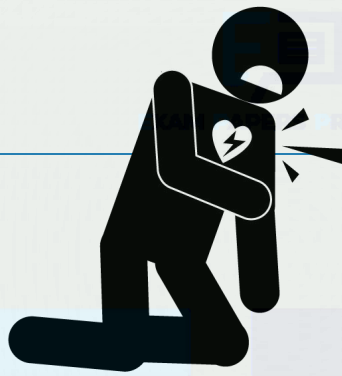
Preventing CHD

no smoking

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Transport in animals



Heart disease - coronary heart disease

Factors that increase a person's risk of getting coronary heart disease

♠ Smoking cigarettes

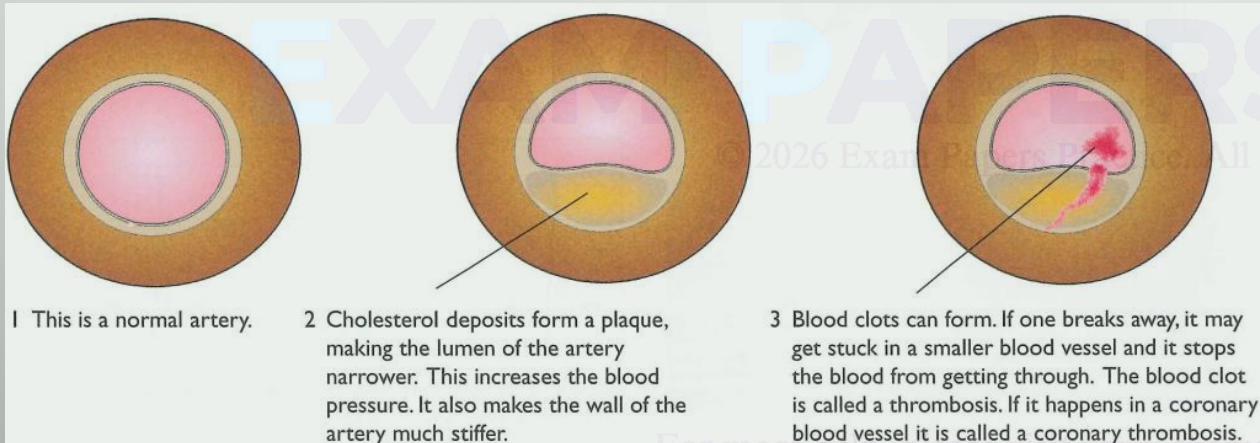
♠ diet

high in salt, saturated fats (animals), cholesterol

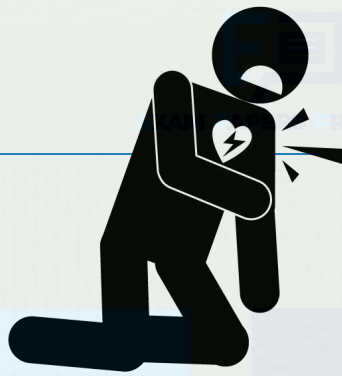
Preventing CHD

Have diets with low saturated fats, cholesterol.

Oils from plants and fish can help prevent heart disease



Transport in animals



Heart disease - coronary heart disease

Factors that increase a person's risk of getting coronary heart disease

- ♠ Smoking cigarettes
- ♠ diet
- ♠ obesity

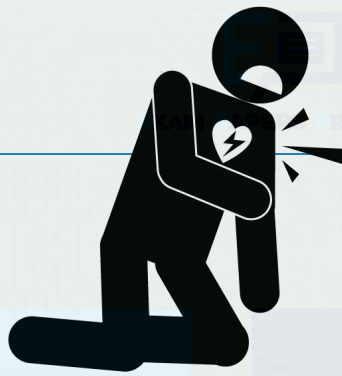
Preventing CHD

Doing exercise helps to keep fit, prevent excessive weight gain and decrease blood pressure.

It also has a 'feel-good' effect, so low stress

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Transport in animals



Heart disease - coronary heart disease

Treating CHD

♠ drugs

statin → decrease the risk of blood clots

aspirin → decrease the risk of blood clots forming inside blood vessels

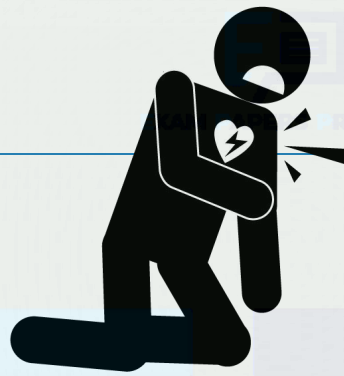
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statin 他汀类
aspirin 阿司匹林

Transport in animals

Heart disease - coronary heart disease



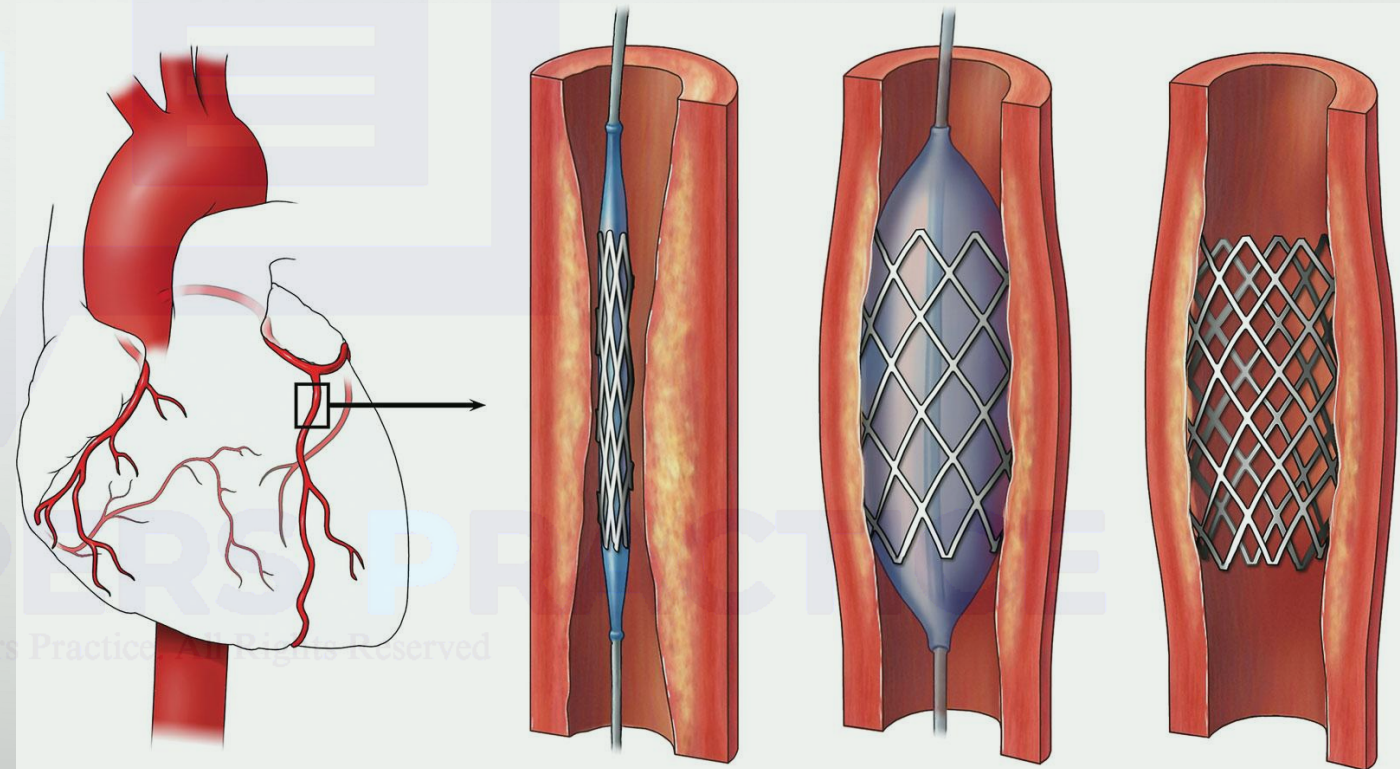
Treating CHD

♠ drugs

♠ surgery

1 > stents

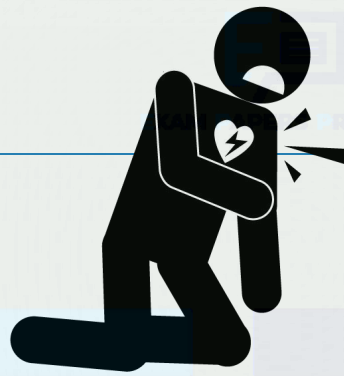
insert a little mesh tube, to keep it open



stent 支架

Transport in animals

Heart disease - coronary heart disease



Treating CHD

♠ drugs

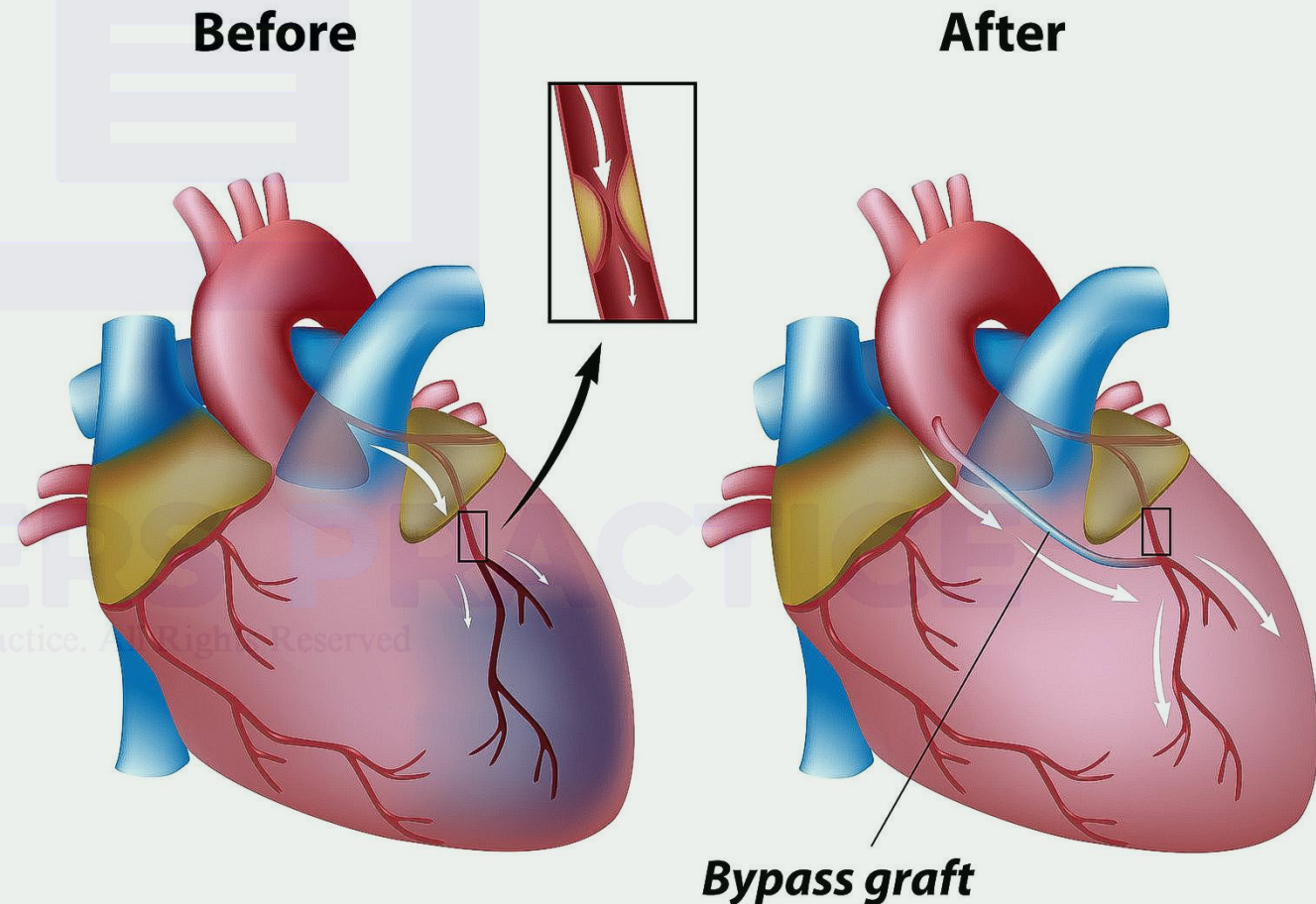
♠ surgery

1> stents

2> bypass

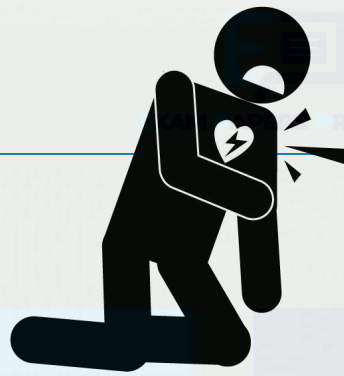
replace blocked coronary artery with a length of blood vessel taken from another part of the body

