SISTEM KARDIOVASKULAR

DENNY AGUSTININGSIH

Tekanan Darah

- PARAMETER YANG MUDAH DIAMATI
- TERMASUK SALAH SATU TANDA VITAL

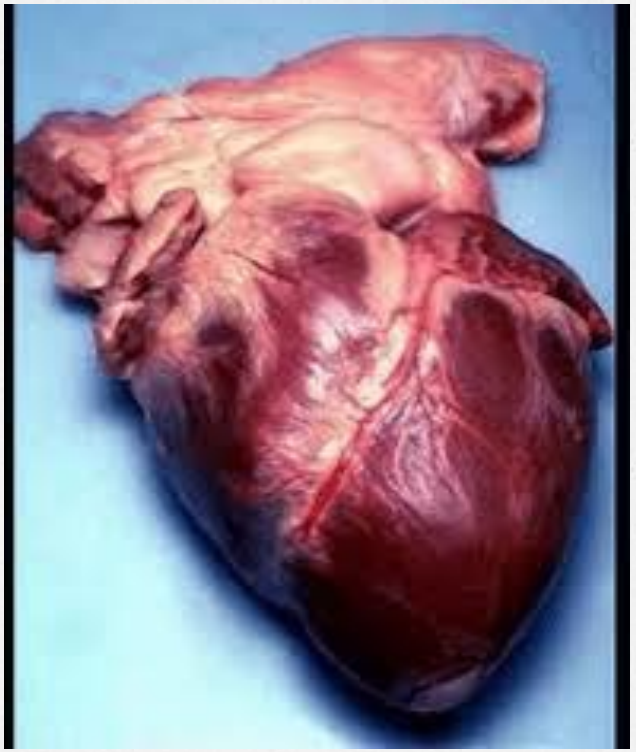
APA YANG DIMAKSUD DENGAN TEKANAN DARAH?

Desakan darah terhadap dinding pembuluh darah akibat pompa jantung

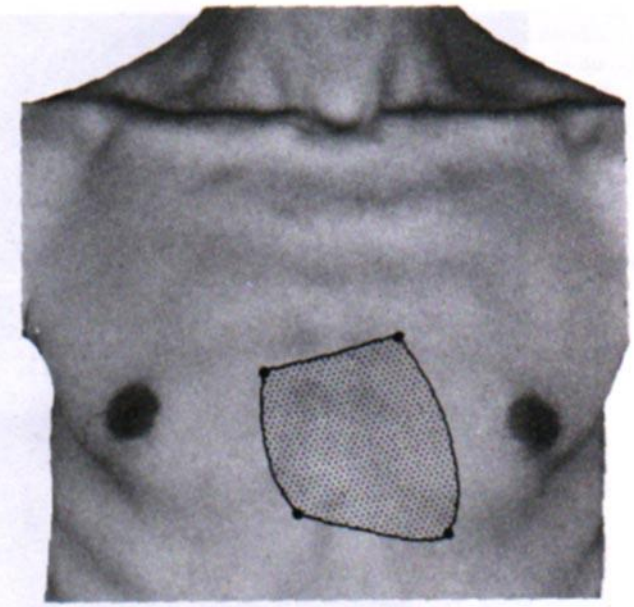
FAKTOR-FAKTOR YG MEMPENGARUHI TEKANAN DARAH

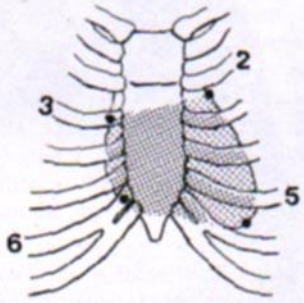
1. POMPA JANTUNG
2. KONDISI PEMBULUH DARAH ARTERI
   - diameter
   - kelenturan dinding
3. DARAH (cairan intravaskular)
   - Volume
   - viskositas

