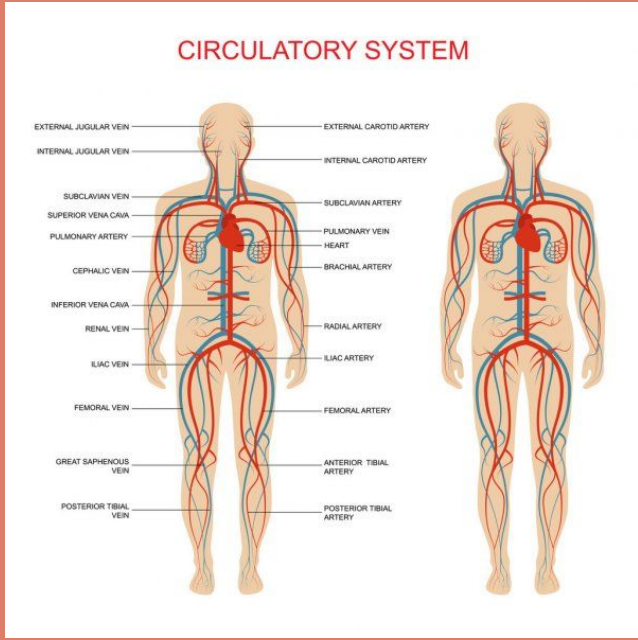
Human cardiovascular system



Human cardiovascular system

Tasks:

- circulates and transports: nutrients, O2, CO2, waste products, ions, hormones, blood cells, antibodies
- maintains homeostasis to provide “everything” for cells

The composition of blood has to be almost constant

The blood is fluid connective tissue without fibres

Human cardiovascular system

2 main parts of blood:

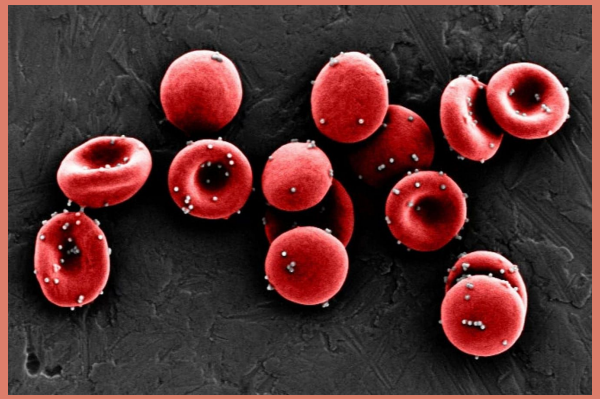
- plasma: 53-58% of blood, components: water, ions (Na+, K+, Cl-, Mg2+, HCO3-), glucose, lactic acid, urea (karbamid), antibodies
- blood cells: 42-47%, produced by the red bone marrow

<u>Red blood cells</u>:

delivering O2/CO2 to the cells and the lungs, their hemoglobin molecule can bind O2/CO2

in 1 mm3 blood 4-5 millions

their lifetime is 90-120 days

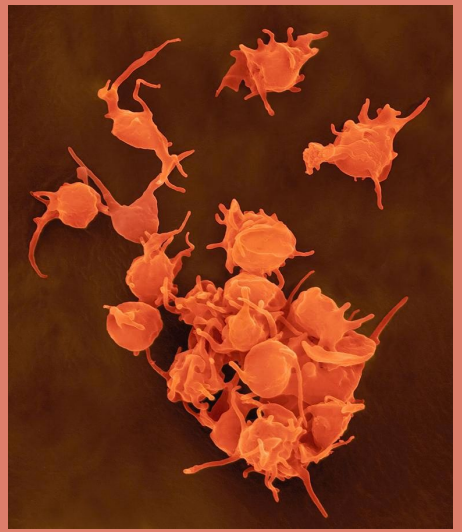


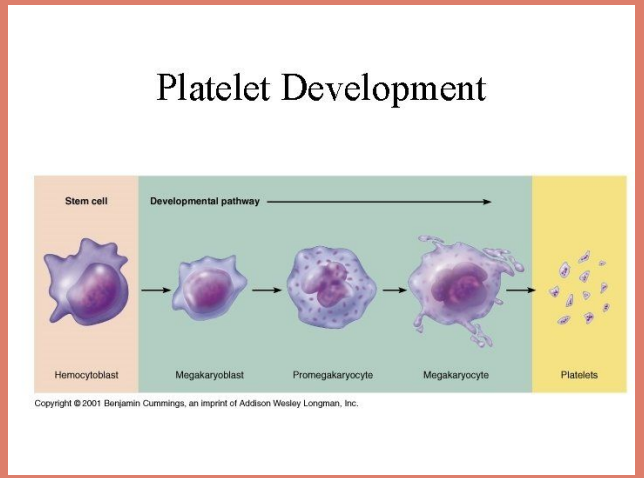
Human cardiovascular system

Platelets/thrombocytes: they stop bleeding, make coagulation, they are cell fragments

