Cardiovascular system

1. Maintenance of metabolism of metabolism and constancy of internal environment
2. Carrying of nutrients, oxygen, biologically active substances with blood to the tissues and cells
3. Removing of waste substances

Functions

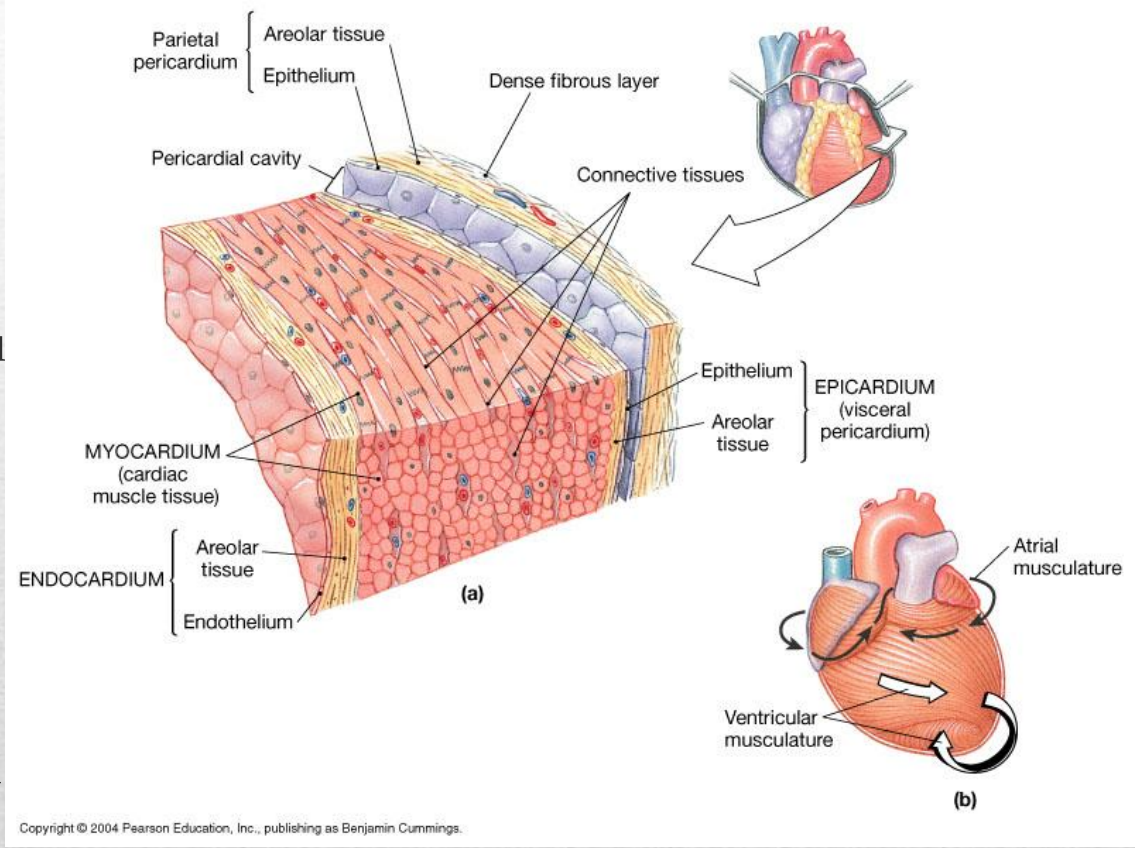
The heart

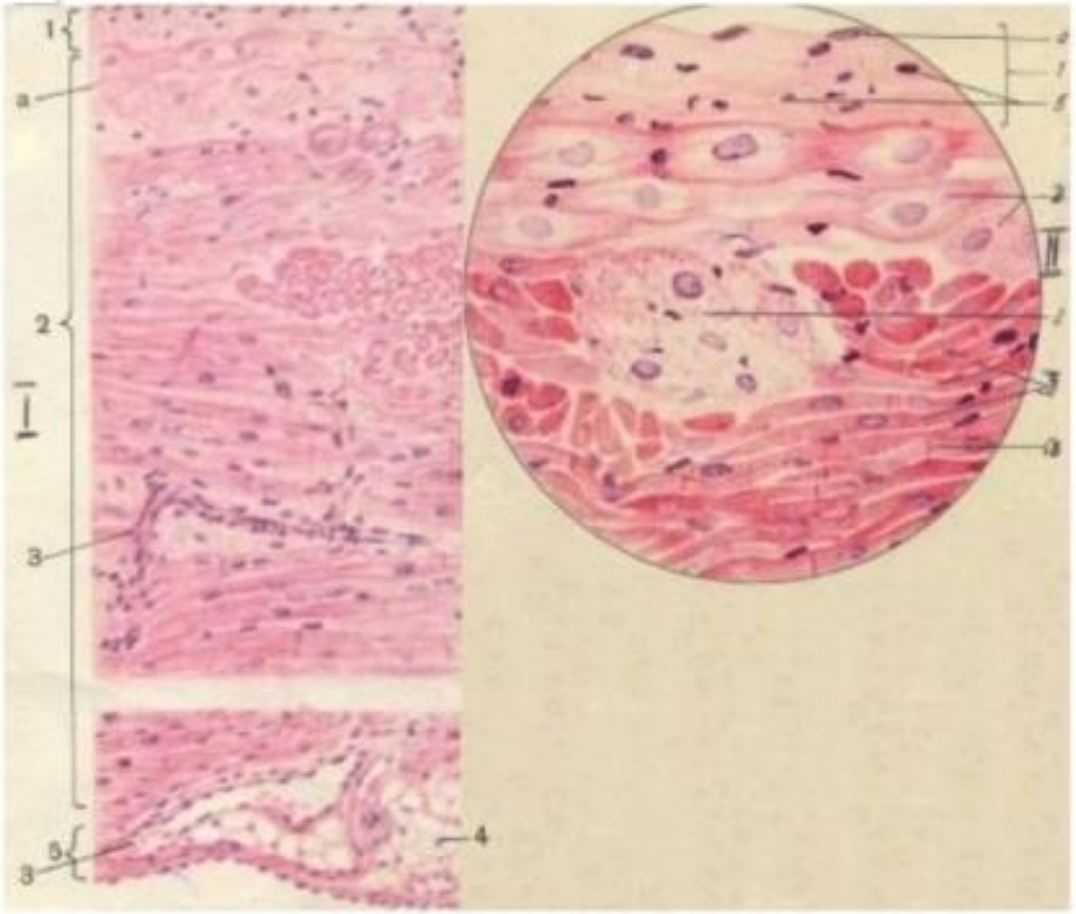
Structure:

- Endocardium:
- Endothelium on the basal lamina
- Subendothelium-LCT
- Musculo-elastic layer-smooth muscle cells+elastic fibers
- External layer of connective tissu

- Myocardium:
- Typical (contractive)
- Atypical (conductive)

- Epicardium – LCT+mesothelium





Стенка сердца
Окраска Г+Э. Endo-myocardium
I Малое увеличение_1 – ендокард (endocardium) 2- миокард (myocardium)