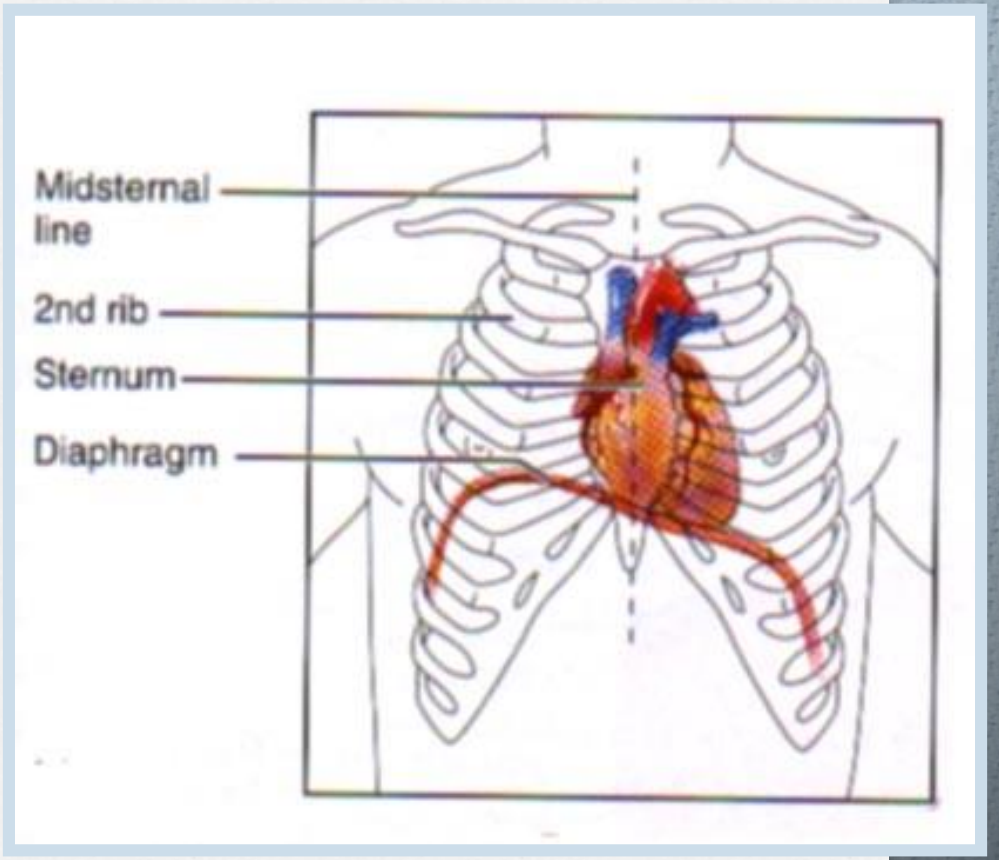
JANTUNG



Location of Heart in Thorax