bypass 搭桥



Transport in animals

Heart disease - coronary heart disease



Treating CHD

♠ drugs

♠ surgery

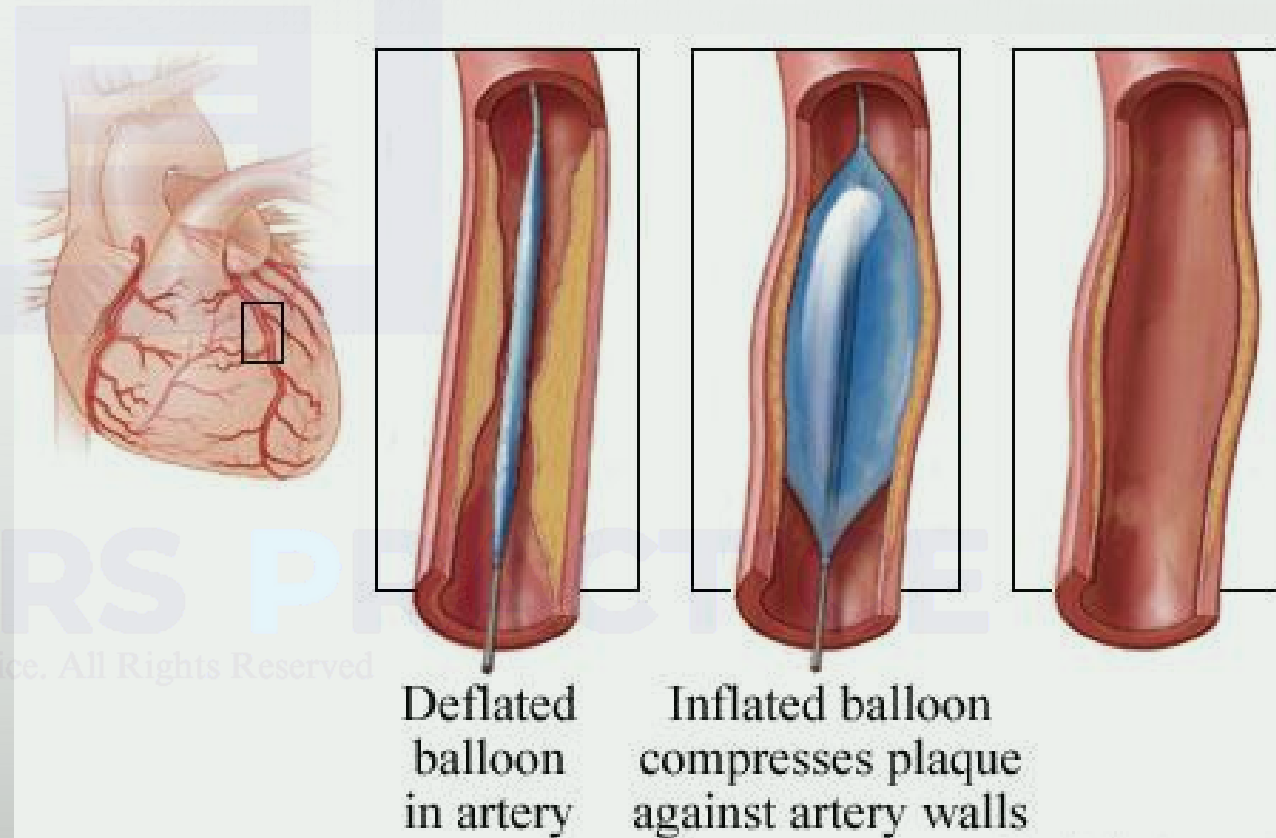
1> stents

2> bypass

3> angioplasty

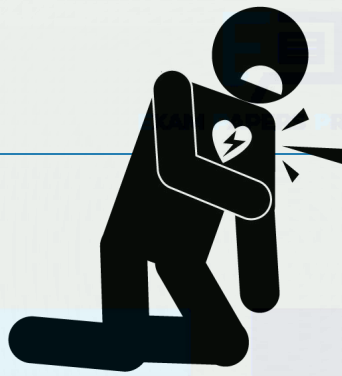
insert a tiny balloon into the collapsed artery, and then inflated using water. This pushes the artery open

angioplasty 血管成形术



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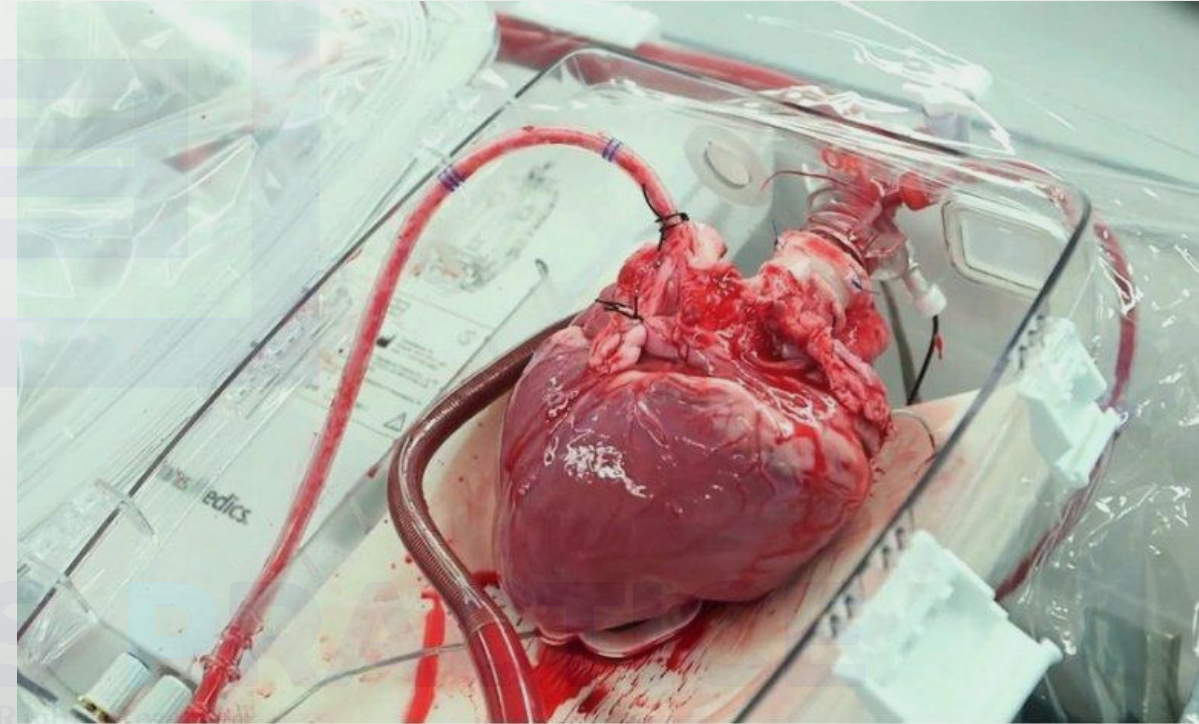
Transport in animals



Heart disease - coronary heart disease

Treating CHD

- ♠ drugs
- ♠ surgery
 - 1> stents
 - 2> bypass
 - 3> angioplasty
 - 4> heart transplant



Heart transplant 心脏移植

Transport in animals

Heart beat



heart beat

ways of measure the rate of heart beat

- » use stethoscope
- » measure pulse rate
- » ECG (electrocardiograph)

Age	18-25	26-35	36-45	46-55	56-65	65+
Athlete	49-55	49-54	50-56	50-57	51-56	50-55
Excellent	56-61	55-61	57-62	58-63	57-61	56-61
Good	62-65	62-65	63-66	64-67	62-67	62-65
Above Average	66-69	66-70	67-70	68-71	68-71	66-69
Average	70-73	71-74	71-75	72-76	72-75	70-73
Below Average	74-81	75-81	76-82	77-83	76-81	74-79
Poor	82+	82+	83+	84+	82+	80+

stethoscope 听诊器
pulse rate 脉搏
ECG 心电图

Transport in animals

Heart beat



heart beat

When a person exercises, their heart beats will be faster, why?

This is because cardiac muscles are using up **oxygen** more quickly in respiration. A faster heart rate means faster delivery of blood to the muscles, providing oxygen.



At rest



During exercise

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Transport in animals

Heart beat

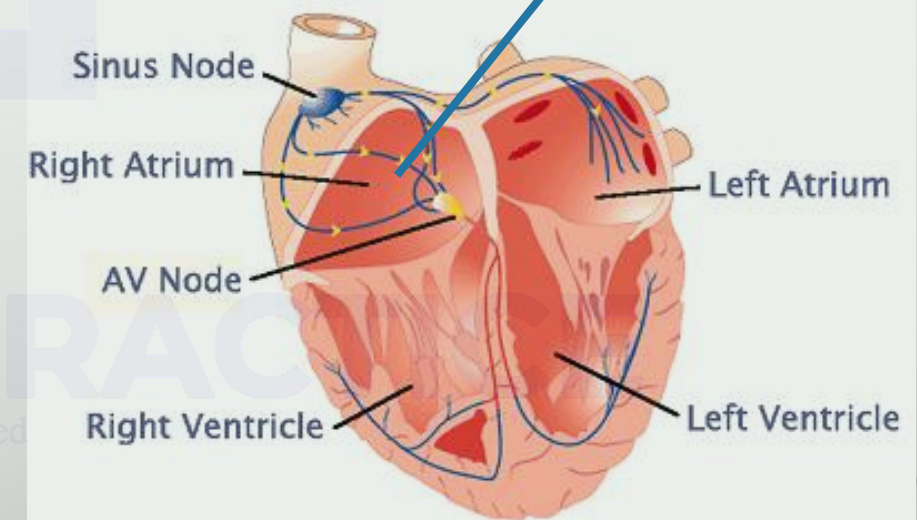
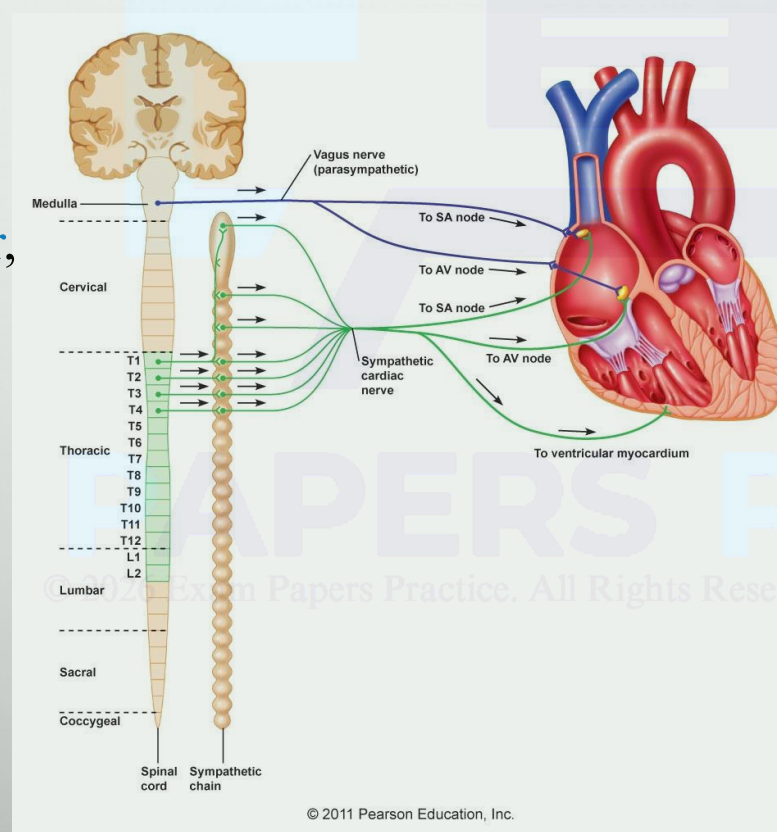
heart beat

Why the heart beat can be adjusted during different conditions?