а - атипические кардиомиоциты (волокна Пуркинье, Purkinje fibers)
б - сократительные кардиомиоциты (contracting muscle cell)
3 - кровеносные сосуды (vessels)
4 - соединительная ткань (connective tissue)
5 - эпикард
II Большое увеличение
1 – ендокард (endocardium)

а – эндотелий (endothelium)
б-подэндотельный и мышечно-эластический слой (subendothelial musculo-elastic layers) 2 - атипичные кардиомиоциты (волокна Пуркинье, Purkinje fibers) 3 - типичные (сократительные, contracting muscle cell) кардиомиоциты а - вставочные дольки

Types of arteries

- Muscular
- Mixed
- Elastic

Elastic arteries
(aorta, pulmonary arteries)

- High blood pressure, high speed

Structure:

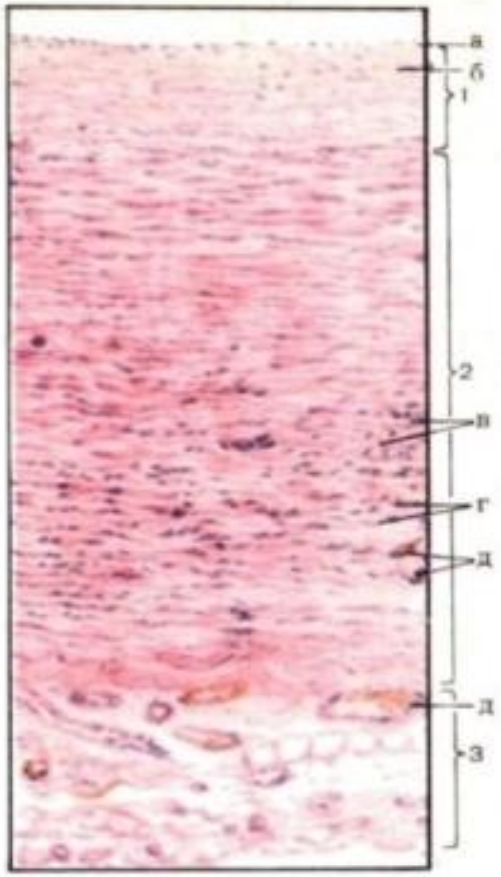
1.Tunica interna (intima)