in 1mm3 blood 200-400 thousands

lifetime: 8-10 days





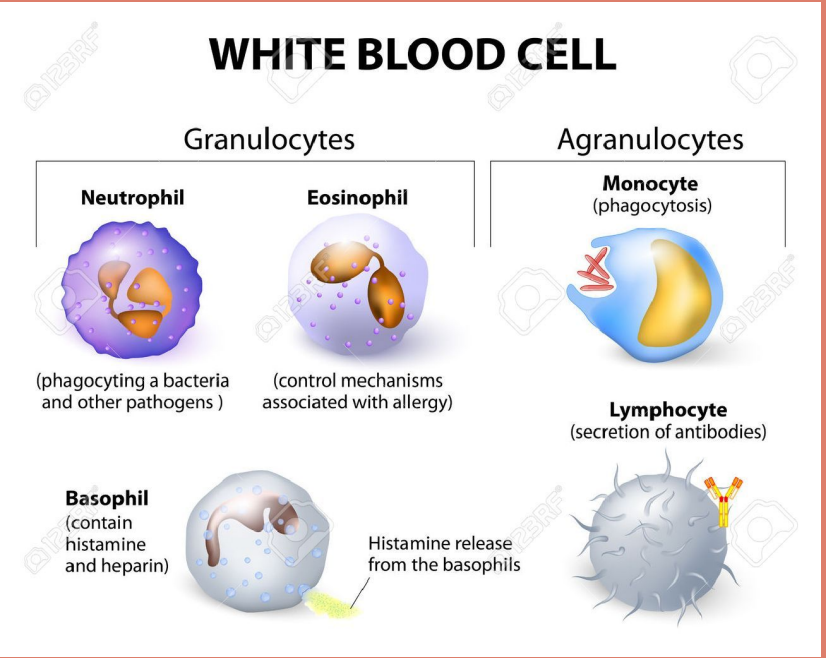
Human cardiovascular system

White blood cells: soldiers of the immune system, they protect the body from pathogens, foreign bodies and own cancer cells

types: monocytes, lymphocytes, granulocytes

in 1mm3 blood 6-10 thousands

lifetime: from few days to years



Human cardiovascular system

Parts of the cardiovascular system:

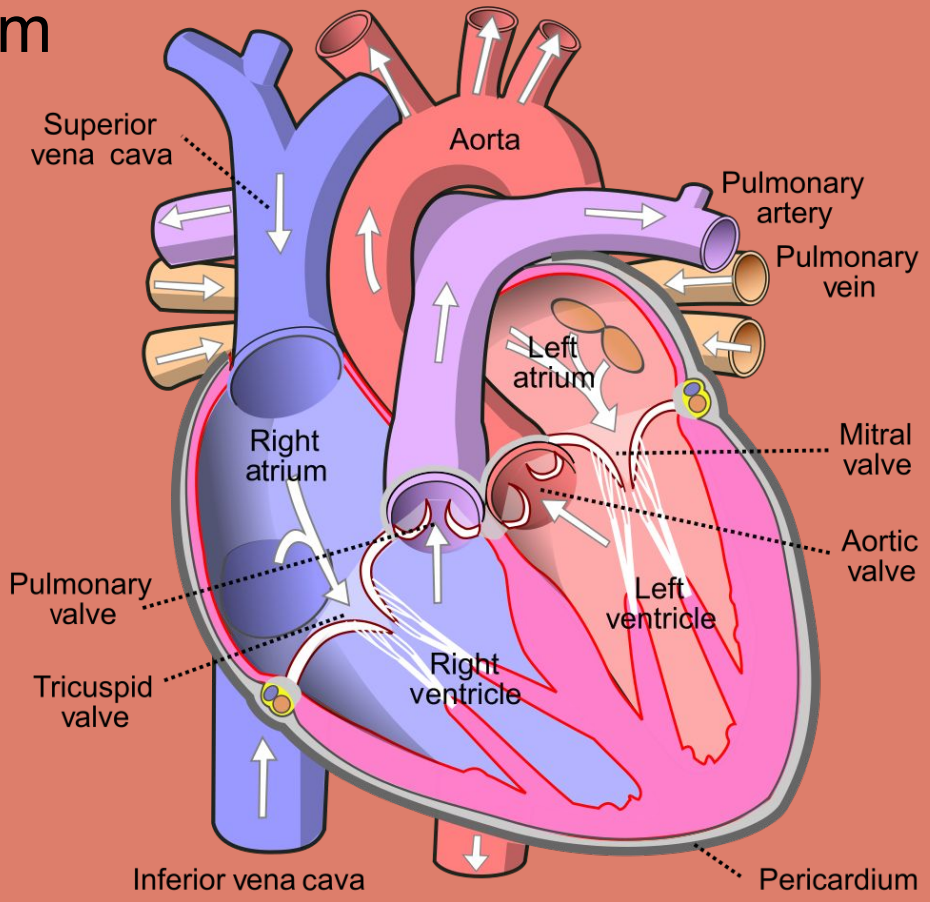
heart, arteries, veins, capillaries

Heart:

centre of the cardiovascular system, that pumps blood through the blood vessels

its own blood vessels are called coronary arteries

it has own impulse generating and leading system which direct the beat of the heart