Sends **electrical signals** through the walls of the heart at regular intervals, which make the muscle contract

pacemaker

Brain sends impulse to **pacemaker**, to make the **heart** change beat.



pacemaker 起搏器
Electrical signal 电信号
impulse 冲动

Transport in animals

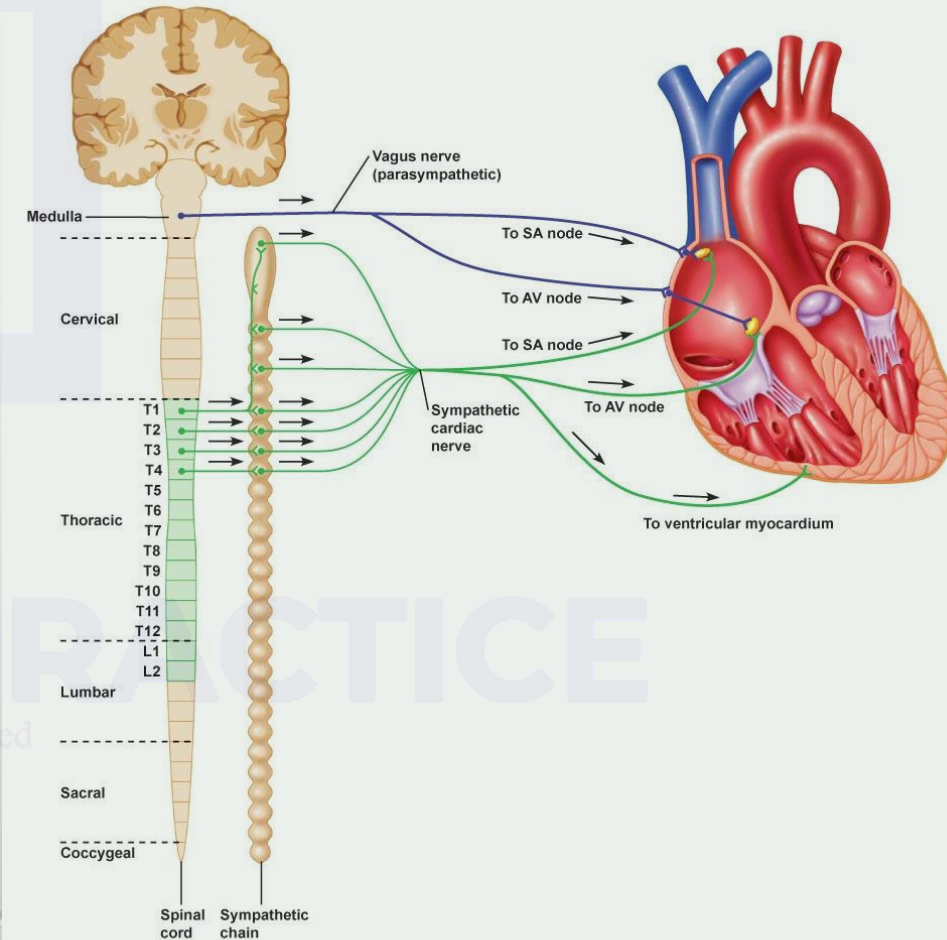
Heart beat

heart beat

How the brain know to adjust the impulses?

> Receptor cells

receptor 感受器



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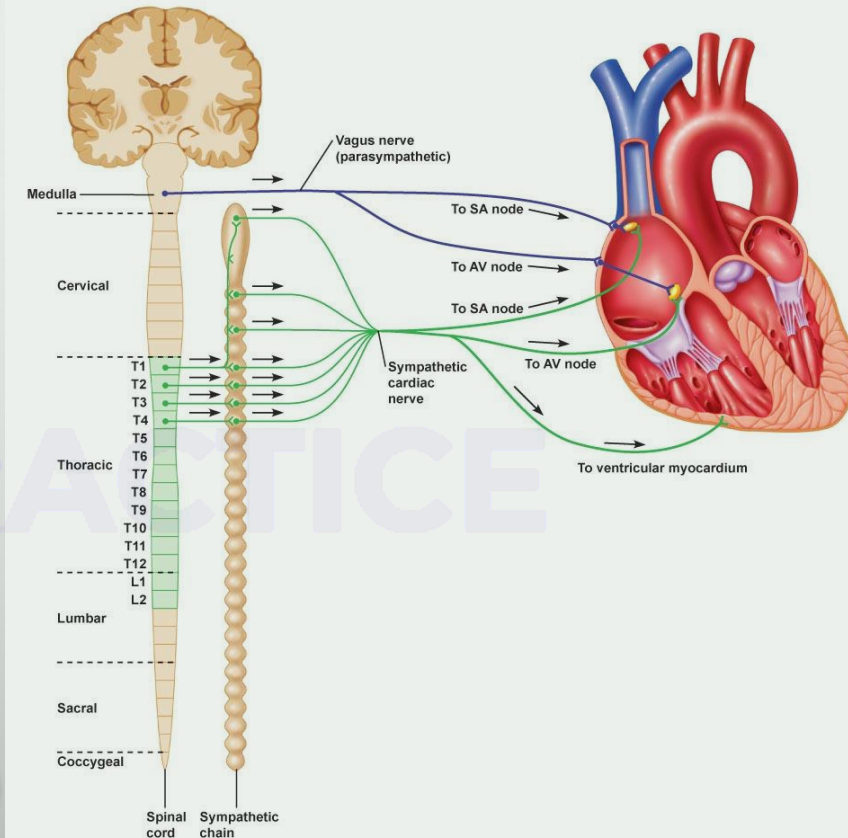
Transport in animals

Heart beat

heart beat

When a person exercises, their heart beats will be faster, why?

- ↓ during exercise, muscles respire more quickly
- ↓ more carbon dioxide is produced
- ↓ PH of the blood low
- ↓ receptor cell in brain sense this drop in PH
- ↓ brain increase the frequency of the nerve impulse to pacemaker
- ↓ pacemaker increase electrical signals sent to cardiac muscle
- ↓ heart beat increase



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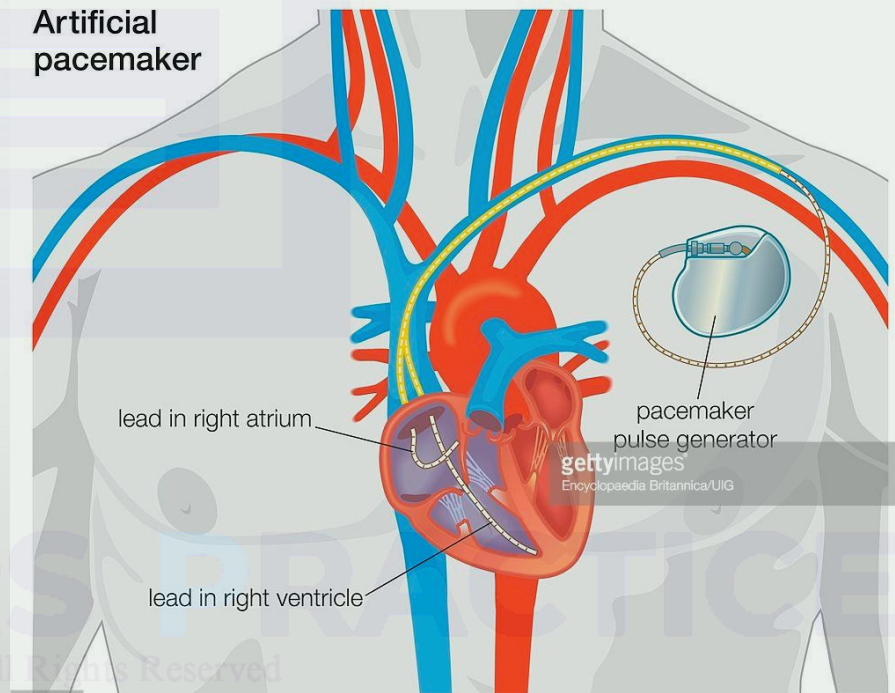
Transport in animals

Heart beat



heart beat

Artificial pacemaker



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Transport in animals

Heart beat



heart beat

Systole : when contract, the heart become smaller, squeezing blood out.

Diastole: when relax, the heart become larger, allowing blood to flow into.

systole
diastole

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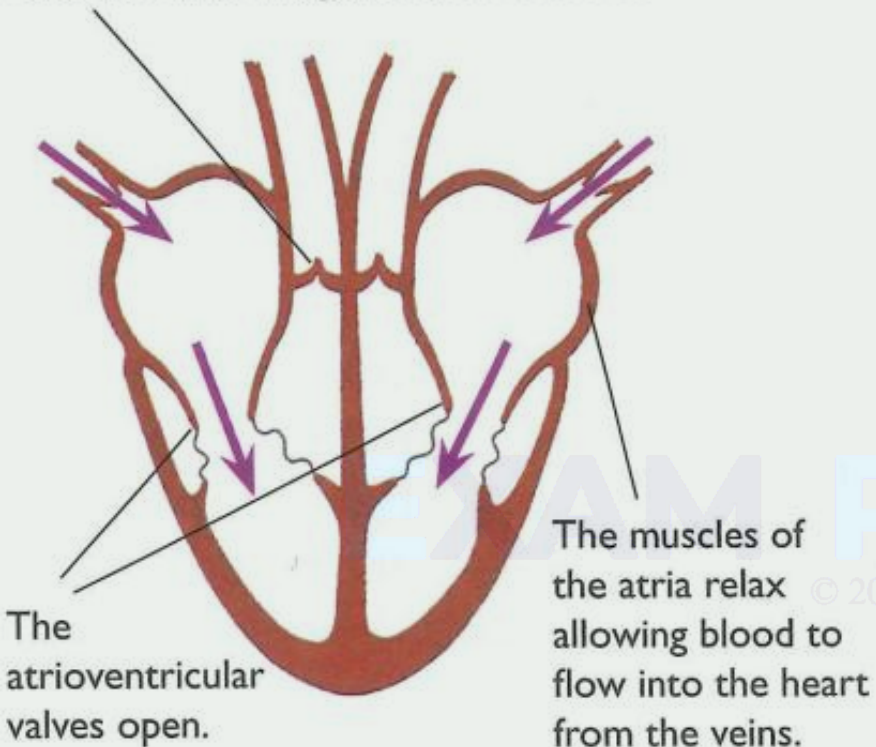
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Transport in animals

Cardiac cycle

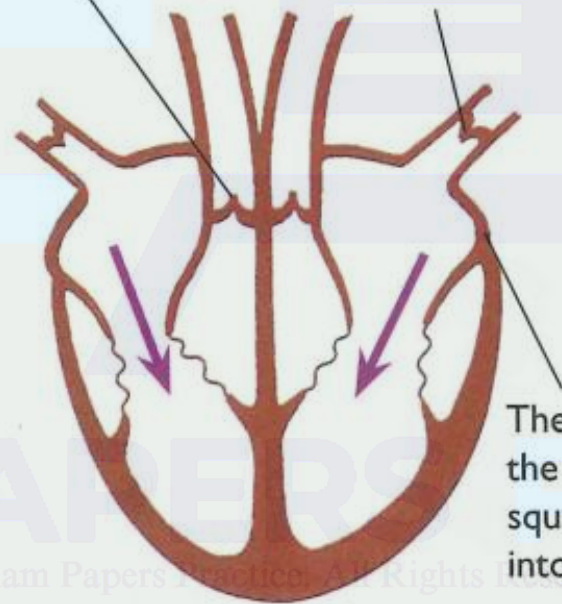
Cardiac cycle

The semilunar valves shut, preventing blood from flowing into the ventricles.



Diastole: all muscles are relaxed. Blood flows into the heart.

The semilunar valves remain shut.



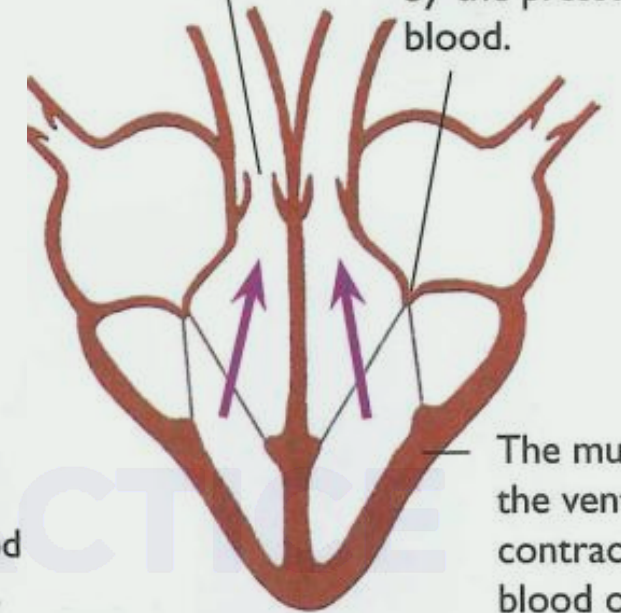
Atrial systole: the muscles of the atria contract. The muscles of the ventricles remain relaxed. Blood is forced from the atria into the ventricles.

The valves in the veins are forced shut by the pressure of the blood, stopping the blood from flowing back into the veins.