- Endothelium
- Subendothelium
- Internal elastic membrane

2. Tunica media

- Elastic membranes together with smooth muscle cells

3. Tunica externa (adventitia) -LCT



Артерия эластического типа. Аорта. Окраска Г+Э. х80

1 – внутренняя оболочка, а - эндотелий, б - подэндотелиальный слой,
2 - средняя оболочка, в-окончатые эластические мембраны, г - гладкие миоциты, д- сосуды сосудов,
3 - наружная оболочка

Aorta. HE. HM.

1-tunica intima
a- endothelium
б- subendothelial layer

2- tunica media
в -elastic fenestrated lamellae
г- smooth muscle cells

д- vasa vasorum

3- tunica externa

Elastic arteries

Structure:

1.Tunica interna (intima)

- Endothelium
- Subendothelium
- Internal elastic membrane

2. Tunica media

- Elastic membranes together with smooth muscle cells
- External elastic membrane

3. Tunica externa (adventitia) -LCT

Mixed arteries
(carotid artery, subclavian artery)

Structure:

1.Tunica interna (intima)

- Endothelium
- Subendothelium
- Internal elastic membrane

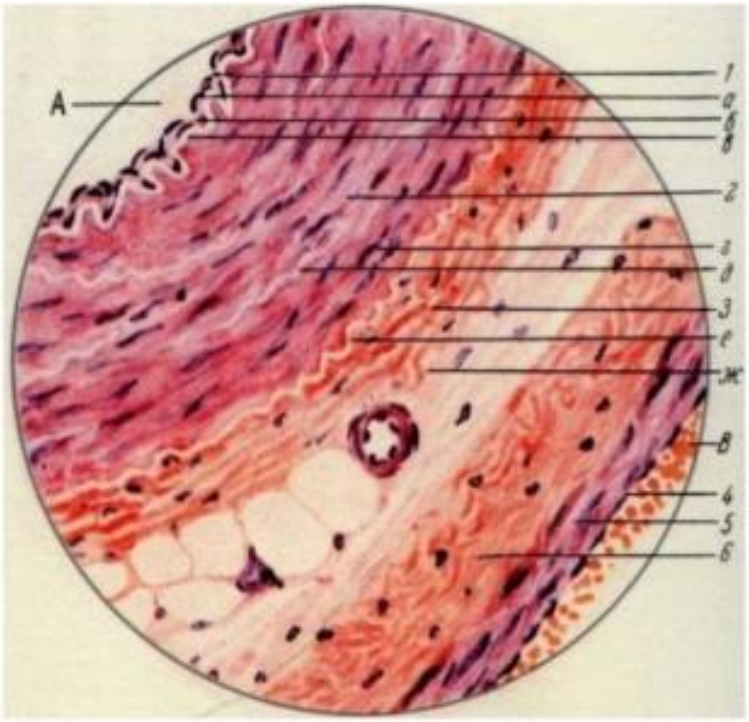
2. Tunica media

- Smooth muscle tissue
- External elastic membrane

3. Tunica externa (adventitia) -LCT

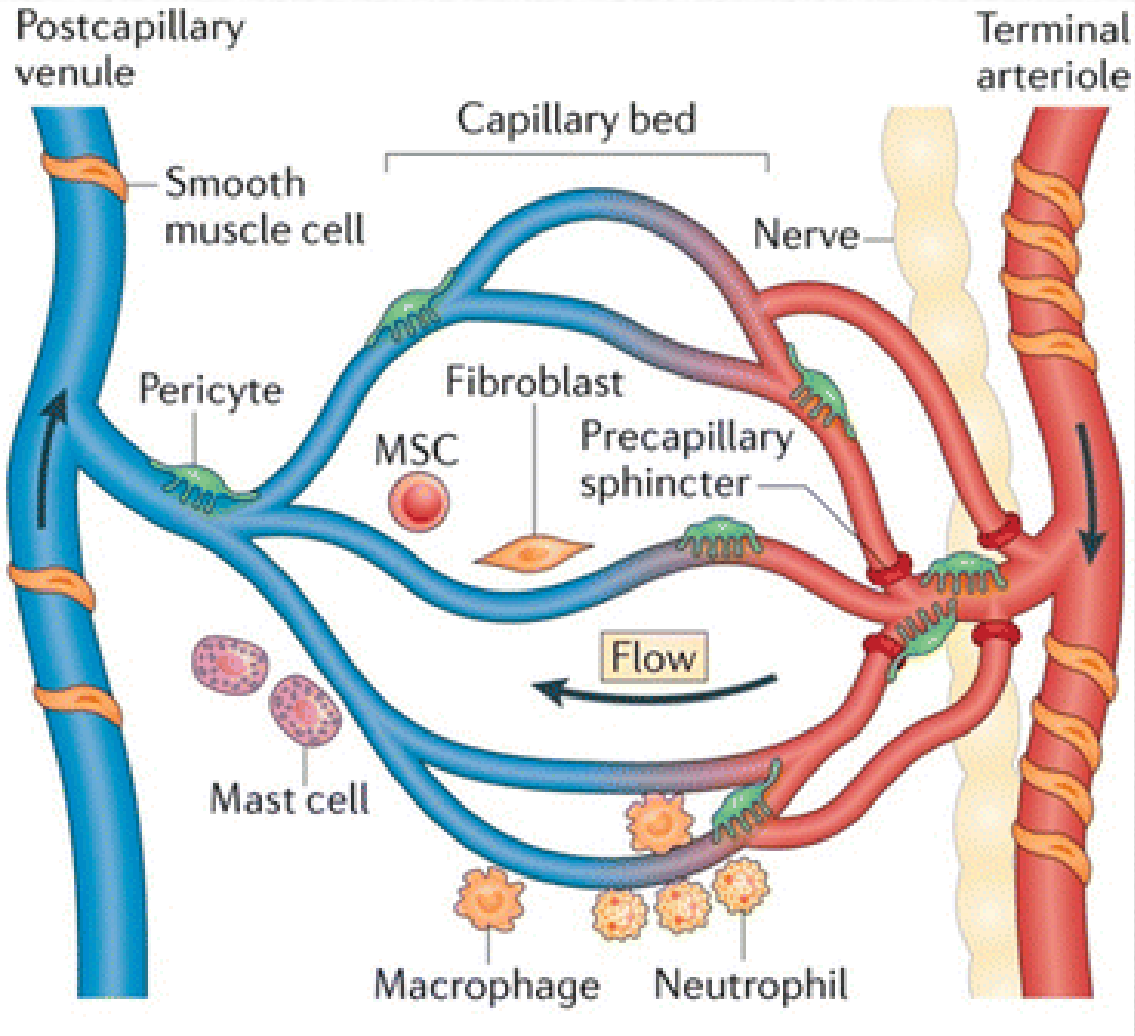
Muscular arteries
(inner organs and extremeties)

А-артерия (muscular arterie)
1-внутренняя оболочка (tunica interna)
а-эндотелий (endothelium); б-подэндотелиальный слой (subendothelium layer); в-внутренняя эластическая мембрана (internal elastic membrane)
2-средняя оболочка (tunica media)
г-гладкие мышечные клетки (smooth muscle cells) ; д-эластиновые волокна (elastic fiber);
3-наружная оболочка (tunica externa); е-наружная эластическая мембрана (ternal elastic membrane) ; ж-волокнистая соединительная ткань (l.conective tissue)
В-вена (muscular vien)
4-внутренняя оболочка(tunica interna)
5- средняя оболочка (tunica media)
6-наружная оболочка (tunica externa)



Microvascular bed

- Arterioles
- Capillary network
- Postcapillary venules



Arterioles

Structure:

1.Tunica interna (intima)