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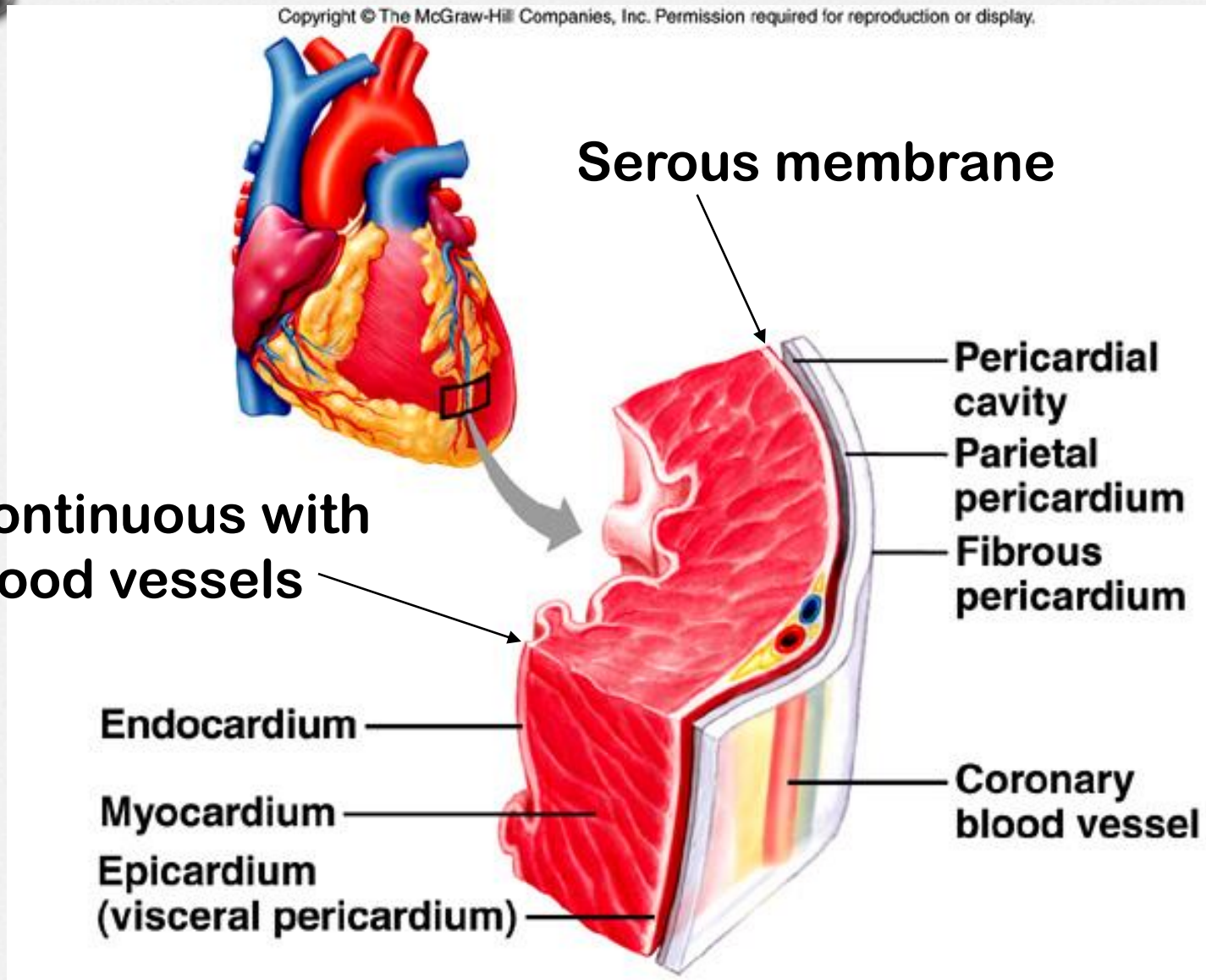