The muscles of the atria contract, squeezing the blood into the ventricles.

The semilunar valves are forced open by the pressure of the blood.

The atrioventricular valves are forced shut by the pressure of the blood.



Ventricular systole: the muscles of the atria relax. The muscles of the ventricles contract. Blood is forced out of the ventricles into the arteries.

heart beat

diastole



atrial systole



ventricular systole



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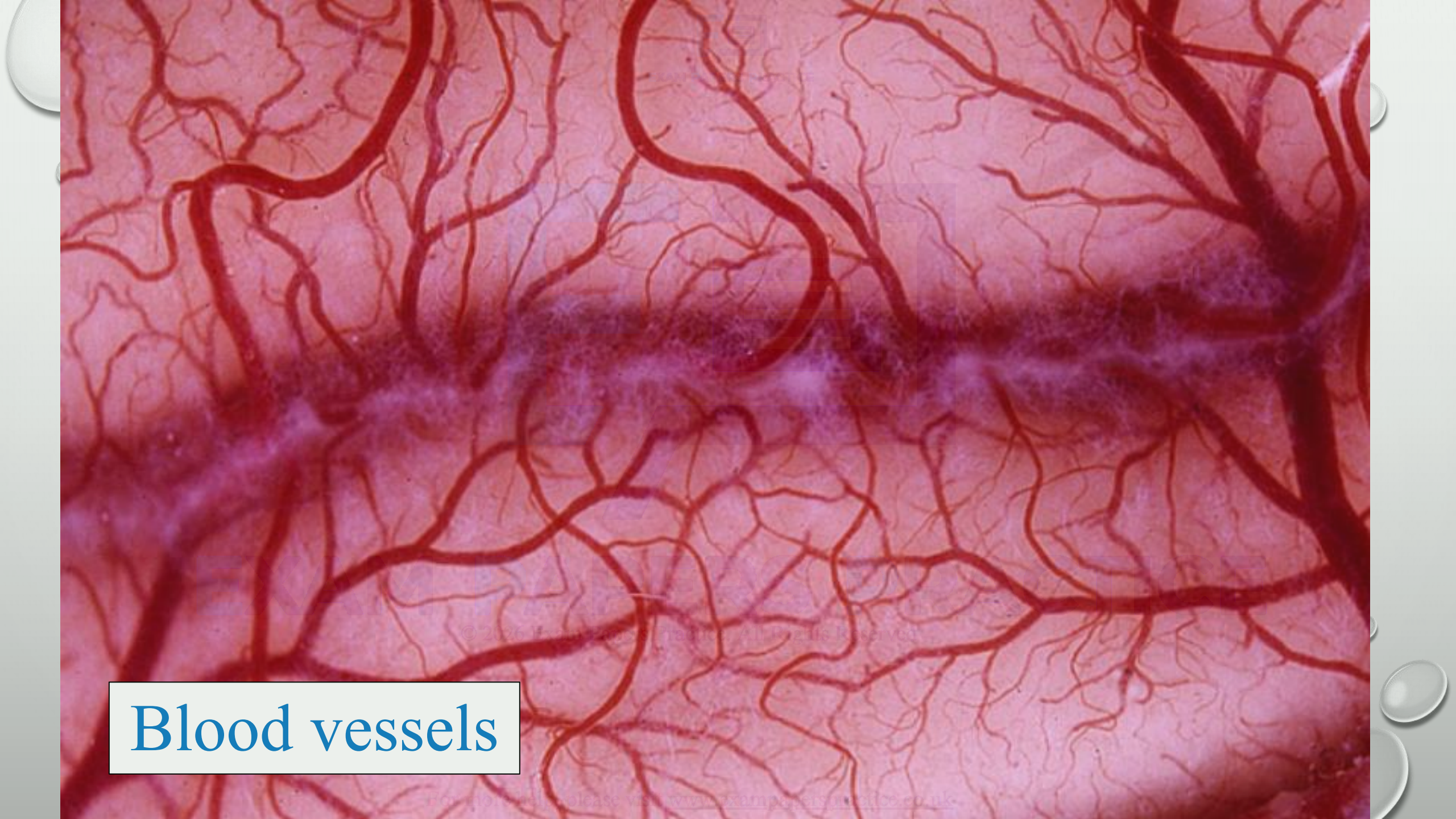
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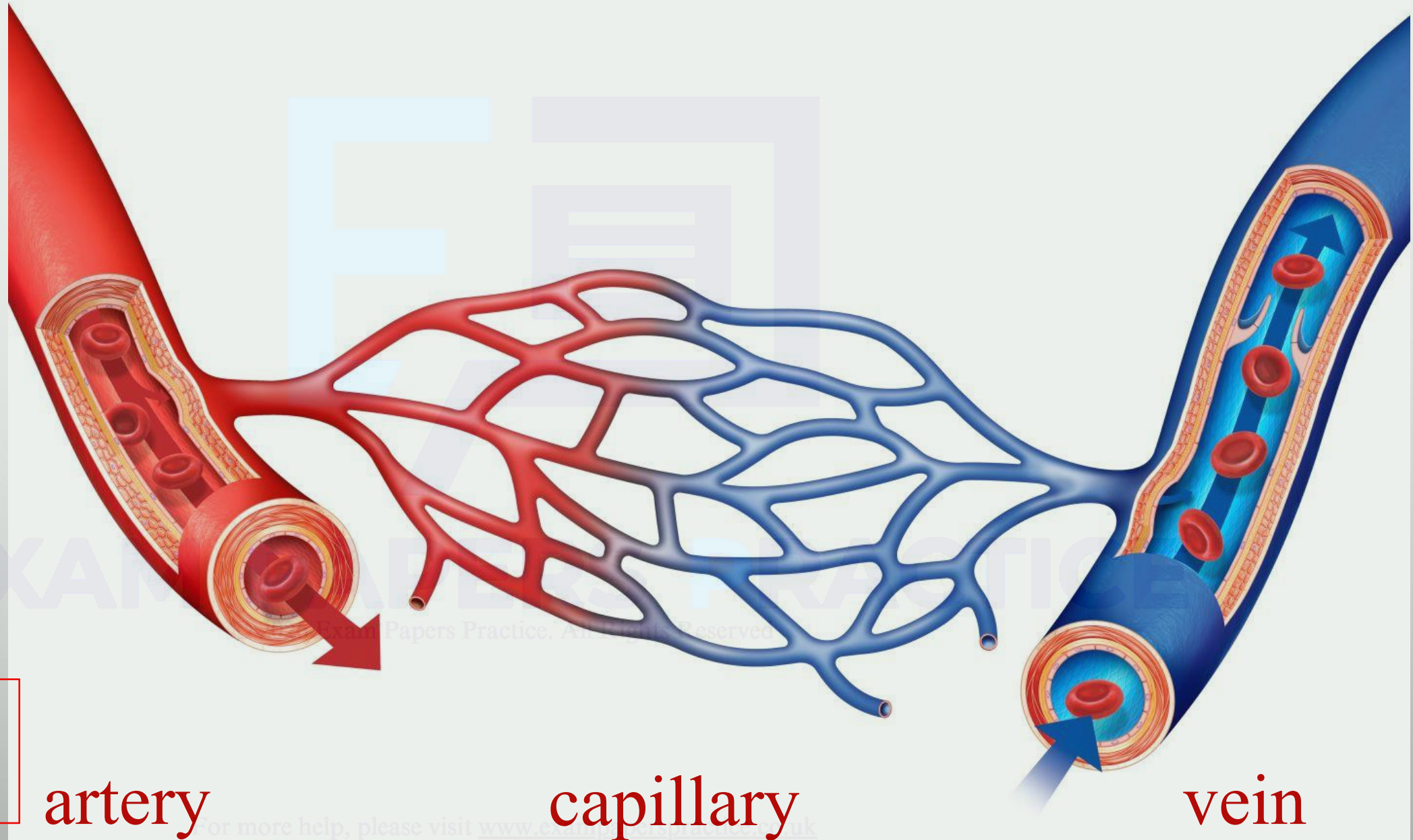
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Blood vessels



artery 动脉
capillary 毛细血管
vein 静脉

artery

capillary

vein

Transport in animals

Arteries

Function: carry blood away from the heart

Structure

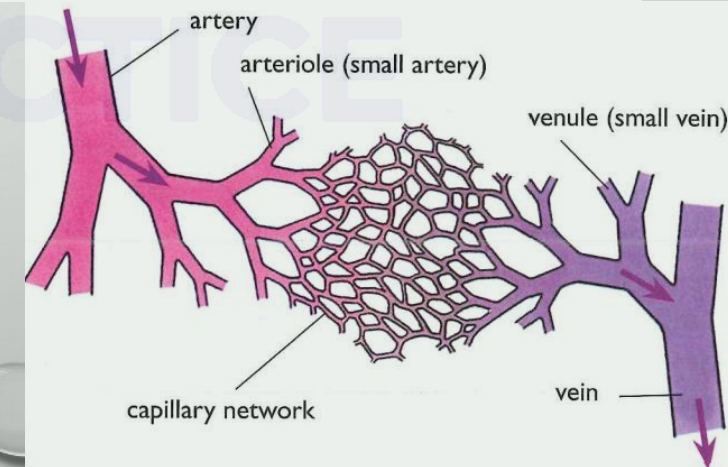
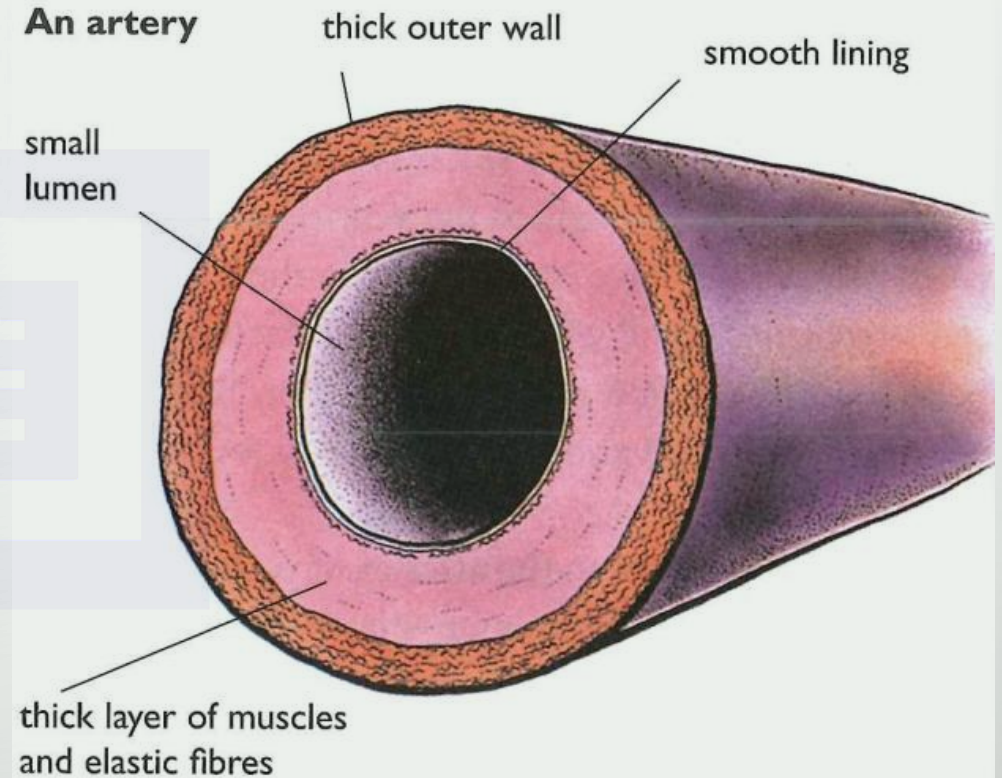
- Thick and strong, containing muscles and elastic tissues
- Small lumen