- Endothelium
- Subendothelium
- Internal elastic membrane

2. Tunica media

- 1-2 layers of smooth muscle tissue

3. Tunica externa (adventitia) -LCT

Capillaries

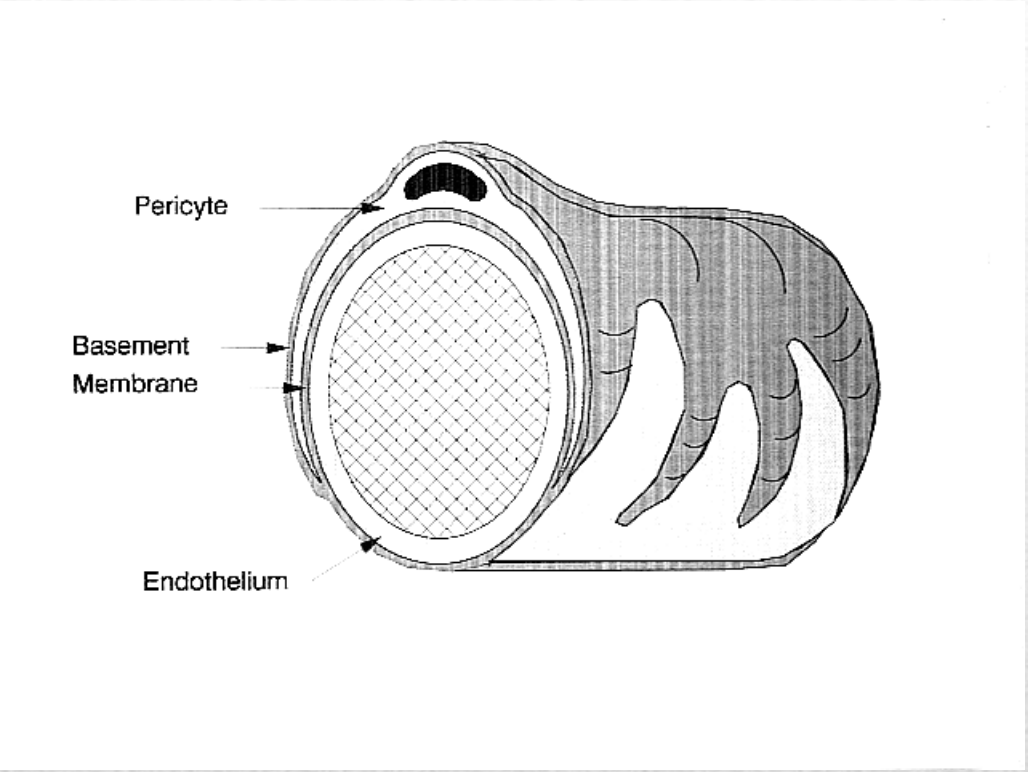
Functions:

- Exchanges of gases, metabolites, waste products between blood and tissues
- Formation of histohematogenous barriers
- Microcirculation