Human cardiovascular system

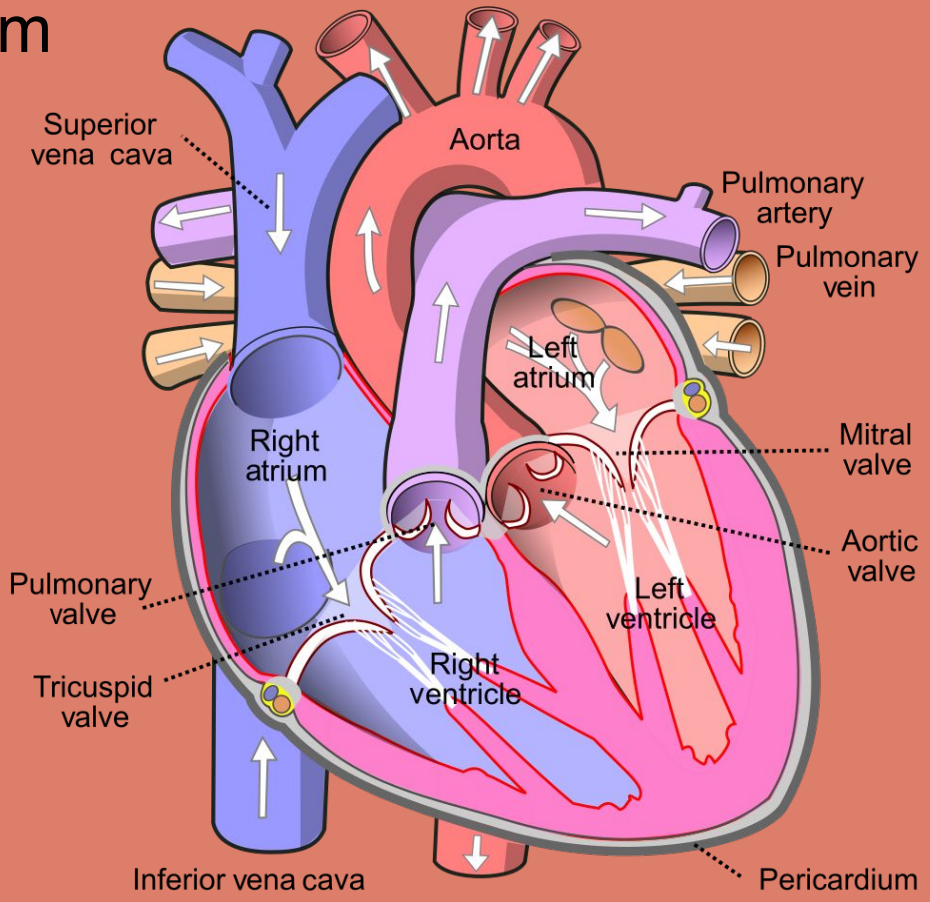
<u>Heart:</u>

4 chambers of the heart:

right atrium and right ventricle

left atrium and left ventricle

the heart valves (szívbillentyűk) prevent the backflow of blood



Human cardiovascular system

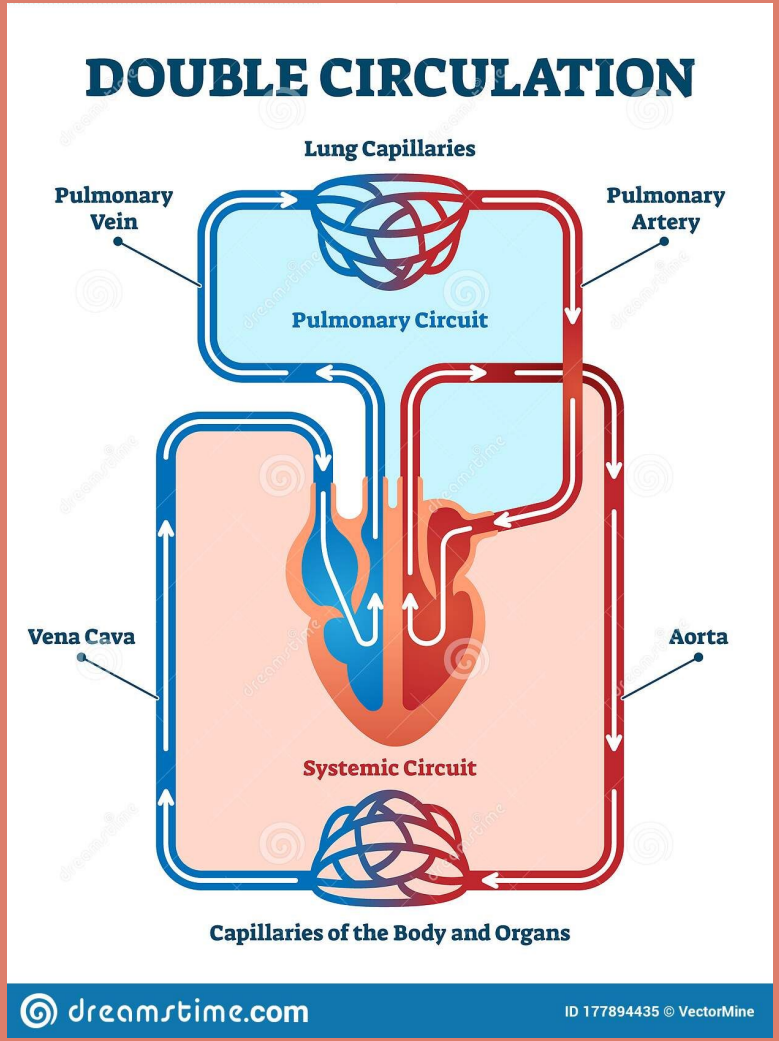
Heart:

2 ways of blood:

systemic circulation/circuit

left ventricle - arteries - body capillaries - veins - right atrium

its veins transport deoxygenated blood



Human cardiovascular system

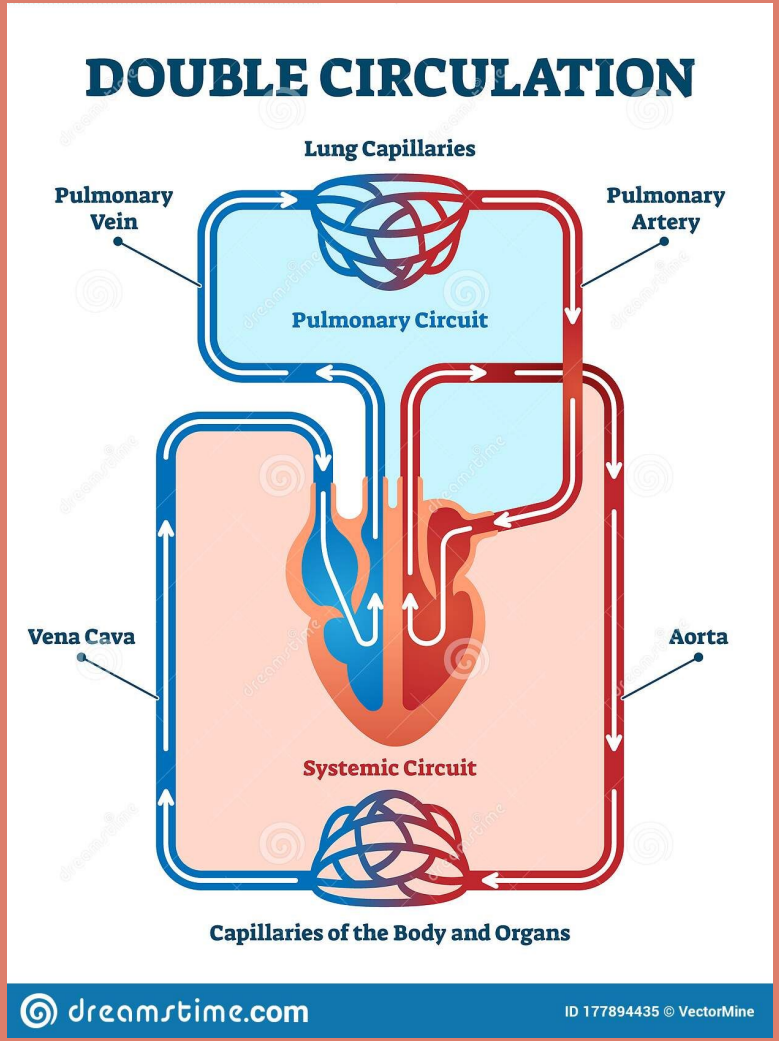
Heart:

2 ways of blood:

pulmonary circulation/circuit

right ventricle - pulmonary arteries - lung capillaries - pulmonary veins - left atrium

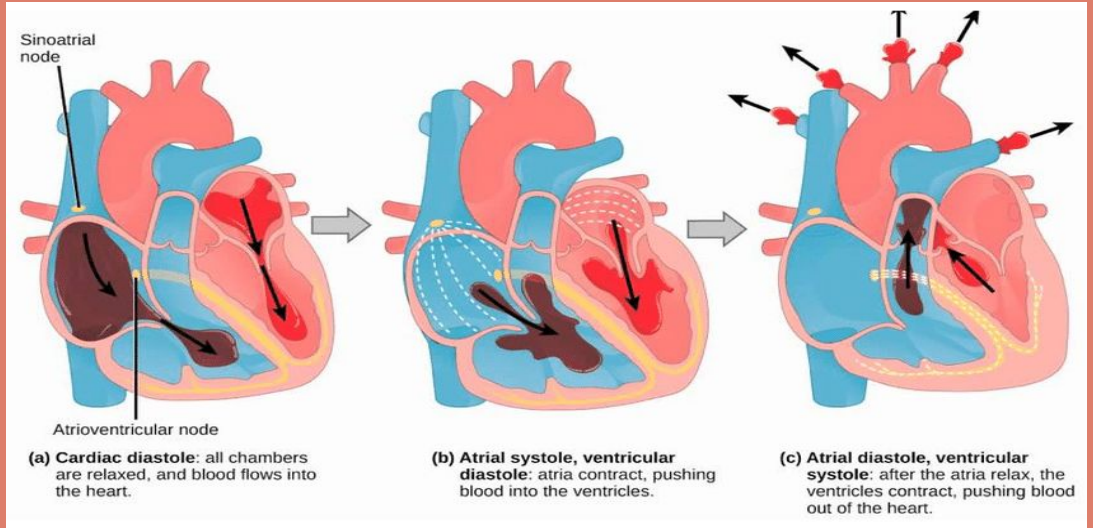
its veins transport oxygenated blood



Human cardiovascular system

Cardiac cycle: the contraction and relaxation alternate between the atria and ventricles