How structure fits function

Strength and elasticity needed to withstand the pulsing of the blood as it is pumped through the heart

elastic 有弹性的
elasticity 弹性
lumen 内腔
stretch 扩张
recoil 弹回

Blood vessels



Transport in animals

Blood vessels

capillaries

Function: supply all cells with their requirements, and take away waste products

Structure

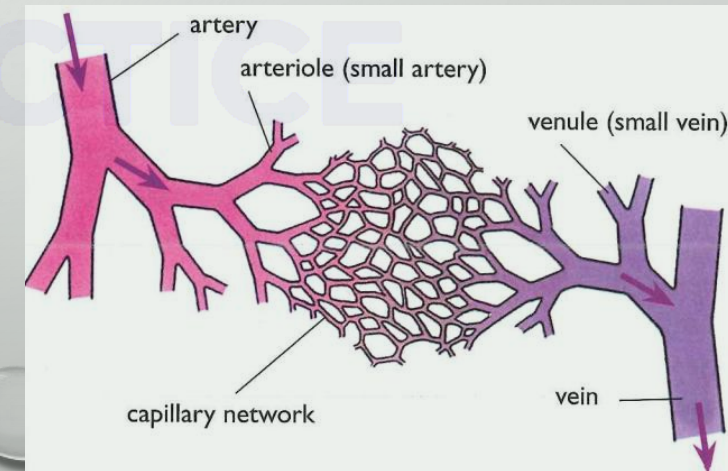
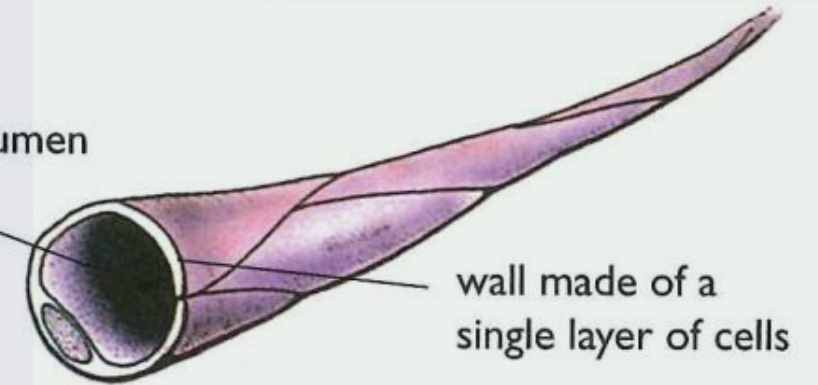
- Very thin, only one cell thick
- The lumen is very narrow, just wide enough for a red blood cell to pass through

How structure fits function

- > No need for strong walls, as most of the blood pressure has been lost;
- > Thin walls and narrow lumen bring blood into close contact with body tissues

blood pressure 血压
waste product 废物

A capillary
very small lumen



Transport in animals

Blood vessels

veins

Function: return blood to heart

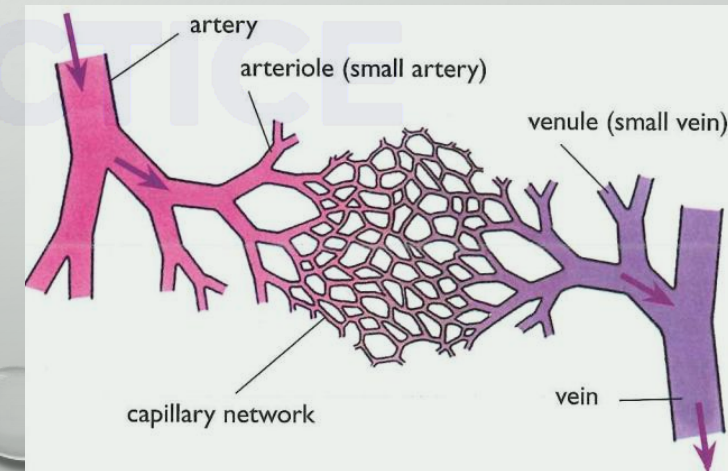
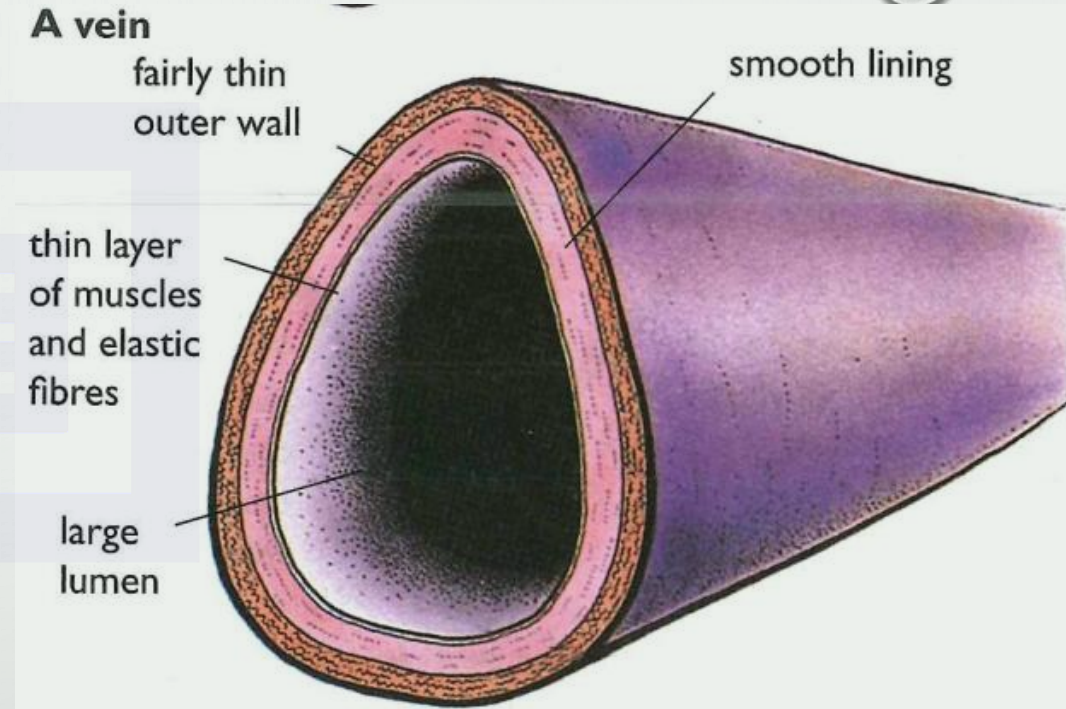
Structure

- Contain less muscle and elastic tissue than arteries
- Wide lumen; contain valves

How structure fits function

- > No need for strong walls, as most of the blood pressure has been lost;
- > wide lumen offers less resistance to blood flow
- > Valves prevent backflow

backflow 回流
resistance 抵抗, 阻碍

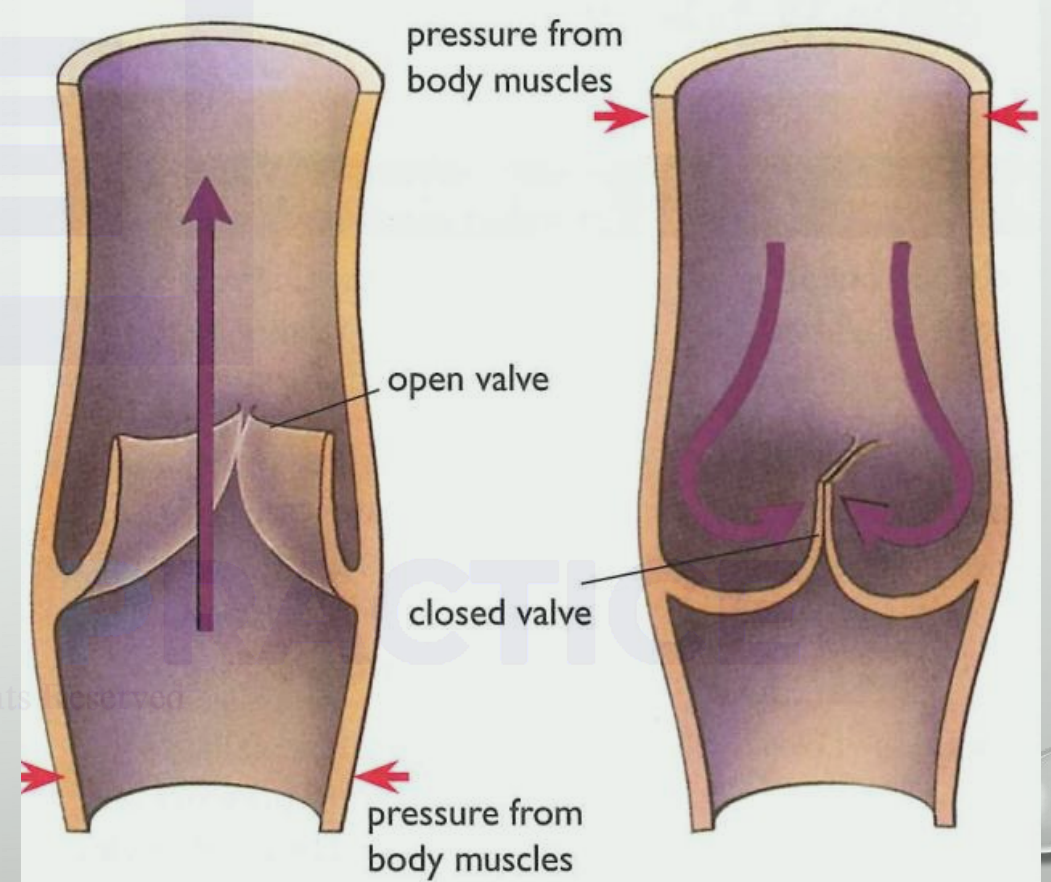


Why do veins have valves, but not arteries?

Because the **force of the heart beat** keeps blood moving forwards.

How to make blood move in veins?

Contraction of muscles keep the blood moving in veins



Transport in animals

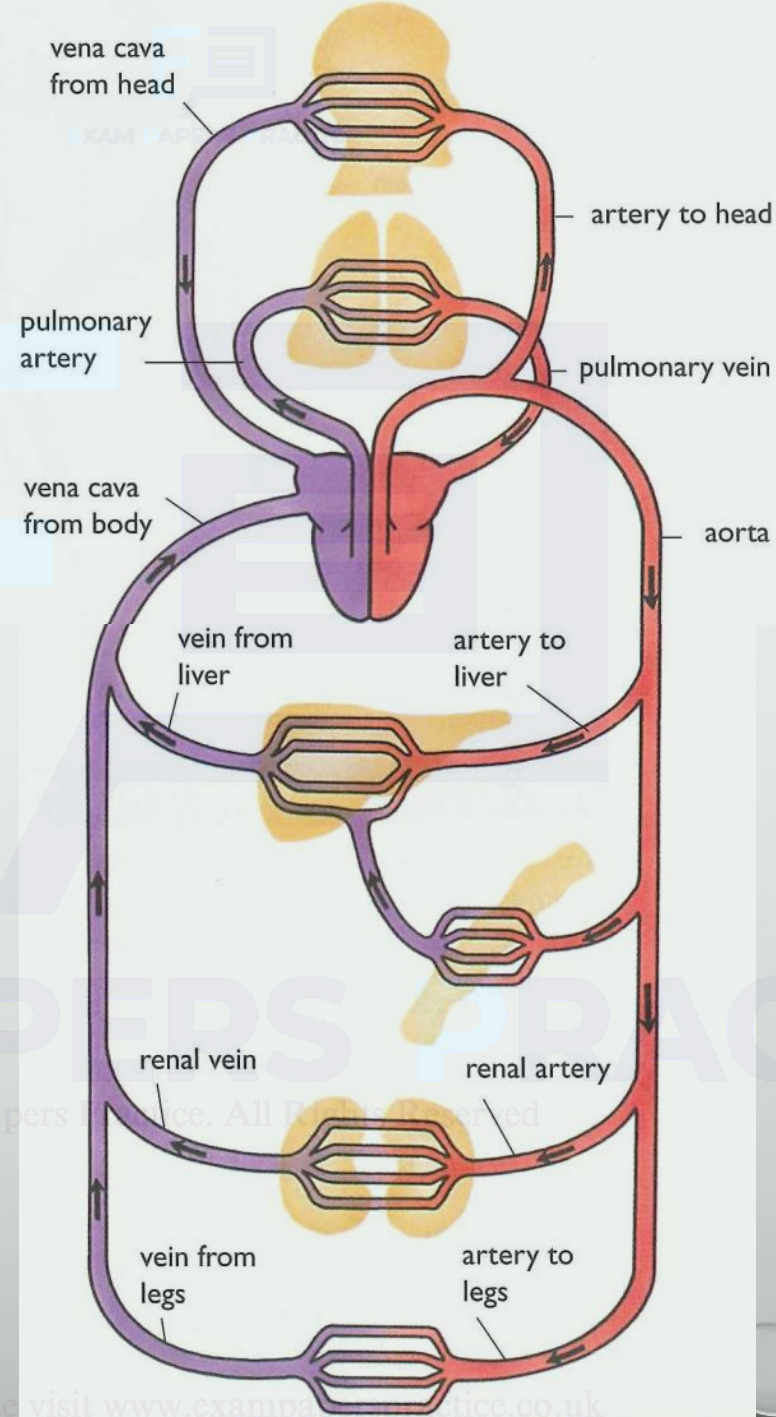
Blood vessels

	Function	Structure of wall	Width of lumen	S How structure fits function
Arteries				
Capillaries				
Veins				