Capillaries

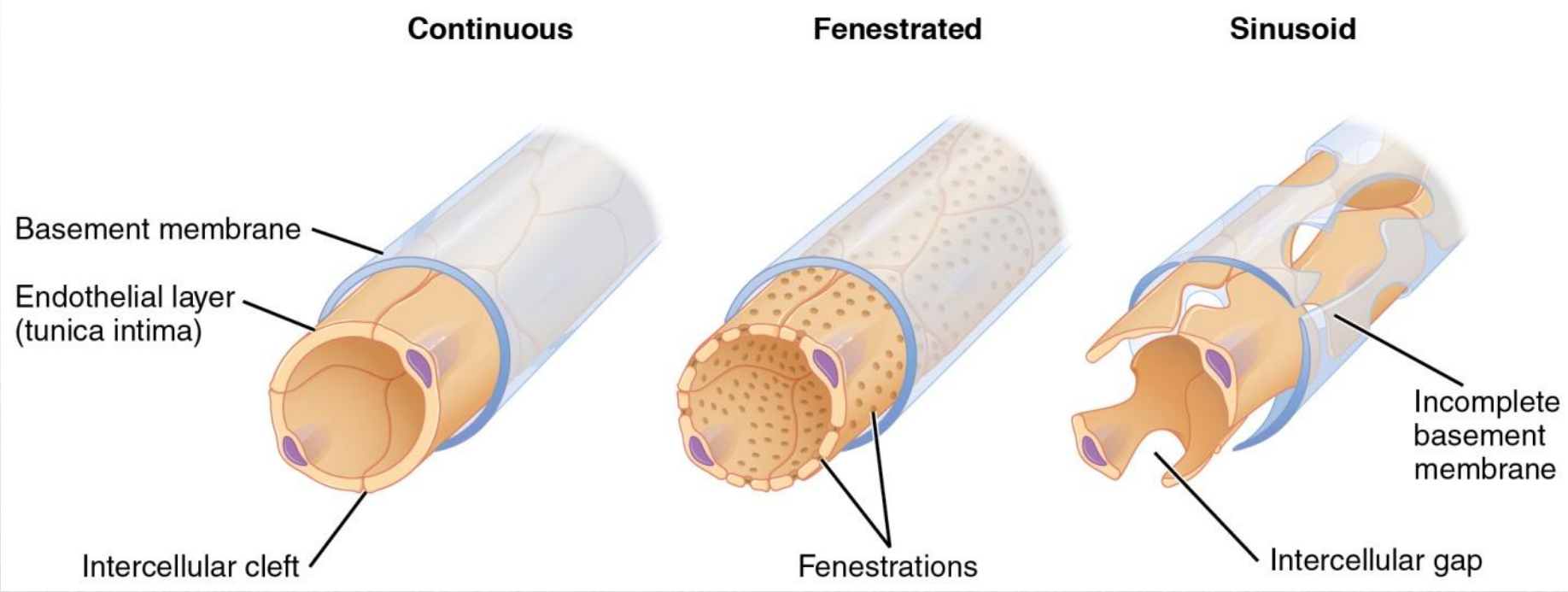
Layers:

- Internal- endothelial cell
- Middle- pericytes
- External-adventitial cell



Cappilaries

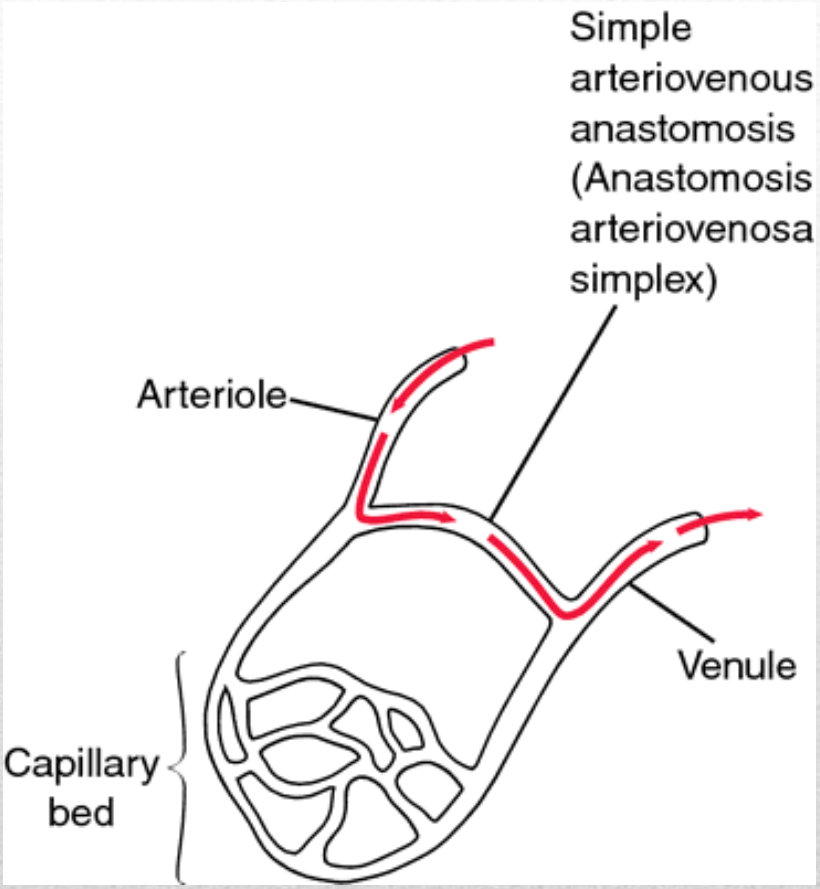
- Types:
- Somatic (continuous endothelial layer)- muscle, skin, CNS.
- Visceral type (fenestrated capillaries)- gallbladder, kidney, intestinal tract.
- Sinusoidal capillaries (discontinuous capillaries)-liver, red bine marrow, spleen.



