



## Department of Anesthesia Techniques



### Title of the lab 2 **Cardiovascular system**

by

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# The cardiovascular system

- The cardiovascular system is a closed system of the heart and blood vessels
- the heart pumps blood into blood vessels
- blood vessels circulate the blood to all parts of the body, to ALL cells
- Functions: to deliver oxygen and nutrients to all body cells, transport enzymes and hormones, and to remove carbon dioxide and other waste products from the cells
- **The heart.** The heart is a hollow, muscular organ about the size of a fist. It is responsible for pumping blood through the blood vessels by repeated, rhythmic contractions
- **Structure of the heart:**
  1. The heart is composed of cardiac muscle, an involuntary muscle tissue that is found only within this organ

2. It has a four-chambered, double pump and is located in the thoracic cavity between the lungs. The cardiac muscle is self-exciting, meaning it has its own conduction system

3. Covering of the heart .

**Pericardium** The pericardium is the thick, membranous sac that surrounds the heart. It protects and lubricates the heart. There are two layers to the pericardium: the fibrous pericardium and the serous pericardium

4. Heart wall

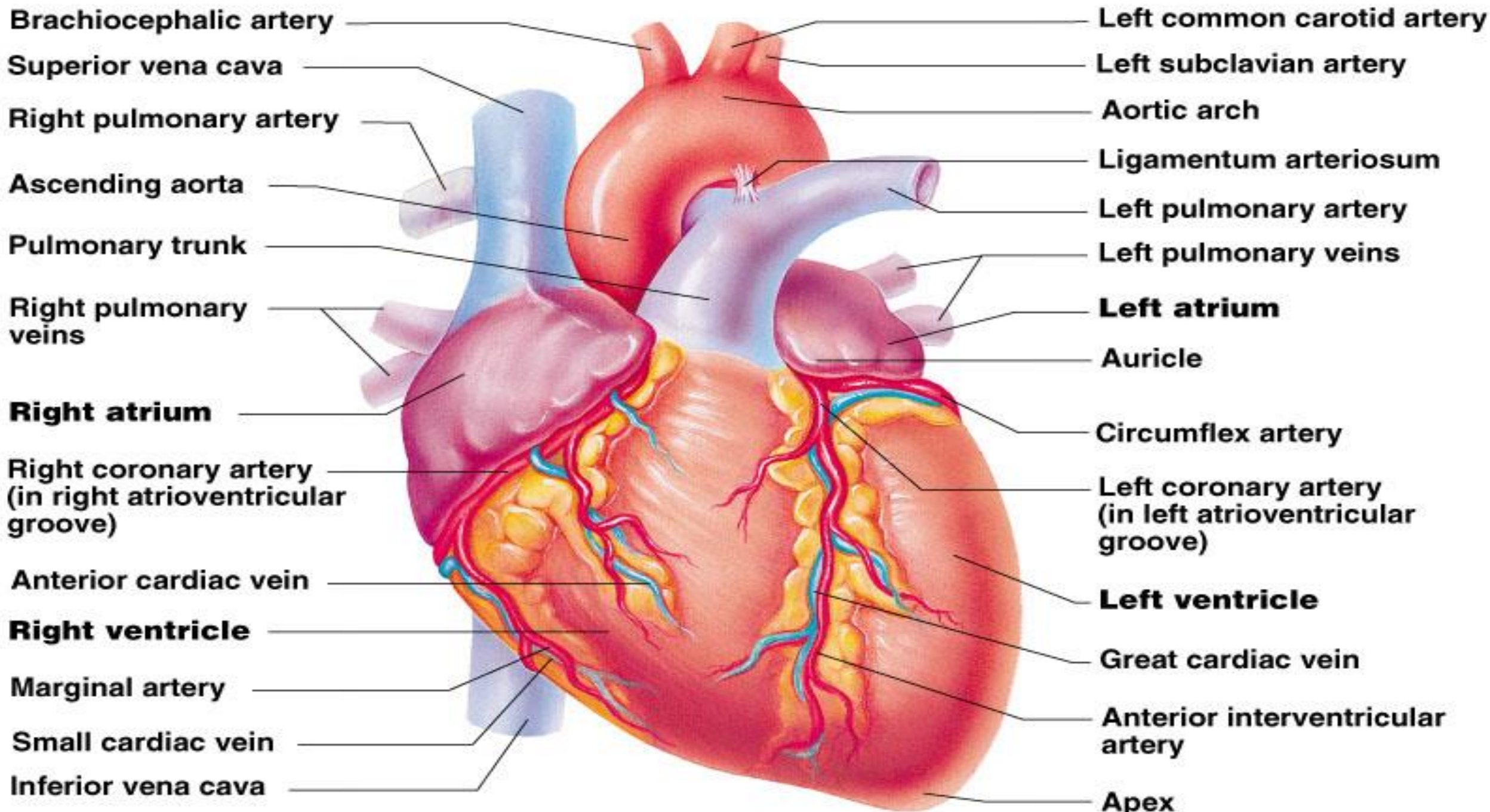
a) **epicardium** outside layer of connective tissue on surface of the heart

b) **myocardium** thick wall of cardiac muscle

c) **Endocardium** inner epithelial & connective tissue lining of heart and valves