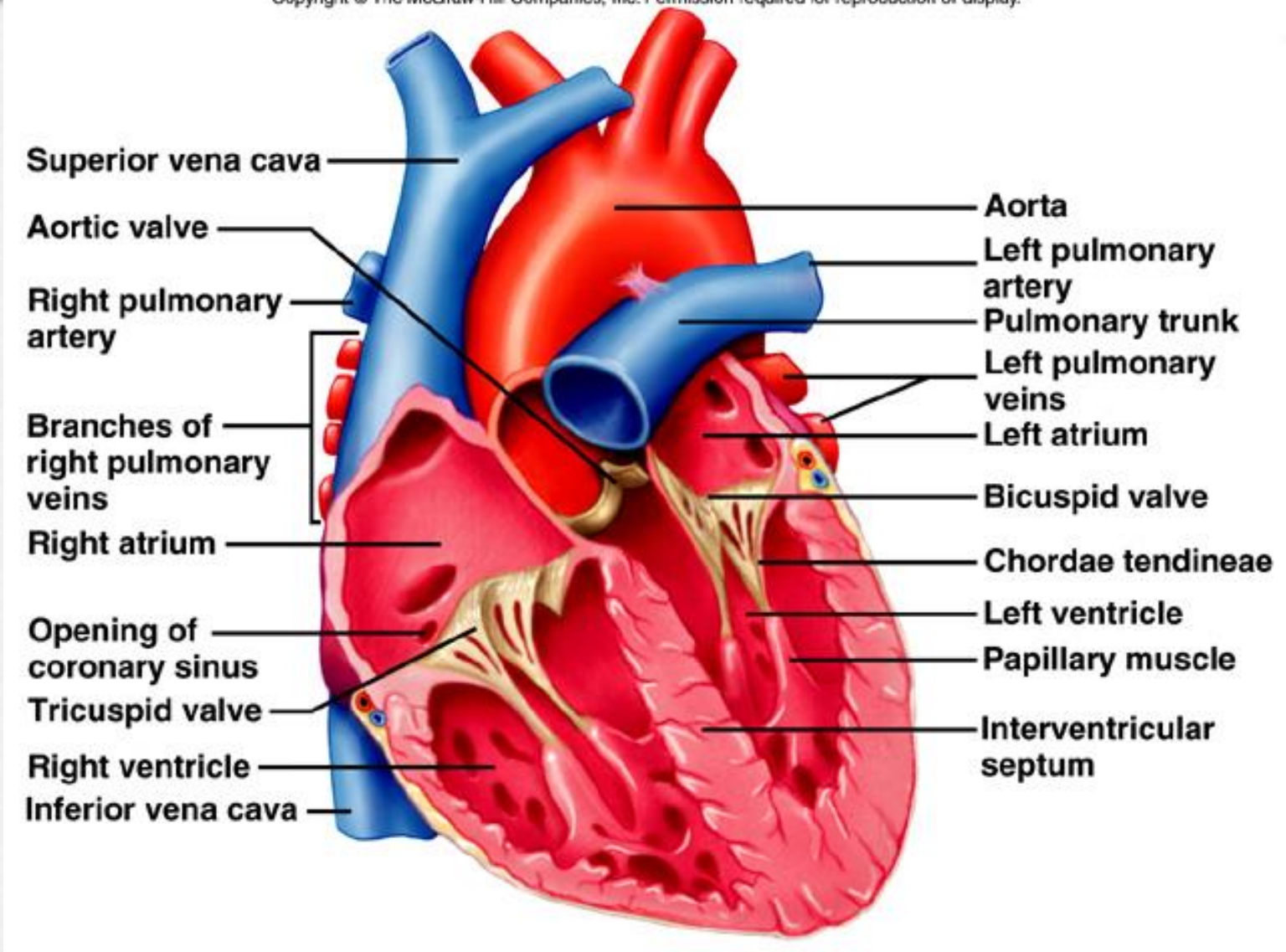
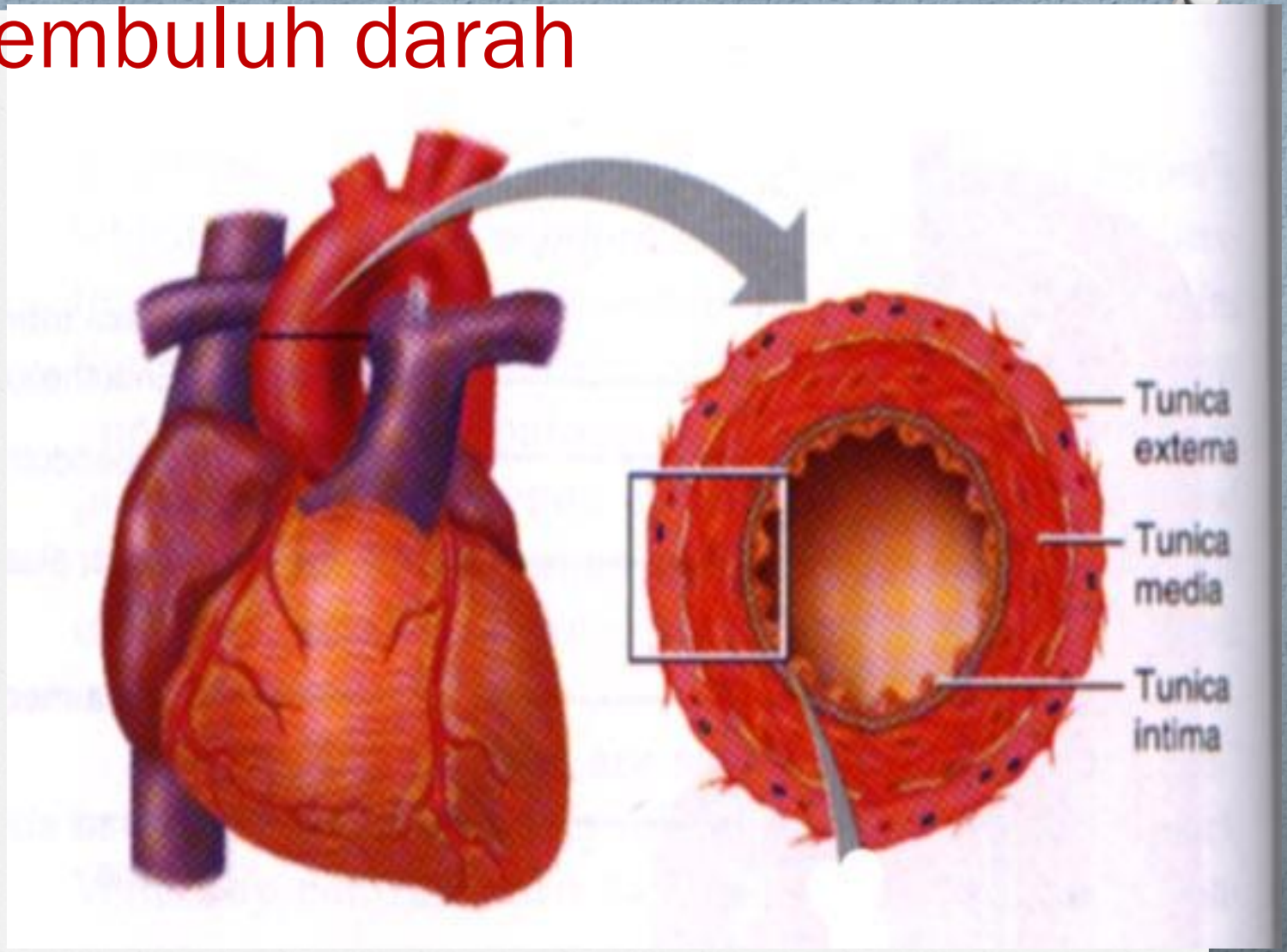
Lapisan-lapisan jantung