Transport in animals

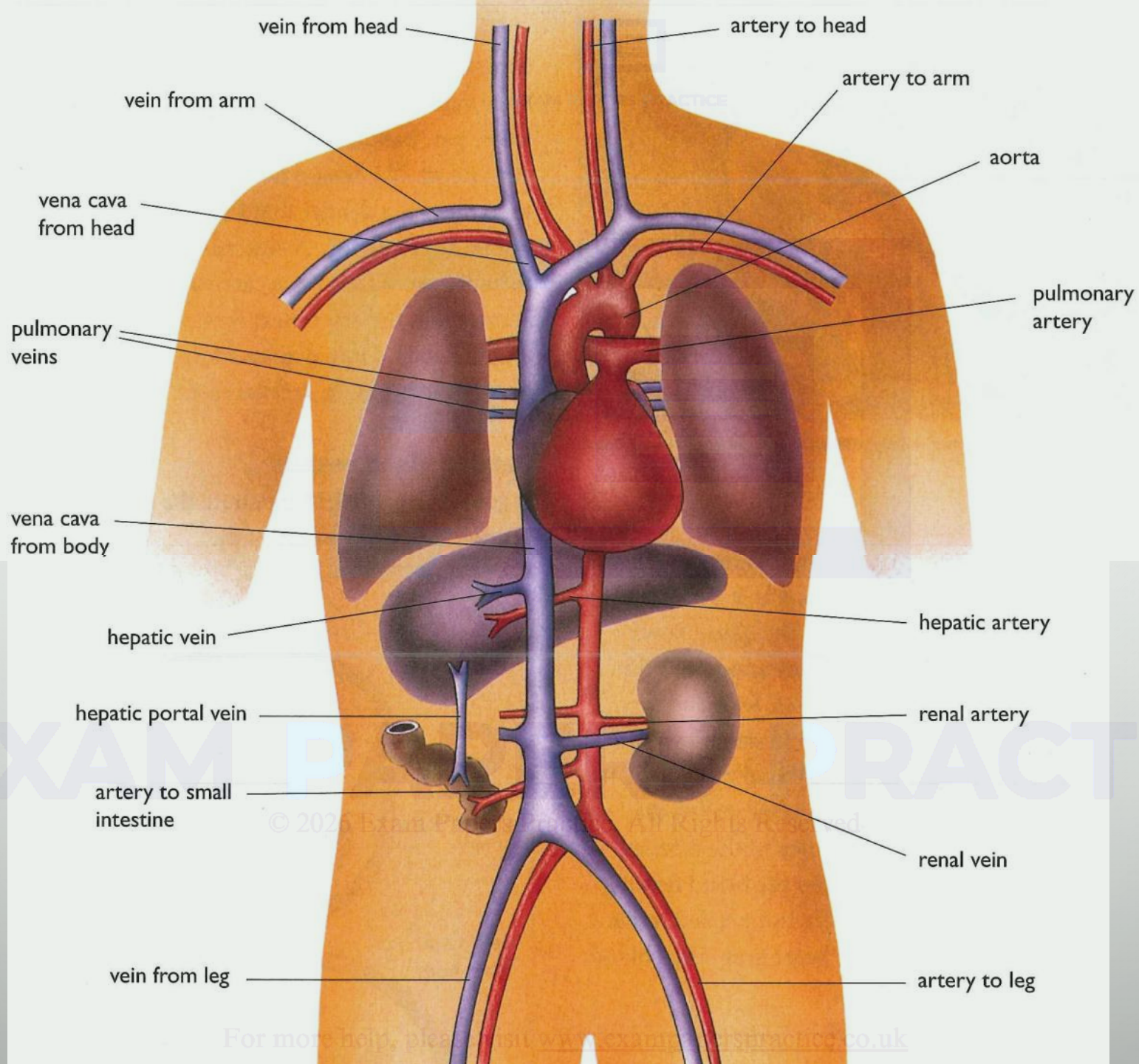
d vessels

vena cava 腔静脉
aorta 主动脉
pulmonary artery 肺动脉
pulmonary vein 肺静脉
renal artery 肾动脉
renal vein 肾静脉
hepatic vein 肝静脉
hepatic portal vein 肝门静脉



Transport

essels





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Transport in animals



Blood

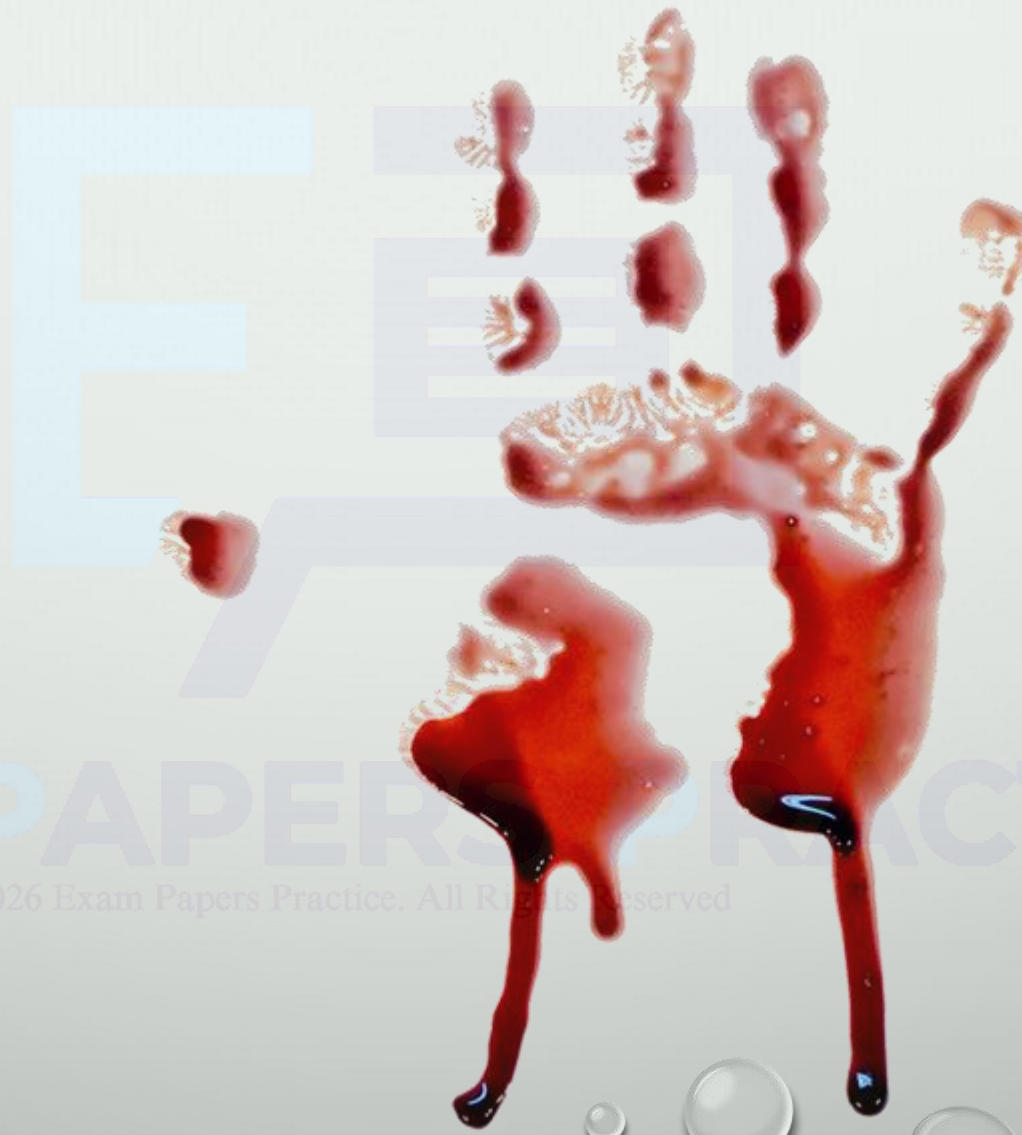


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Blood



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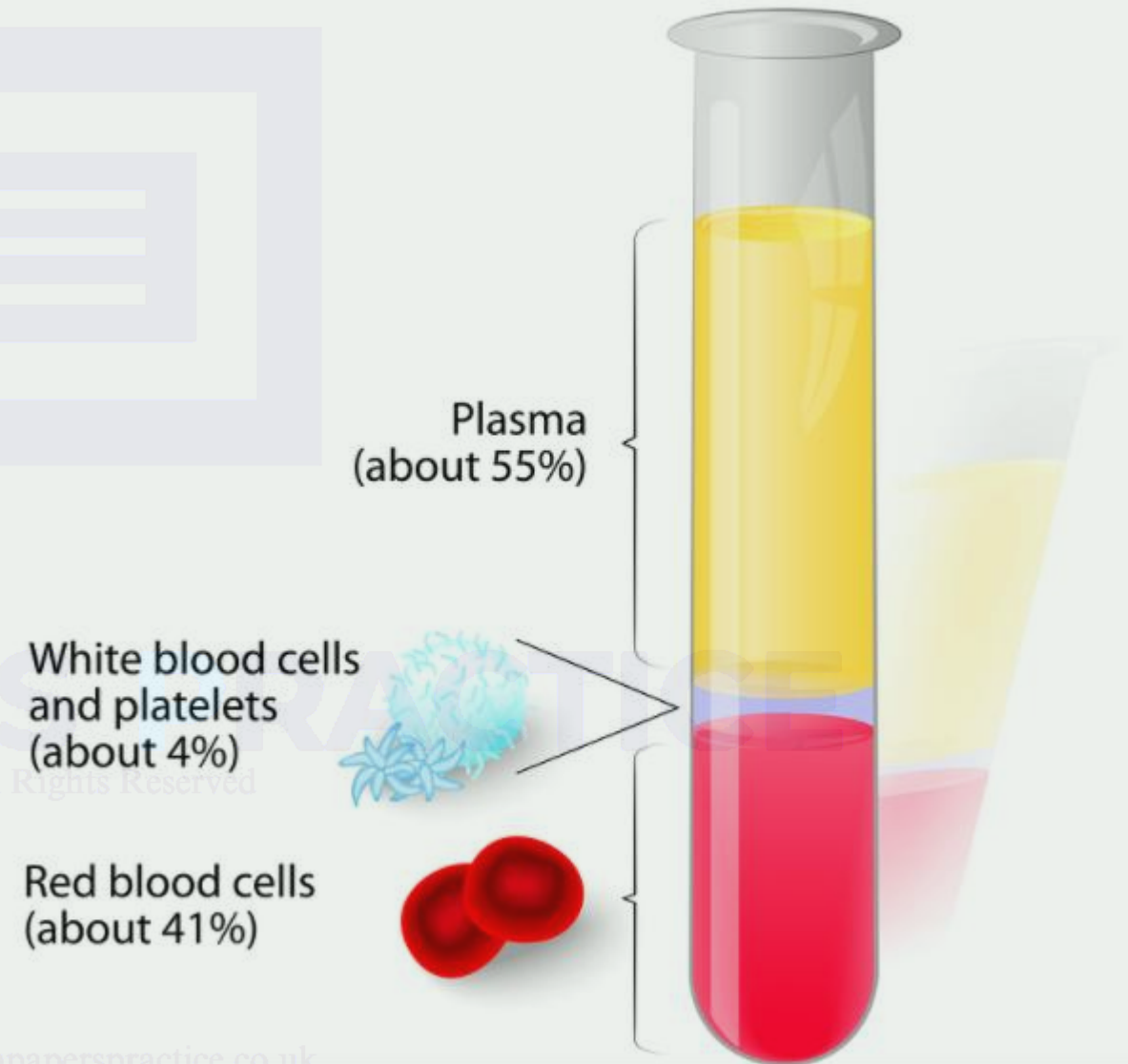
Transport in animals

Blood

Blood = Plasma + blood cells

Blood cells (white blood cells, red blood cells, platelets)

plasma 血浆
white blood cell
red blood cell
platelet 血小板



Transport in animals

Blood - plasma

plasma

- > Liquid medium in which cells and platelets can float
- > Transports CO₂, nutrients, urea, hormones, proteins, antibodies
- > transport heat