5. Chamber of the heart atrium (R & L)—receive blood each atria extends into a smaller, external chamber called an auricle

ventricle (R & L)—inferior to the atria; expel blood out of the heart. The chambers on the left are separated from the chambers on the right by a septum (wall of cardiac muscle), interatrial septum, interventricular septum



**(a)**

6. Valves of the heart. atrioventricular (AV) valves – between each atrium and ventricle; allow blood flow from each atrium down into the ventricle bicuspid/mitral valve (left side), tricuspid valve (right side)

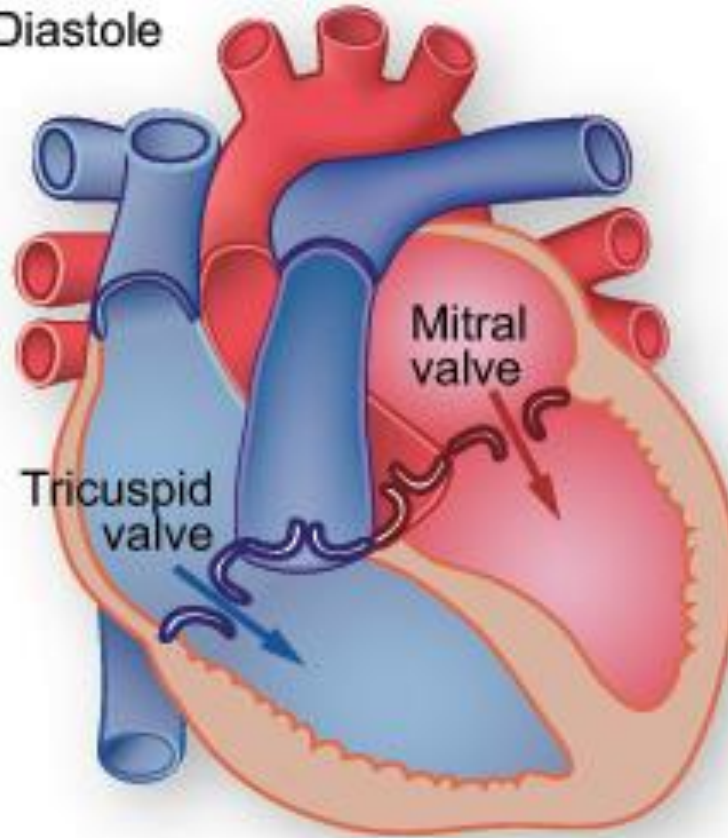
semilunar valves - between ventricle and major heart artery; allow blood flow out of each ventricle through one of the major heart arteries; pulmonary valve (R ventricle & pulmonary trunk) aortic valve (L ventricle & aorta).

#### ❖ Vascular system

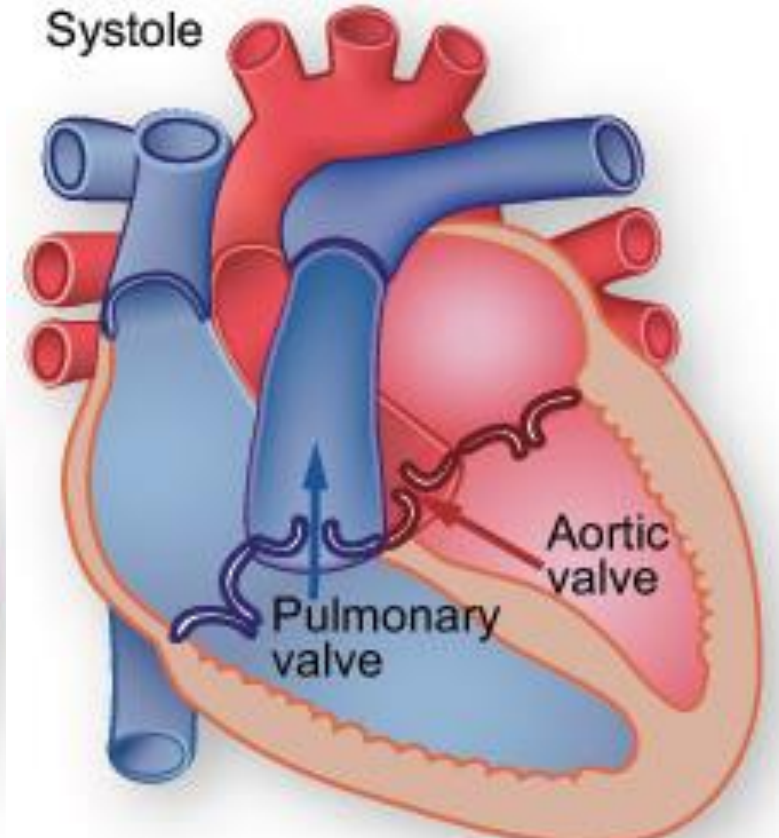
- aorta carries oxygenated blood from the left ventricle to upper & lower body
- pulmonary arteries : carries deoxygenated blood from right ventricle to lungs
- vena cava: carries deoxygenated blood from upper & lower body into right atria
- pulmonary veins: carry oxygenated blood from lungs into left atria