Cappilaries

Arterio-venous anastomoses

Connection between two blood vessels (arteriole and venule) to bypass cappilaries



Arterio-venous anastomoses

Types:

1. True (shunts)

- Simple AVA-the regulation of blood flowing is provided by smooth muscle cells of the middle layer of arteriole.
- AVA with special contractile elements – muscular pads in the subendothelial layer

1. Atypical (semi-shunts)-connection between arteriole and venule through short capillary type vessel

Venules

Types:

- Postcapillary
- Colligens
- Muscular

Veins

Classification:

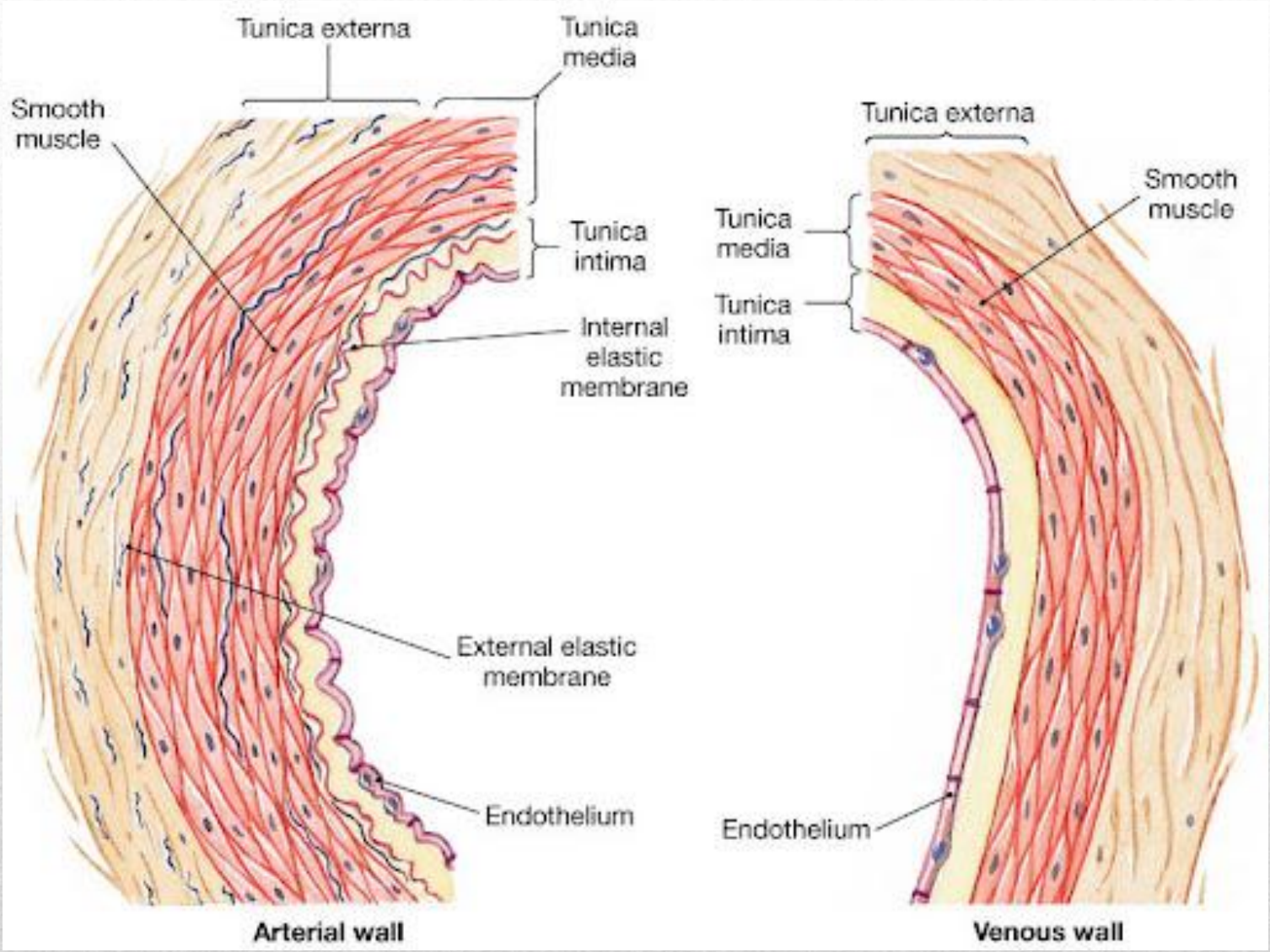
1. **Amascular** (*veins of retina, spleen, bones, placenta)*