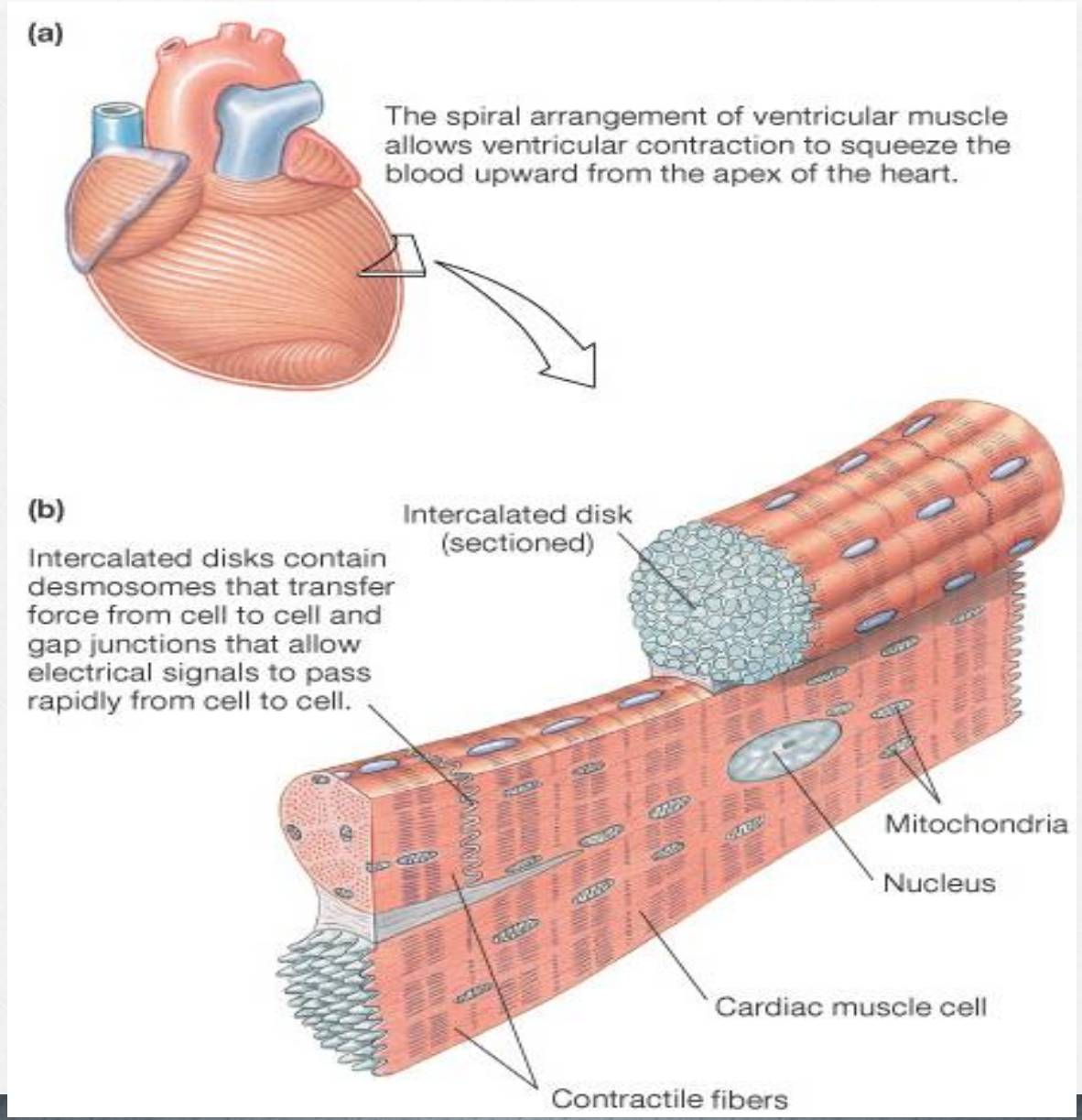
Chambers of the heart; valves



Pembuluh darah



Otot jantung



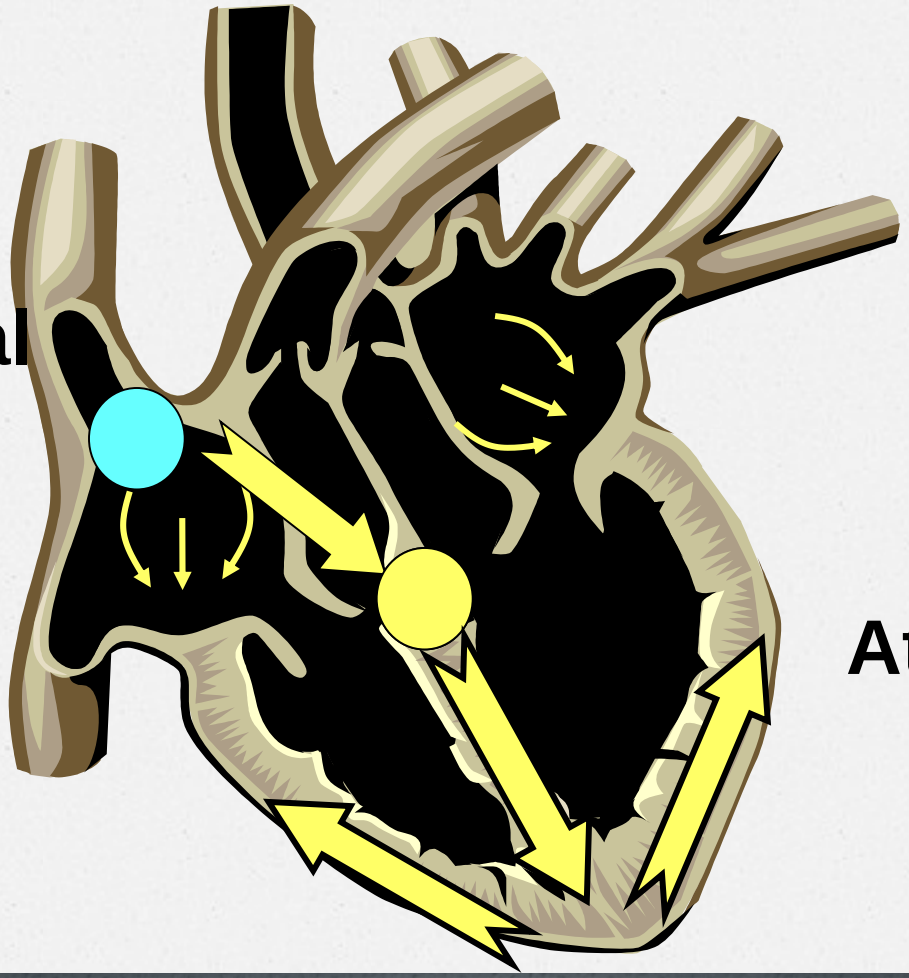
BAGAIMANA JANTUNG DAPAT MEMOMPA DARAH ?

1. **Faktor kelistrikan**
2. **Faktor Mekanik**

DUA JENIS SEL OTOT JANTUNG

- SEL KONTRAKTIL: 95%- 99%
  - Untuk kekuatan memompa darah
  - Tidak mudah lelah
- SEL AUTORITMIK/AUTOMATIK: 1%-5%
  - Bertanggung jawab untuk memulai dan/atau menjalarkan impuls listrik
  - pacemaker potential
  - Menentukan frekuensi dan irama denyut jantung