Valves pathology:  
an incompetent valve can lead to backflow, heard as a “heart murmur” and repumping (regurgitation) of the same blood  
stenosis = narrowing of valve  
increases workload on heart to pump out blood

Diastole



Systole



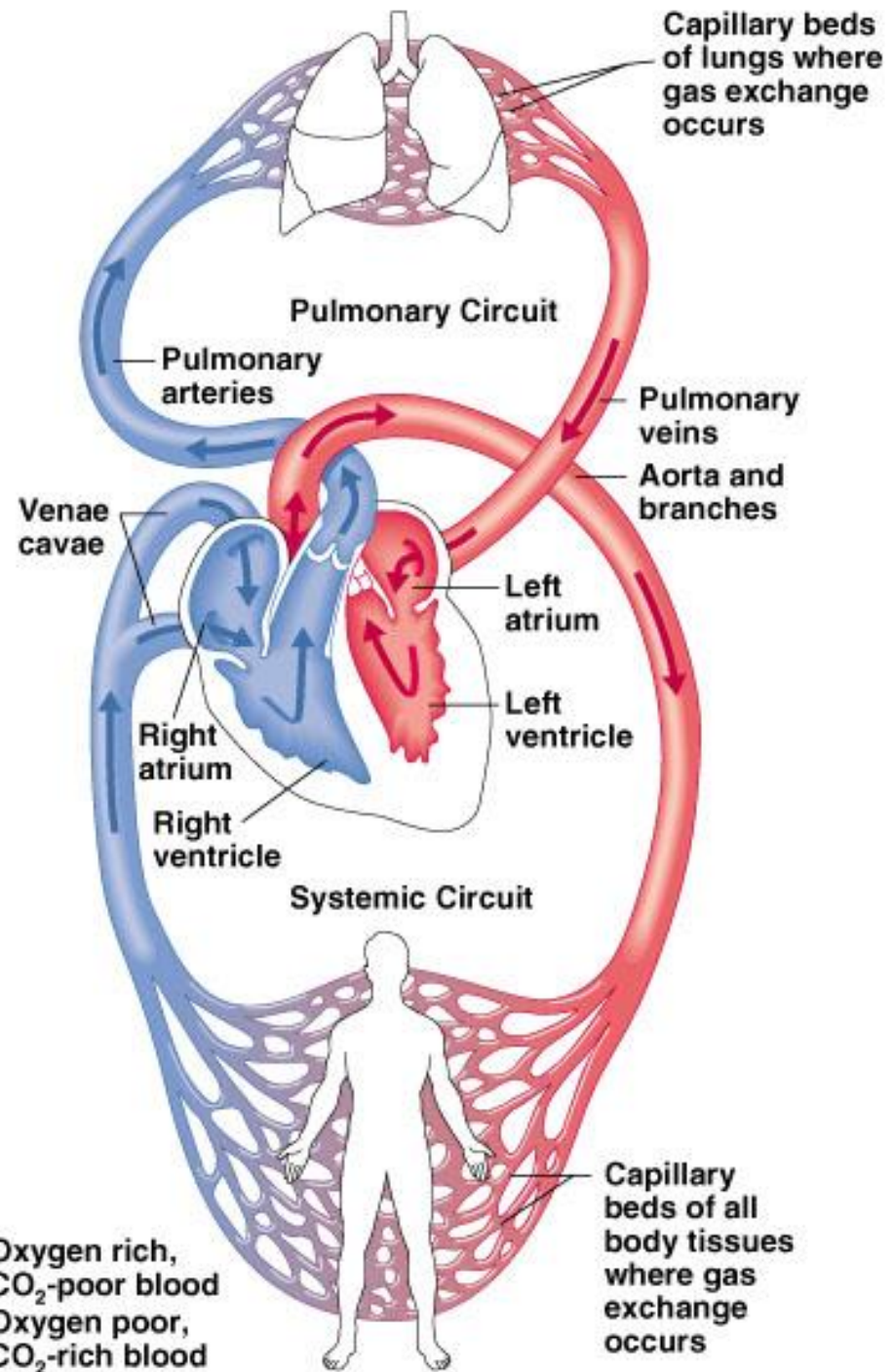
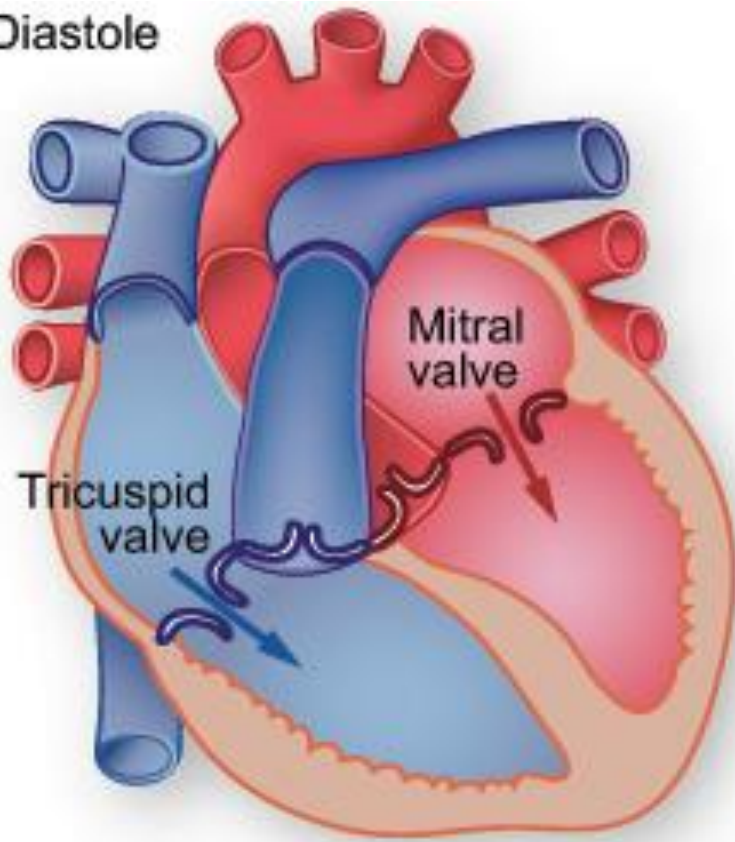
- The cardiovascular pathways:
- 1. The Pulmonary Circuit
- In the pulmonary circuit, blood is pumped to the lungs from the right ventricle of the heart.
- 2. the ventricle contracts and pumps blood into the aorta. Systemic arteries split from the aorta and direct blood into the capillaries. The veins drain the deoxygenated blood from the capillaries and return the blood to the right atrium.
- 3. coronary circuit The heart has its own network of blood vessels to supply the cardiac muscle cells
- coronary arteries & veins, capillaries