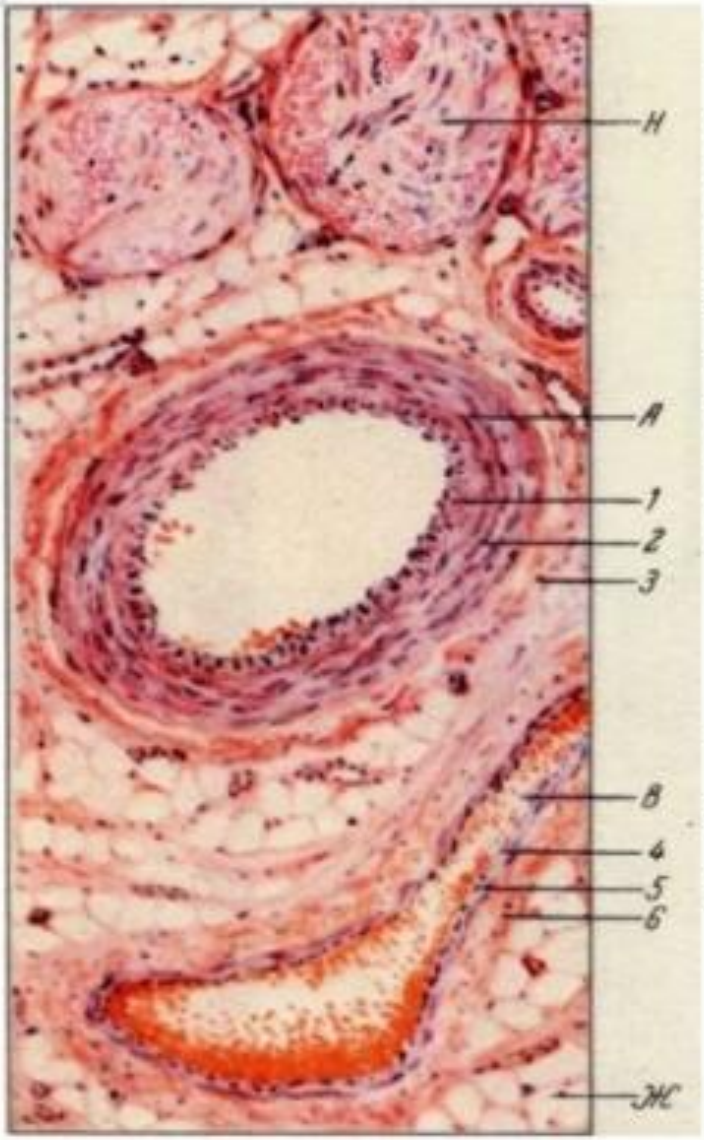
2. **Muscular**

- **Veins with low development of tunica** *media (v. cava superior)*-connected with hemodynamic conditions and blood flows under the force of gravity
- **Veins with medium development of tunica media** *(v. brachialis)* have valves
- **Veins with high development of tunica *media*** *(veins of lower part of the body and lower limbs)*

1. The wall of the vein is thinner than in the accomponying artery
2. In veins collagen fibers prevail over elastic ones
3. External elastic membrane is absent, internal elastic membrane underdeveloped
4. On the cross section the lumen of the vein is irregular in shape, when the lumen of artery is round
5. In veins tunica externa is the thickest one, in arteries- tunica media
6. In some veins the valves are present

Differences between arteries and veins


Tunica externa
Tunica media
Smooth muscle
Tunica intima
Internal elastic membrane
External elastic membrane
Endothelium
Arterial wall
Tunica externa
Smooth muscle
Tunica media
Tunica intima
Endothelium
Venous wall



Сосудисто-нервный пучок. Окраска гематоксилин-эозином.
А-артерия мышечного типа
1-внутренняя оболочка
2-средняя оболочка
3—наружная оболочка
В-вена мышечного типа
4-внутренняя оболочка
5-средняя оболочка
6-наружная оболочка
Н-мякотный нерв
Ж-жировые клетки

А- muscular arterie, B-muscular vien

1,4-tunica interna

2,5-tunica media

3,6-tunica externa