SISTEM KONDUKSI OTOT JANTUNG



Sinoatrial Node

Atrioventricular Node

Purkinje fiber

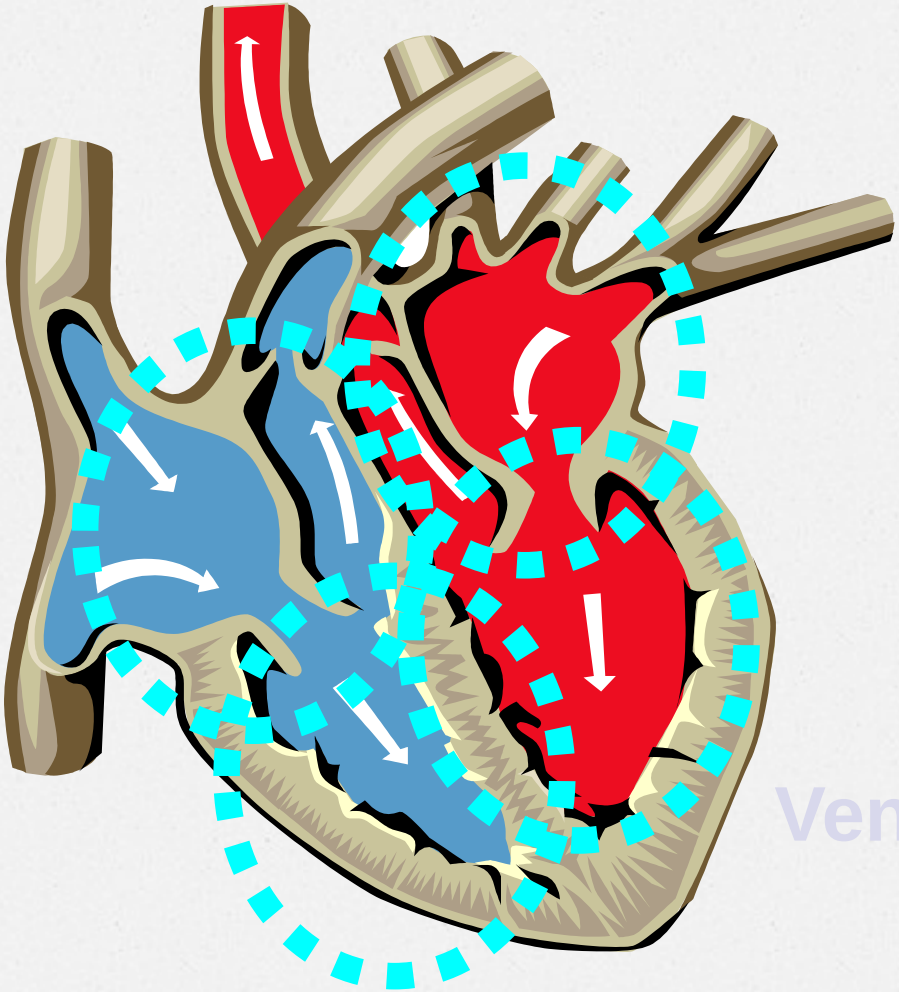
Kelistrikan jantung menentukan

1. Frekuensi denyut jantung
2. Irama denyut jantung
3. Terjadinya kontraksi otot jantung

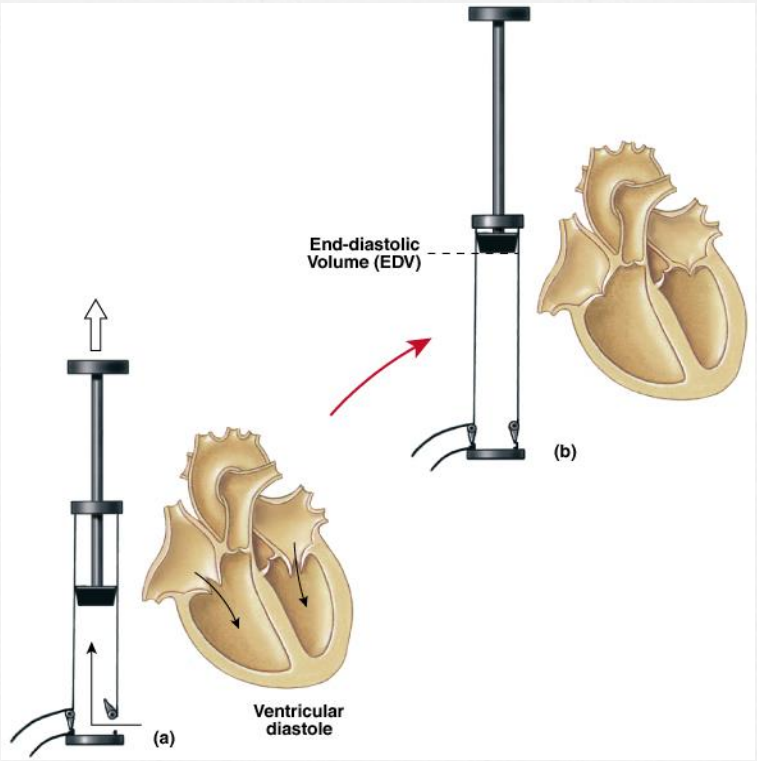
FAKTOR-FAKTOR YG MEMPENGARUHI FREKUENSI DENYUT JANTUNG

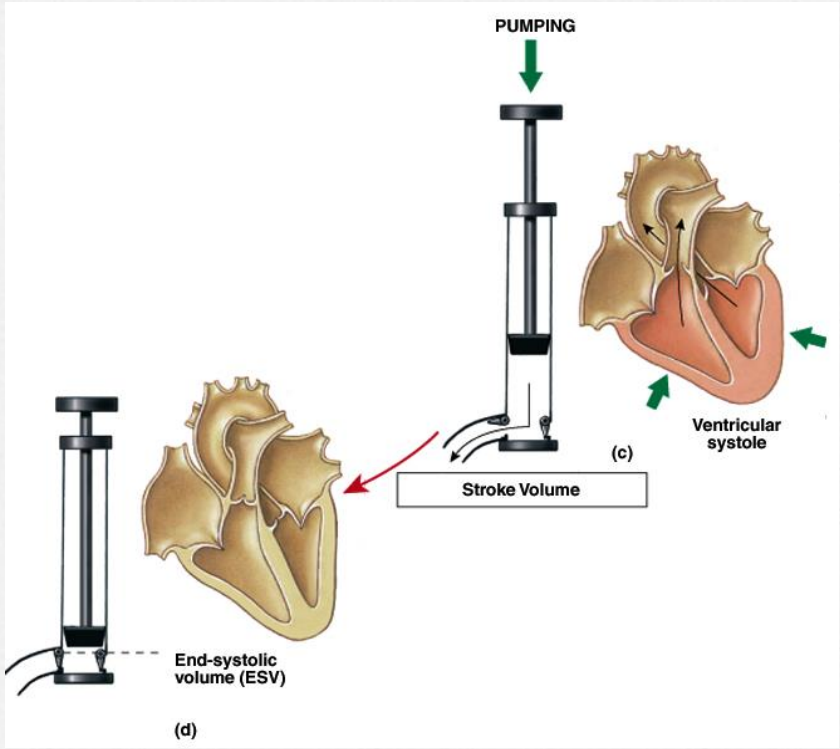
1. saraf simpatis dan parasimpatis
2. Hormon adrenalin, asetilkolin, tiroid, estrogen, testosteron
3. Ion Na, Ca, K
4. Suhu badan