□ **the cardiac cycle:** 1. A cardiac cycle refers to the series of contractions & relaxations of the heart to produce a complete heartbeat

systole = contraction

diastole = relaxation

Diastole





# Events of the cardiac cycle

## ❖ Diastole

I. Atria and ventricles fill with blood

II. Atria contract (simultaneously) to complete the filling of ventricles; ventricles are relaxed

## ❖ Systole

III. Ventricles contract forcing blood up and out of the heart arteries; AV valves shut (“lup”)

IV. Backflow in the aorta & pulmonary arteries cause semilunar valves to shut (“dup”)

## ☐ Conduction system of the heart

- is an intrinsic, nodal conduction system that regulates heart wall contractions via electrical impulses
- Specialized muscle tissue regulates contractions by carrying nerve impulse

1. sinoatrial (SA) node = “pacemaker” (located in the wall of the right atrium)
2. atrioventricular (AV) node (in septum at the junction of the R & L atria)
3. atrioventricular bundle or Bundle of His (in the interventricular septum)
4. bundle branches (right and left)
5. Purkinje fibers (in the myocardium wall)

## □ **Physiological Properties of the Heart**

- 1) Automatic (autonomic) function = ability to work also after an isolation
- 2) Conductivity The special conductive system of the heart:
- 3) Excitability = ability to react to a stimulus
- 4) Contractility = ability of the myocardial fibres to contract
- 5) Rhythmicity = regular alternation of contraction and relaxation