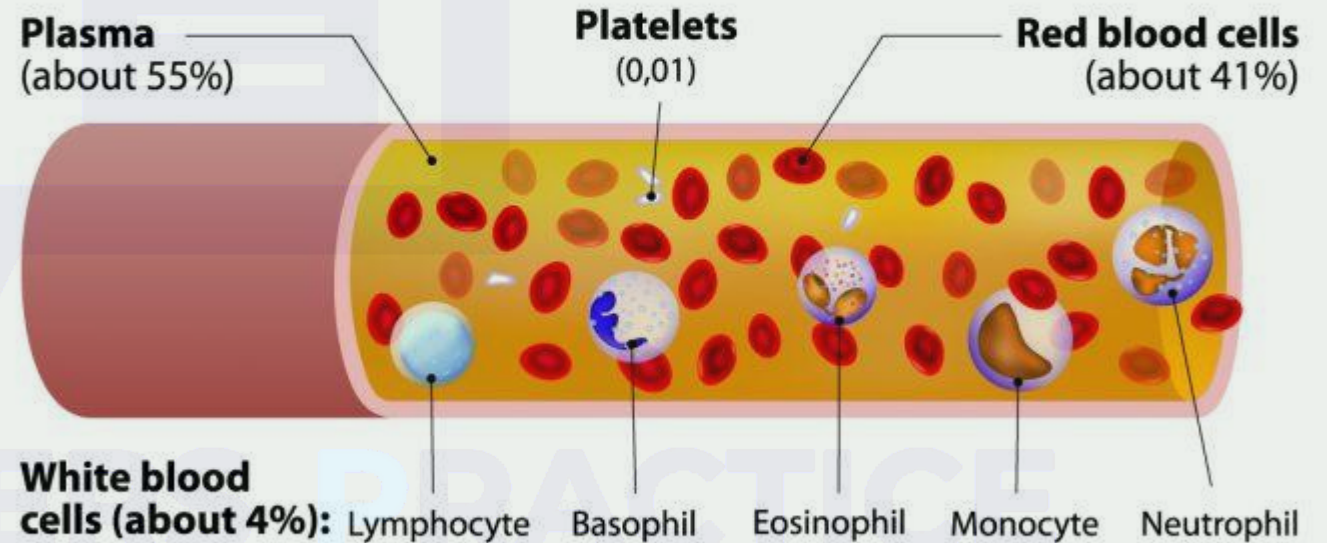
urea 尿素
hormone 激素
antibody 抗体

Component	Source	Destination	Notes
Water	Absorbed in small intestine and colon.	All cells.	Excess is removed by the kidneys.
Plasma proteins (including fibrinogen and antibodies)	Fibrinogen is made in the liver. Antibodies are made by lymphocytes.	Remain in the blood.	Fibrinogen helps in blood clotting. Antibodies kill invading pathogens.
Lipids including cholesterol and fatty acids	Absorbed in the ileum. Also derived from fat reserves in the body.	To the liver, for breakdown. To adipose tissue, for storage. To respiring cells, as an energy source.	Breakdown of fats yields energy – heart muscle depends largely on fatty acids for its energy supply. High cholesterol levels in the blood increase the risk of developing heart disease.
Carbohydrates, especially glucose	Absorbed in the ileum. Also produced by the breakdown of glycogen in the liver.	To all cells, for energy release by respiration.	Excess glucose is converted to glycogen and stored in the liver.
Excretory substances, e.g. urea	Produced by amino acid deamination in the liver.	To kidneys for excretion.	
Mineral ions, e.g. Na ⁺ , Cl ⁻	Absorbed in the ileum and colon.	To all cells.	Excess ions are excreted by the kidneys.
Hormones	Secreted into the blood by endocrine glands.	To all parts of the body.	Hormones only affect their target cells. Hormones are broken down by the liver, and their remains are excreted by the kidneys.
Dissolved gases, e.g. carbon dioxide	Carbon dioxide is released by all cells as a waste product of respiration.	To the lungs for excretion.	Most carbon dioxide is carried as hydrogencarbonate ions (HCO ₃ ⁻) in the blood plasma.

Blood cells

white blood cells
red blood cells
platelets

The elements of blood



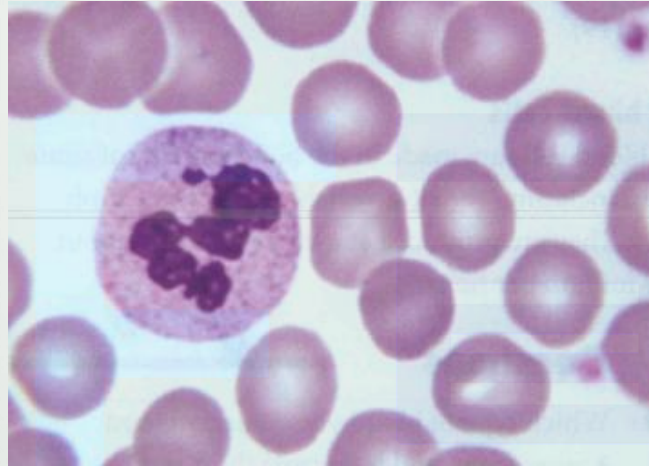
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Transport in animals

Blood – white cells

white blood cells

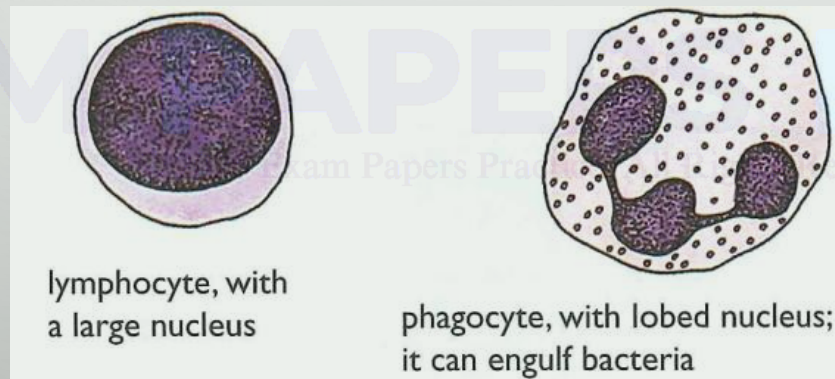
- Have **nucleus** (large and lobed)
- Functions: fight **pathogens**



Lymphocyte (large nucleus) →→ produce **antibodies**

phagocyte (lobed nucleus) →→ phagocytosis (engulf bacteria)

pathogen 病原体
lymphocyte 淋巴细胞
antibody 抗体
phagocyte 吞噬细胞
phagocytosis 吞噬作用
engulf 吞食

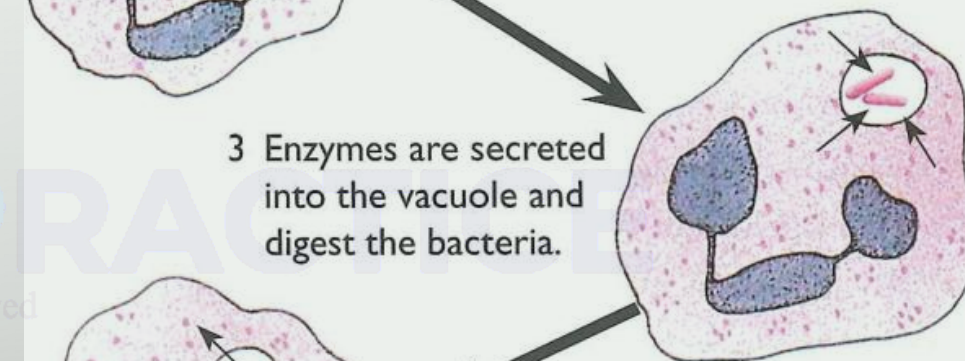


1 A phagocyte moves towards a group of bacteria, and flows around them.



2 The phagocyte's cell membrane fuses together, enclosing the bacteria in a vacuole.

3 Enzymes are secreted into the vacuole and digest the bacteria.



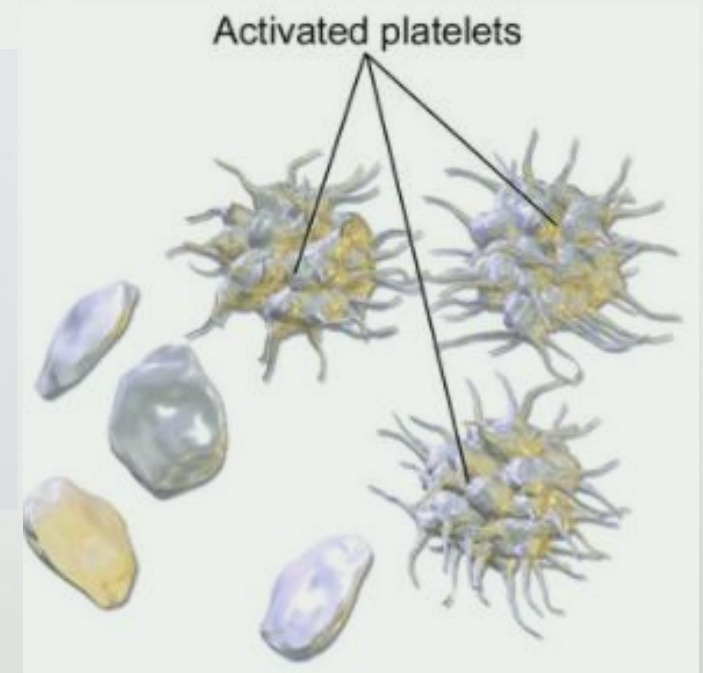
4 Soluble substances diffuse from the vacuole into the phagocyte's cytoplasm.



platelets

When a blood vessel is cut, the platelets **bump into the rough edges** and reacting by releasing a chemical.

The damaged tissues around the blood vessel also release chemicals.



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platelet 血小板

Transport in animals

Blood clotting

>Platelets

>Fibrinogen

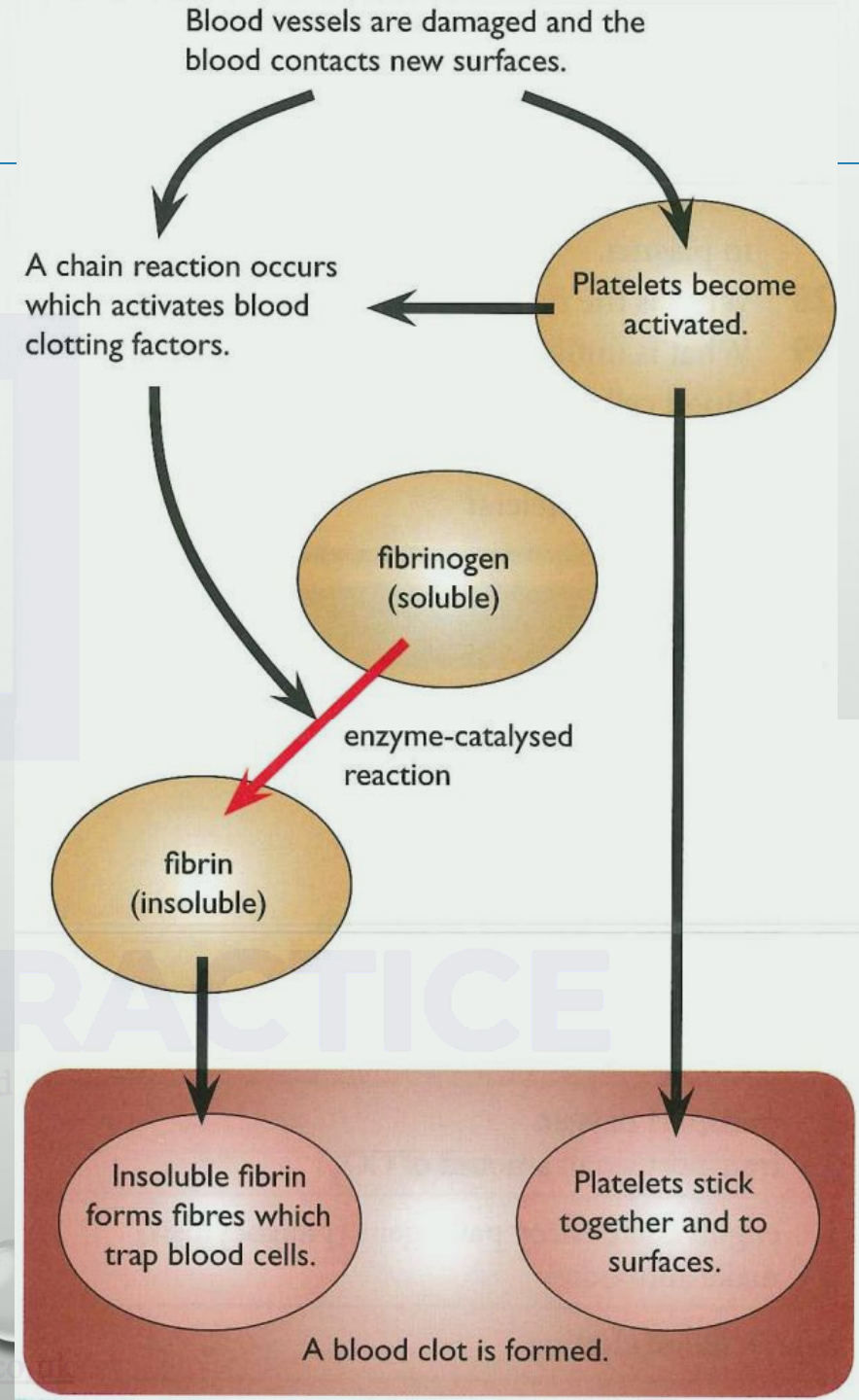
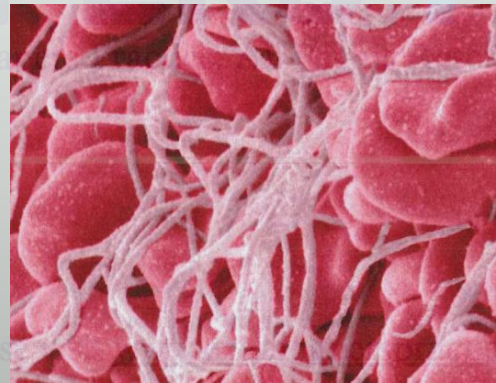
fibrinogen(soluble) → fibrin (form fibres and insoluble)
→ this form a mesh across the wound. red blood cells and platelets get trapped in the tangle of fibres, forming a blood clot.