1. left and right atria contract
2. left and right ventricles contract (atria relax)
3. both of them are relaxed



Human cardiovascular system

Important data belong to the work of heart:

- amount of blood: 70 kg adult has about 5l (0,08 dl/ kg) (+12 kg means + 1l blood)
- heart rate (pulzusszám): number of contractions during a minute, average in tranquility 72/min
- stroke volume (pulzustérfogat): volume of blood pumped out from heart with 1 beat, average: 0,8 dl= 80 cm3, our blood circulates around our body in 1 minute

Human cardiovascular system

Important data belong to the work of heart:

- blood pressure: pressure of circulating blood on the walls of blood vessels

  it is measured in millimeters of mercury (Hgmm)

  2 data refers to the contraction and the relaxation of the left ventricle

  normal resting blood pressure 120/80 Hgmm (systolic/diastolic= contracted/relaxed left ventricle)

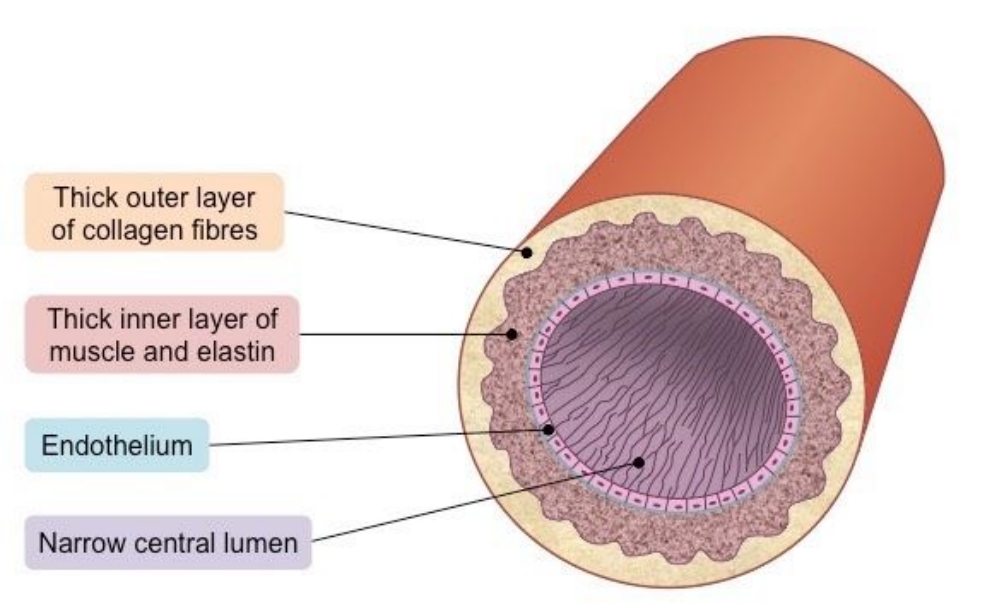
Human cardiovascular system

<u>Arteries:</u>

blood vessels come from the heart

their cross section is round

their wall is thick and flexible



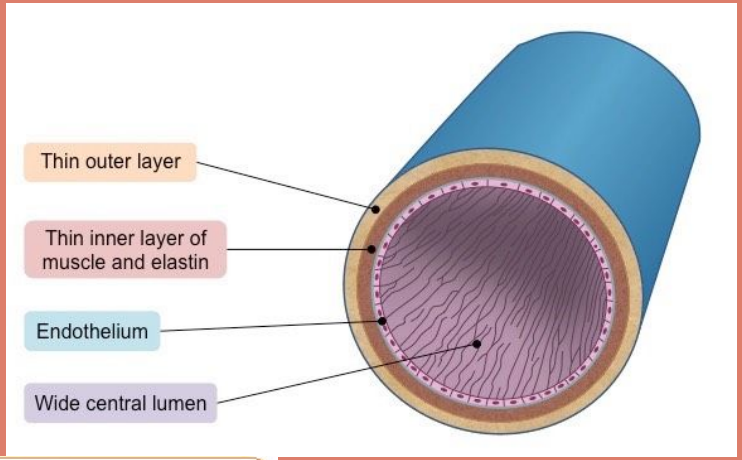
Human cardiovascular system

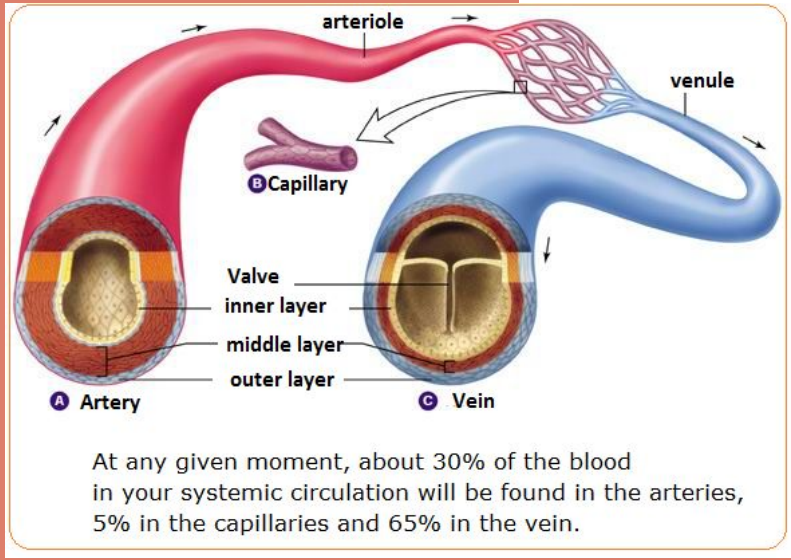
<u>Veins:</u>

blood vessels come back the heart

their cross section is oval

their wall is thin





Human cardiovascular system

Capillaries:

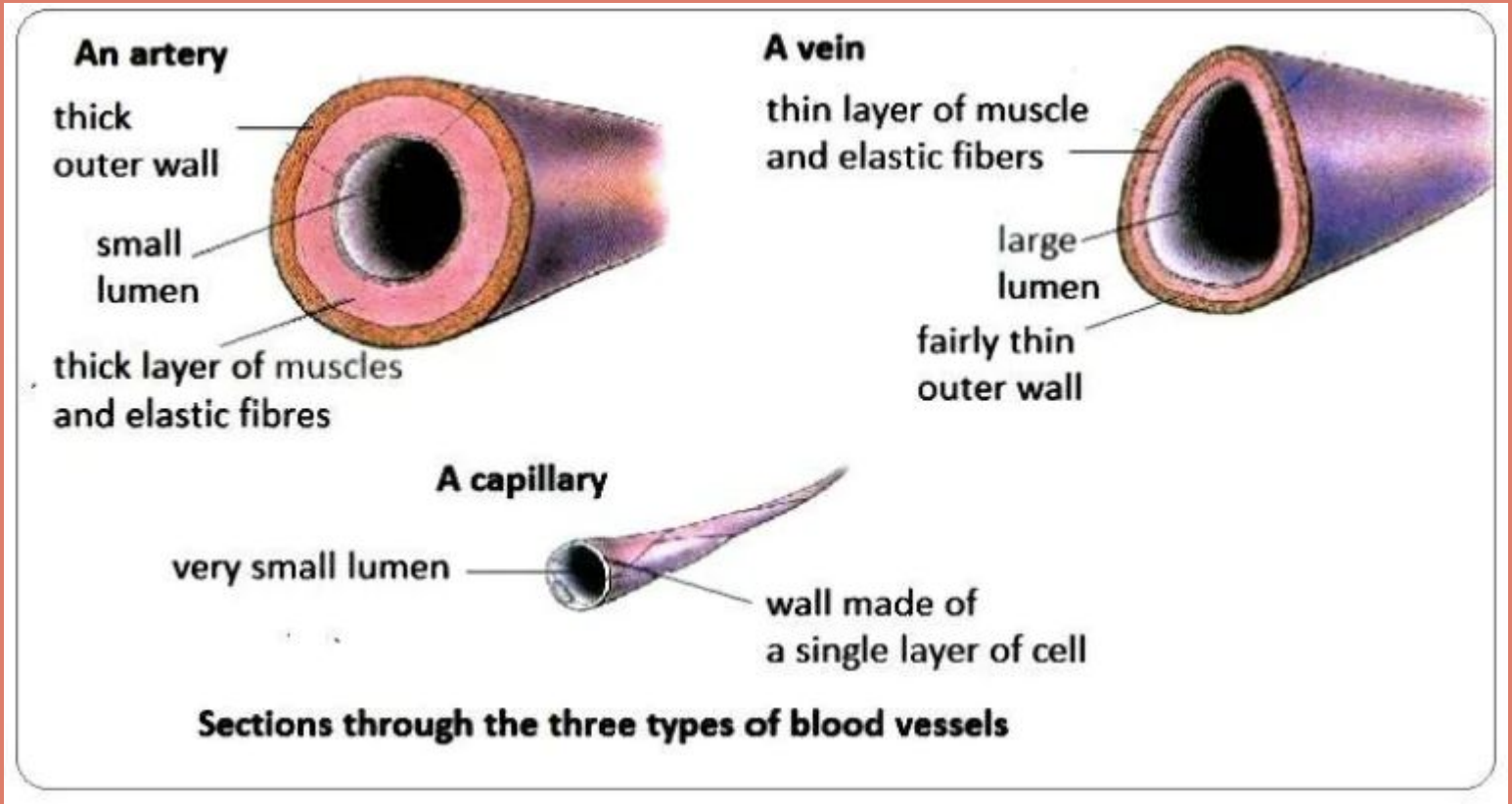
blood vessels that connect arteries and veins

smallest blood vessels

their wall is thin, only 1 layered epithelium

through their walls happen the exchange of substances between the cells and the blood