**Superior vena cava**

**Sinoatrial node (pacemaker)**

**Atrioventricular node**

**Right atrium**

**Bundle branches**

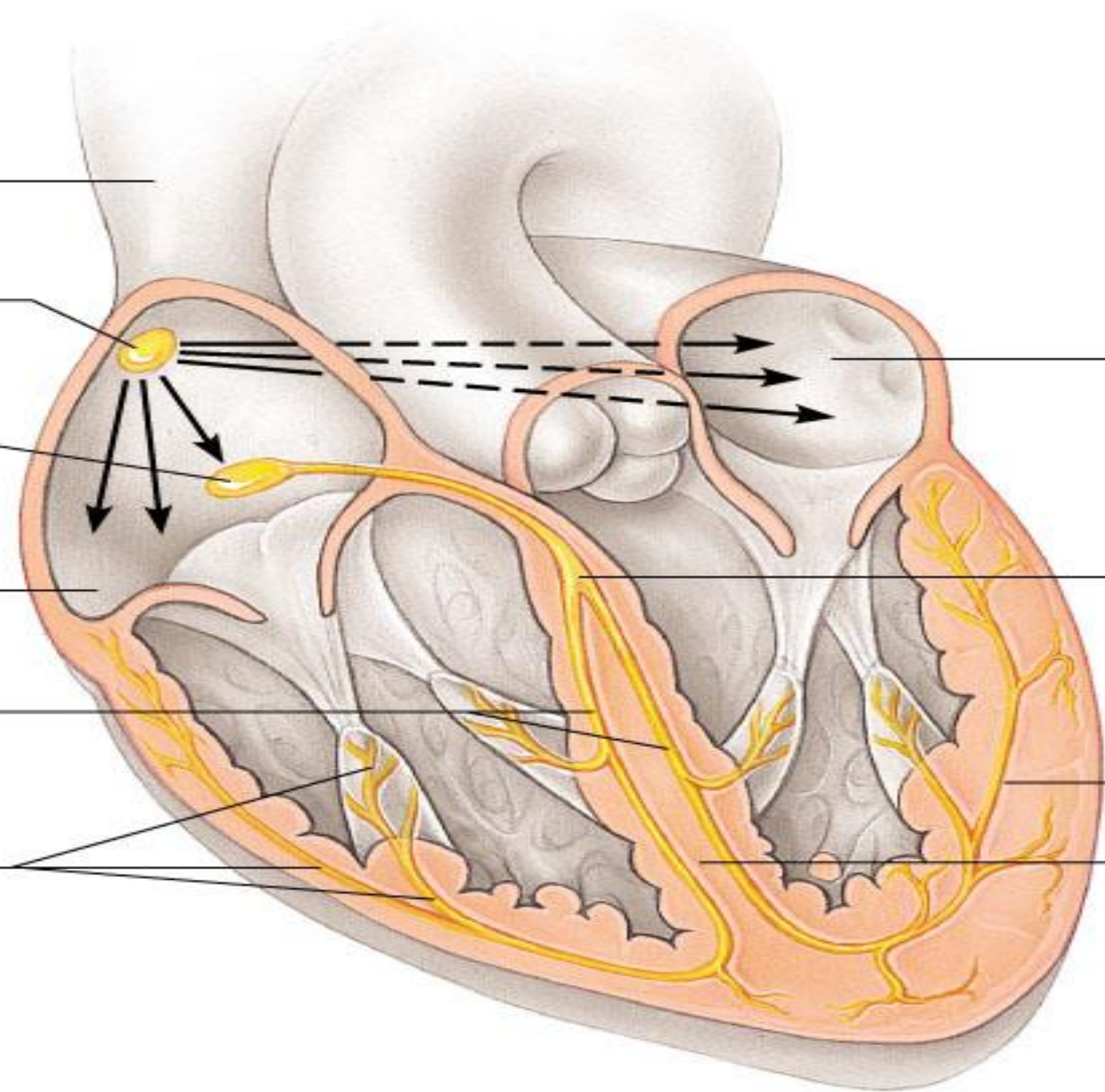
**Purkinje fibers**

**Left atrium**

**Atrioventricular bundle (Bundle of His)**

**Purkinje fibers**

**Interventricular septum**



Thank You

The text 'Thank You' is written in a highly decorative, cursive script. The letters are black with a gold outline. The 'T' is particularly large and features a long, sweeping tail that extends to the left. The 'Y' and 'o' have long, horizontal strokes underneath them. The text is embellished with clusters of gold stars and dots at the beginning and end.

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