TWO SEPARATE PUMPS

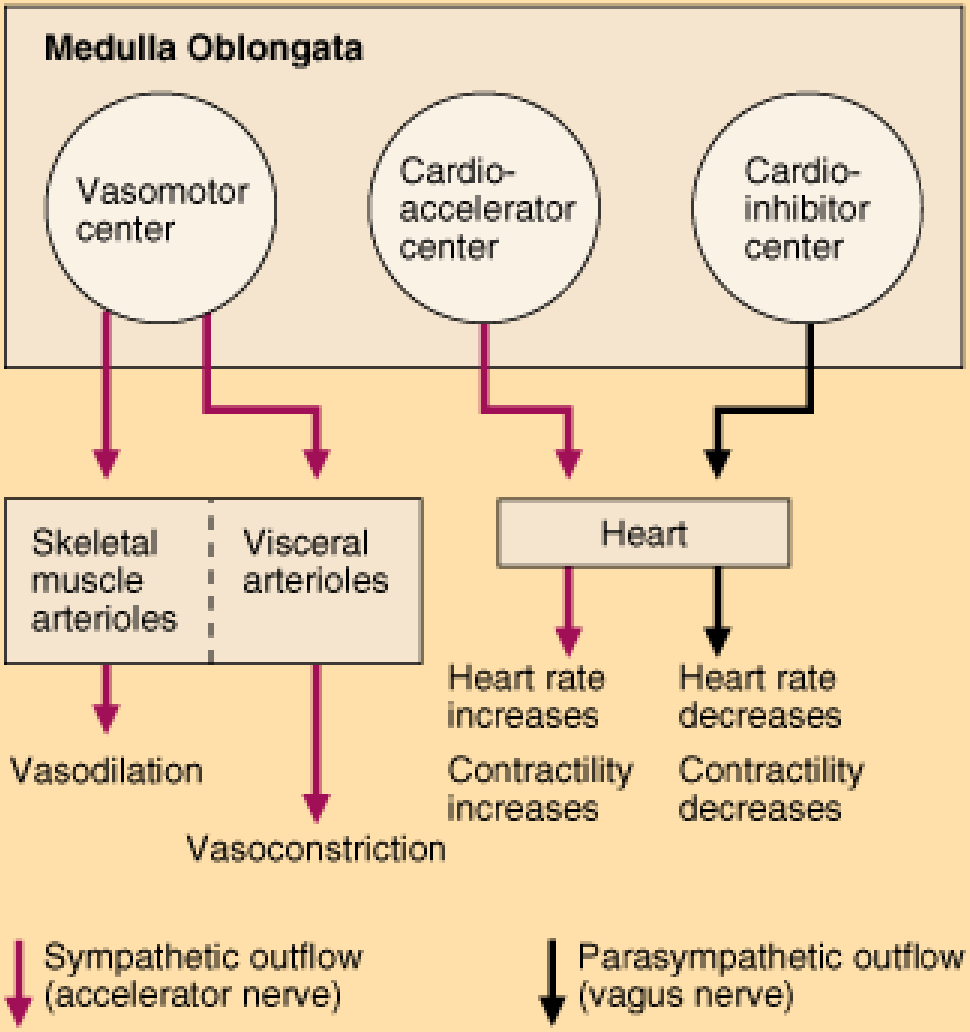


POMPA JANTUNG



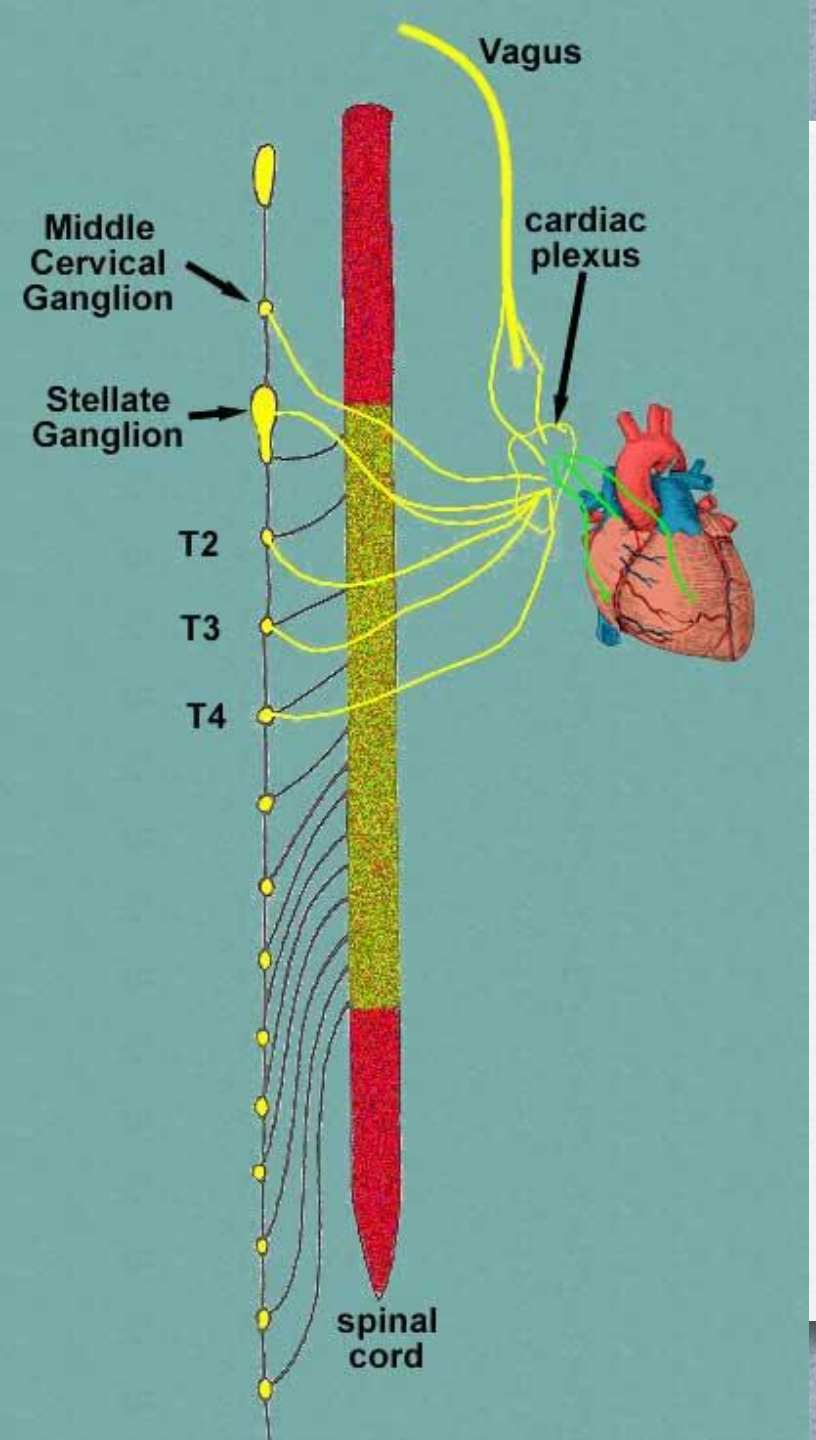


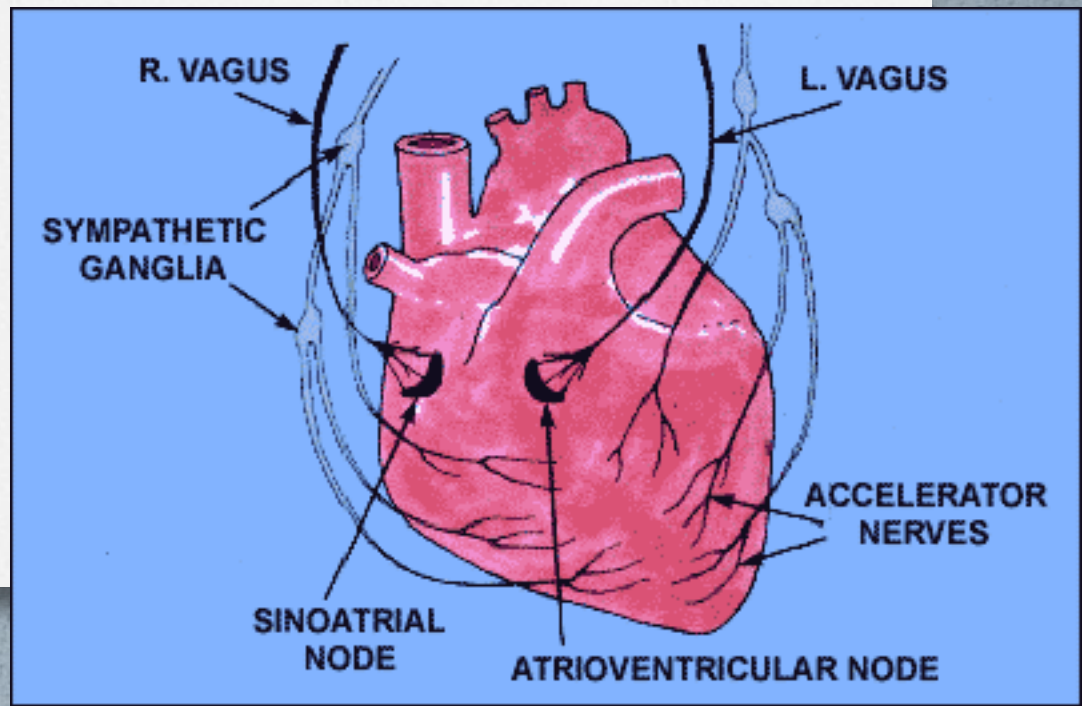
▶ Neural Control of Cardiovascular Function