Human cardiovascular system



Human cardiovascular system

https://www.youtube.com/watch?v=_vZ0lefPg_0

Diseases of the human cardiovascular system

They are among the most common cause of death

The problems with the circulatory system have effects on the whole body

Factors that contribute to the development of cardiovascular diseases:

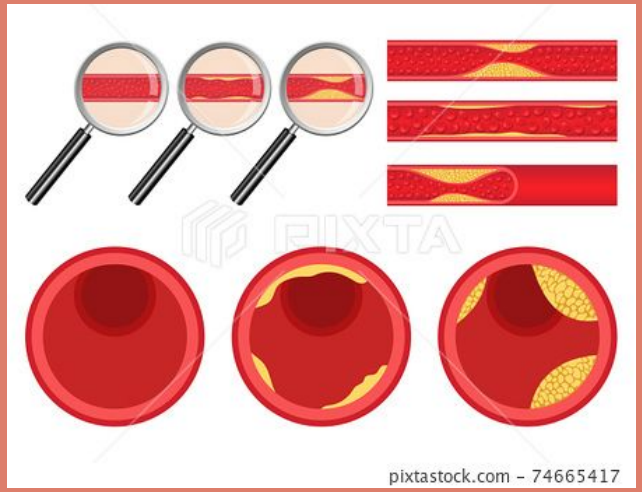
- stress
- overweight
- unhealthy diet: too much saturated fat, salt
- physical inactivity
- smoking, drinking alcohol
- genetic predisposition
- age
- hypertension (cause and effect)

Diseases of the human cardiovascular system

The **arteriosclerosis** (érelmeszesedés) contributes to other diseases

The cross section of the blood vessels reduced because of the deposition of fats and other substances

The blood vessels flexibility decreases and it causes problems with the flow of blood, so the tissues get less O2 and nutrients

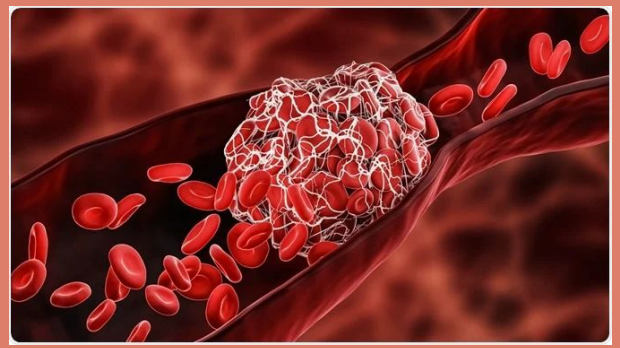


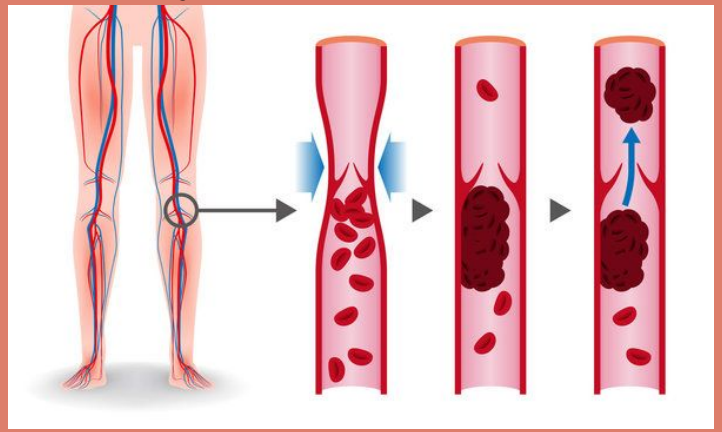
Diseases of the human cardiovascular system

1. Thrombosis:

formation of blood clots/thrombus inside a blood vessel, it obstructs the flow of blood

the blood clot can travel elsewhere and causes serious problems: tissue death (blood supply is low), heart attack, stroke, pulmonary embolism, deep vein thrombosis (mainly affects legs)





Diseases of the human cardiovascular system

2. Heart attack:

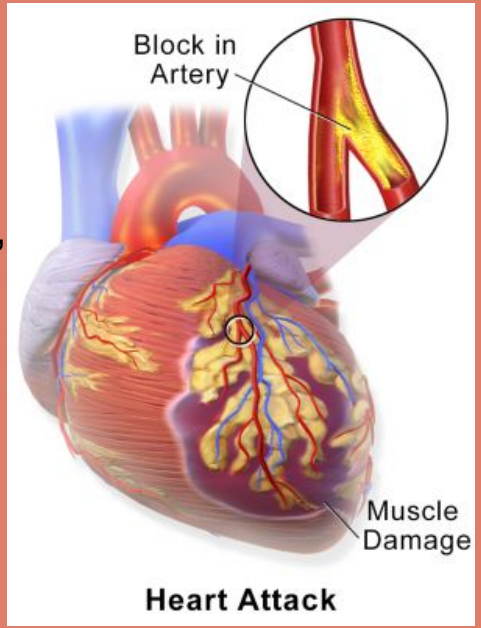
obstruction of a coronary artery by a thrombus, causes insufficient supply of O2 and nutrients to the heart muscle