The blood- clotting prevent blood loss and the entry of pathogens.

fibrinogen 纤维蛋白原

fibrin 纤维蛋白

blood-clotting 凝血

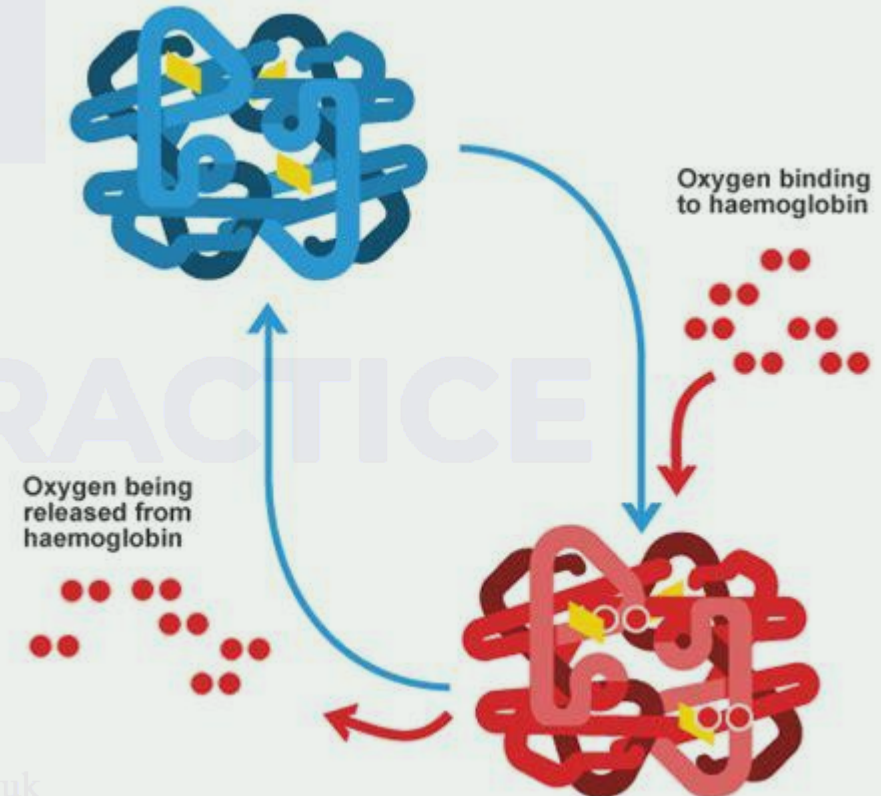


Transport in animals

Blood – red blood cells

Red blood cells

- biconcave disc
- No nucleus
- haemoglobin (Hb)
haemoglobin $\leftrightarrow$ oxyhaemoglobin (oxyHb)
- Function: transport oxygen and small amount of carbon dioxide



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Component	Structure	Functions
plasma		
red cells		
white cells		
platelets		

Transport in animals

Blood

Component	Structure	Functions
plasma	water, containing many substances in solution	1 liquid medium in which cells and platelets can float 2 transports CO_2 in solution 3 transports nutrients in solution 4 transports urea in solution 5 transports hormones in solution 6 transports heat 7 transports proteins, e.g. fibrinogen 8 transports antibodies
red cells	biconcave discs with no nucleus, containing haemoglobin	1 transport oxygen 2 transport small amount of CO_2
white cells	variable shapes, with nucleus	1 engulf and destroy pathogens (phagocytosis) 2 make antibodies
platelets	small fragments of cells, with no nucleus	help in blood clotting



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Transport in animals

Platelets

plasma + white blood cells
(capillary)

tissue fluid
(surround all the cells)

Lymph
(lymphatic
capillaries)

Tissue fluid is the **immediate environment** of every cells.

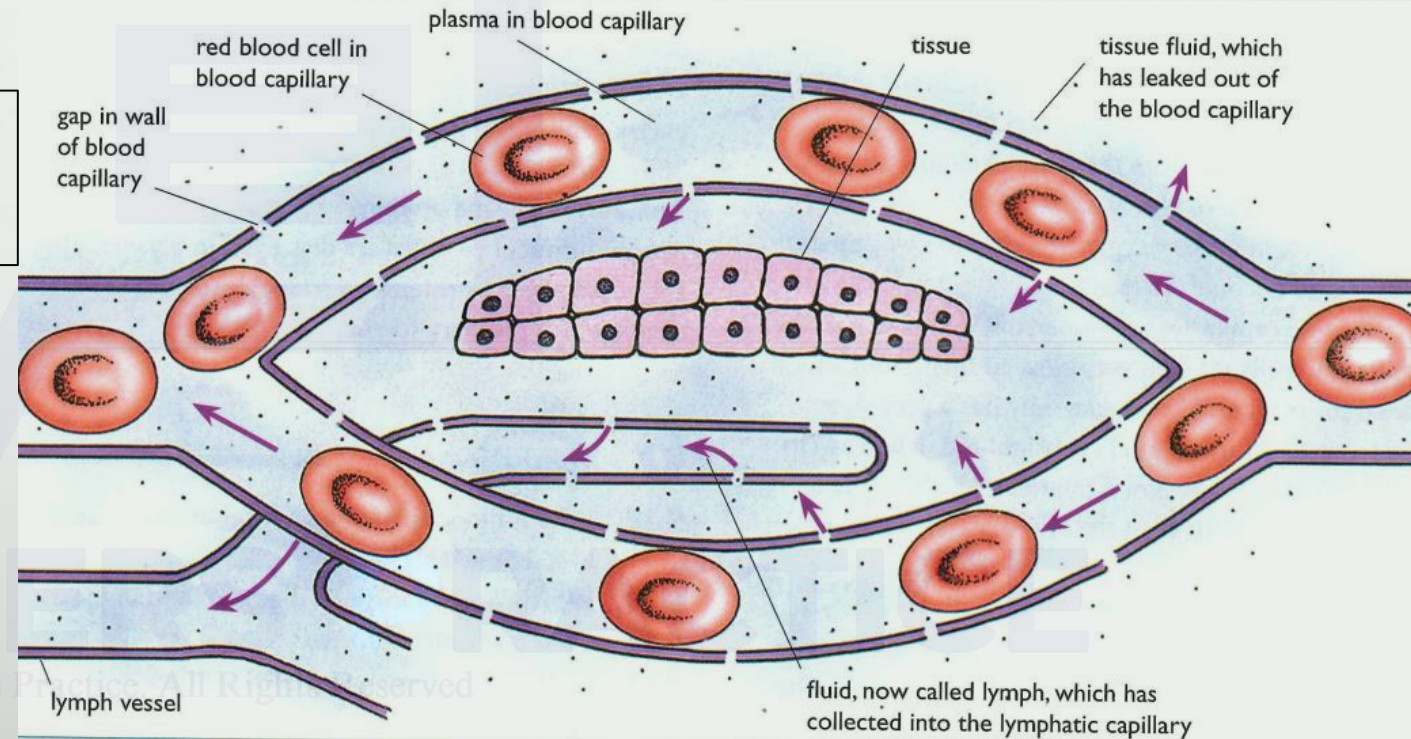
It is very important. It supplies cells with all their requirements, such as oxygen and glucose. Waste products, such as carbon dioxide, diffuse into tissue fluid from cells.

tissue fluid 组织液

lymph 淋巴液

lymphatic capillary 毛细淋巴管

lymphatic system 淋巴系统



Transport in animals

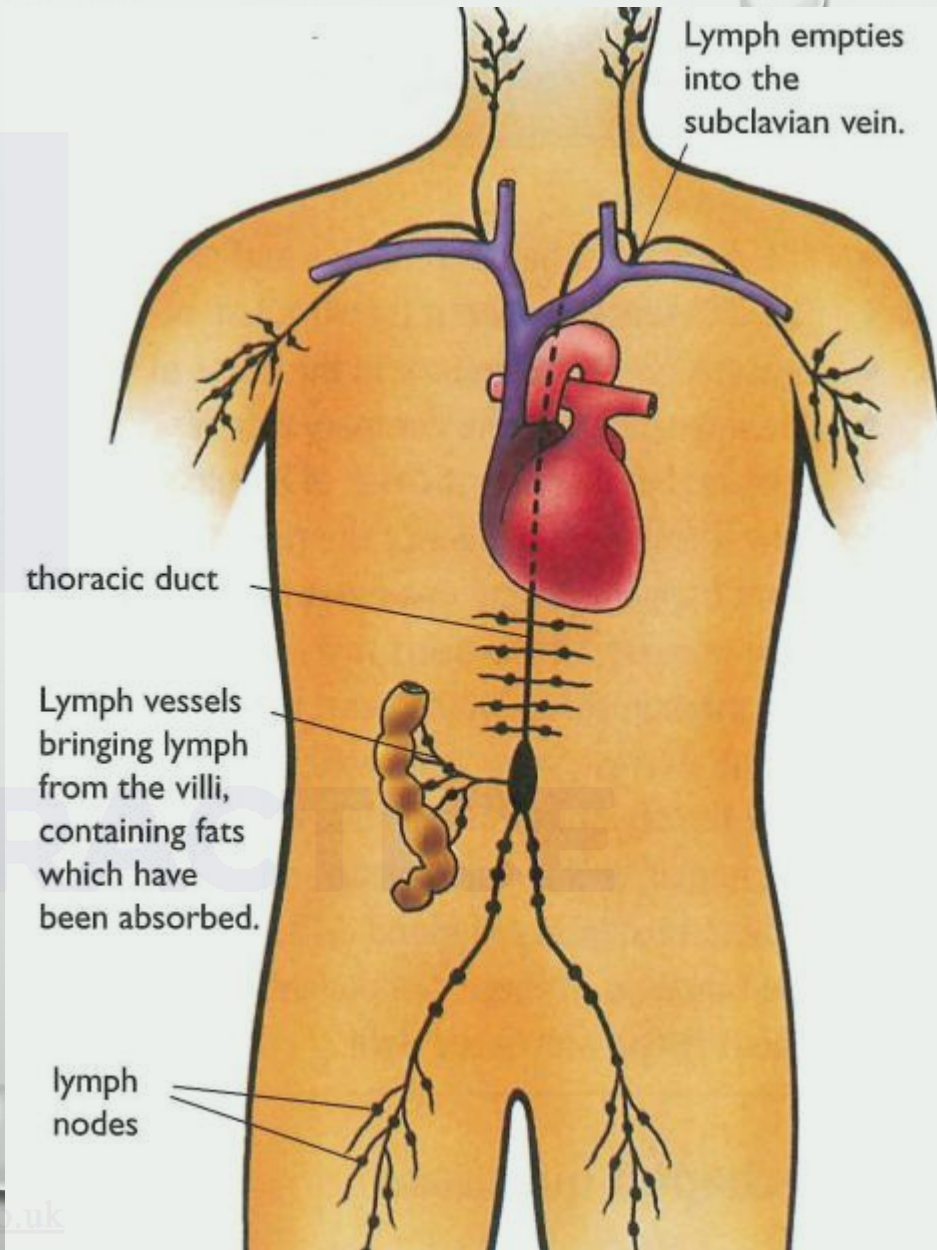
Platelets

Lymphatic system

The lymphatic system is part of the circulatory system and an important part of the **immune system**, comprising a network of **lymphatic vessels** that carry a clear fluid called **lymph**, and contain many **lymph nodes**

Function of lymphatic system

- ♥ collect tissue fluid, help body circulation
- ♥ protect of the body from infection
(lymph nodes—— white blood cells)



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