the result is tissue death, it can cause death

symptoms: pressure or pain in the chest,

pain in the jaw/neck/back/left upper arm, shortness of breath,

nausea or vomiting, fainting



Diseases of the human cardiovascular system

3. Stroke:

rapid decline of brain function caused by the insufficient blood supply

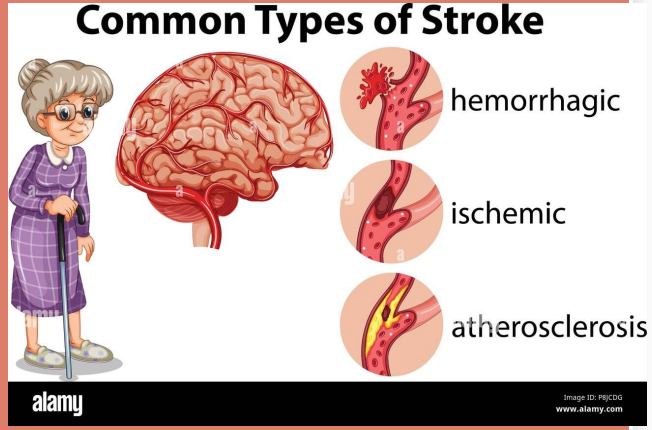
reason can be: thrombus, bleeding (haemorrhaging)

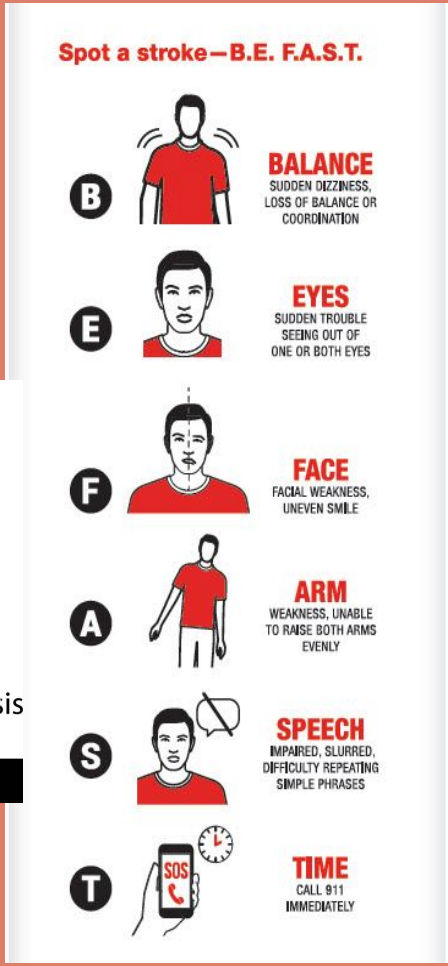
the result depends on the extent of the affected area:

vital and/or bigger area - death

smaller area - paralysis, problems with communication,

movement





Diseases of the human cardiovascular system

4. Hypertension = high blood pressure

endemic, leading cause of cardiovascular mortality

persistently high blood pressure in arteries 140/90 Hgmm

around 30% of population affected worldwide

causes: genetic factors, lifestyle: stress, smoking, drinking alcohol/coffee, fatty/salty diet, obesity

major risk factor of: heart failure, stroke, coronary artery disease, vision loss, chronic kidney disease

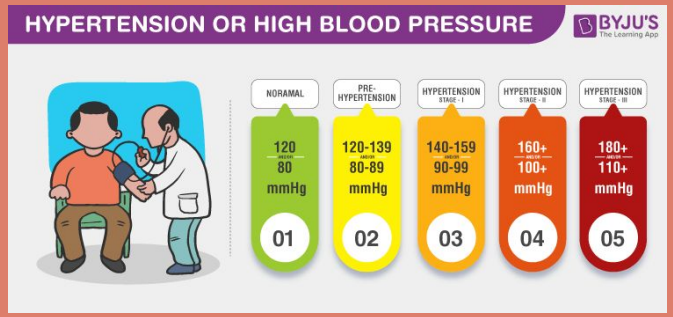
hypertension is often without symptoms - called the silent killer, so screening is needed

symptoms: headache, fatigue, dizziness, nose bleeding, blurred vision

treatment is important to avoid the damage of heart, kidneys, eyes, brain

solution: change in lifestyle: sport, diet

using pills



Diseases of the human cardiovascular system

5. Anemia

lowered ability of blood to carry O2

causes: iron deficiency, lack of vitamin B12, inappropriate hemoglobin and or red blood cell production

symptoms: fatigue, dizziness, pale skin, headache, shortness of breath, cold limbs

important to find the reason with blood tests

solution/treatment: complement of iron and B12 vitamin with pills and or dietary supplementation, consumption of : red meats, egg, green leafy vegetables (spinach, kale, broccoli), liver, nuts and seeds