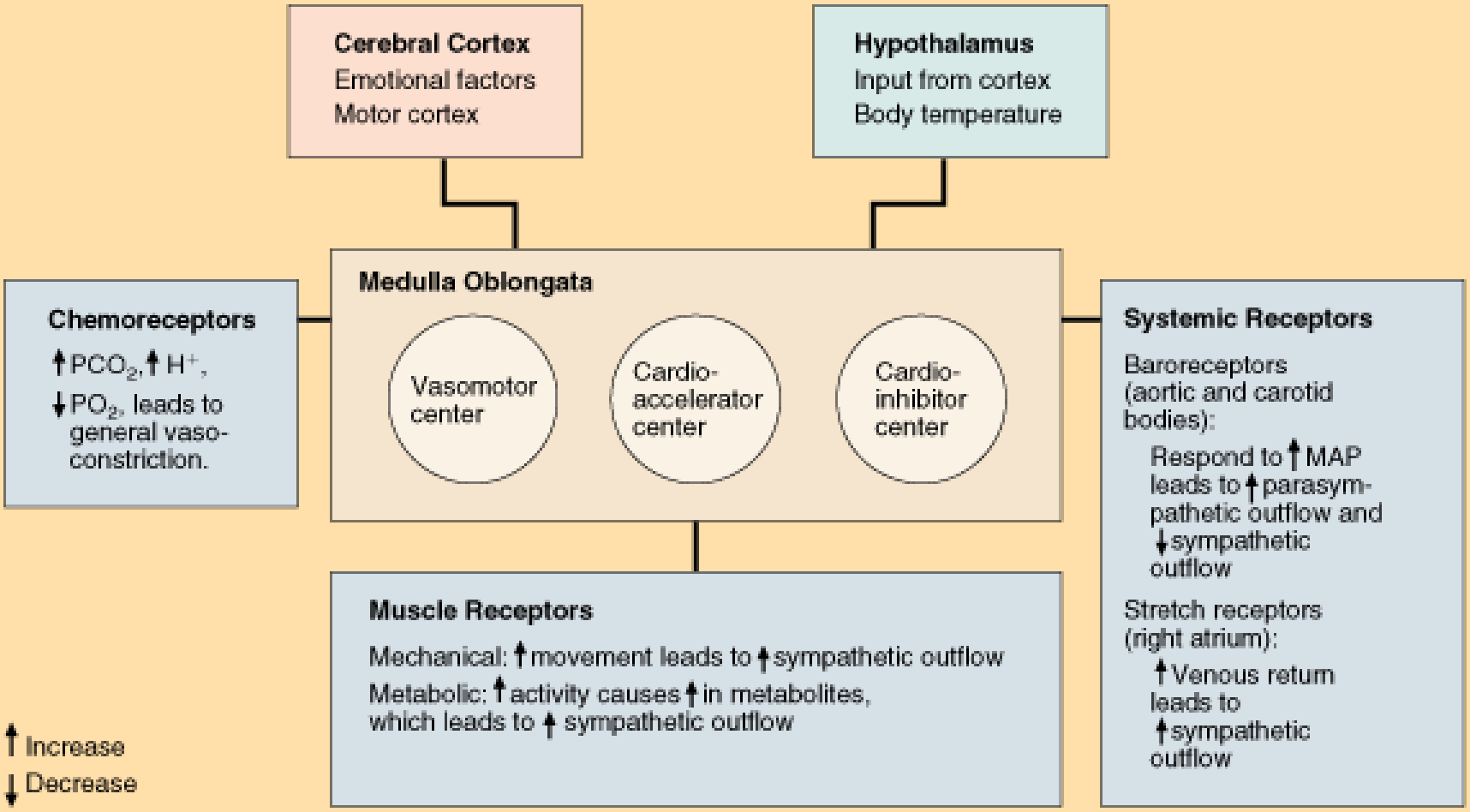
Heart Innervation

- Heart receives visceral motor innervation
  - Sympathetic (speeds up)
  - Parasympathetic (slows down)



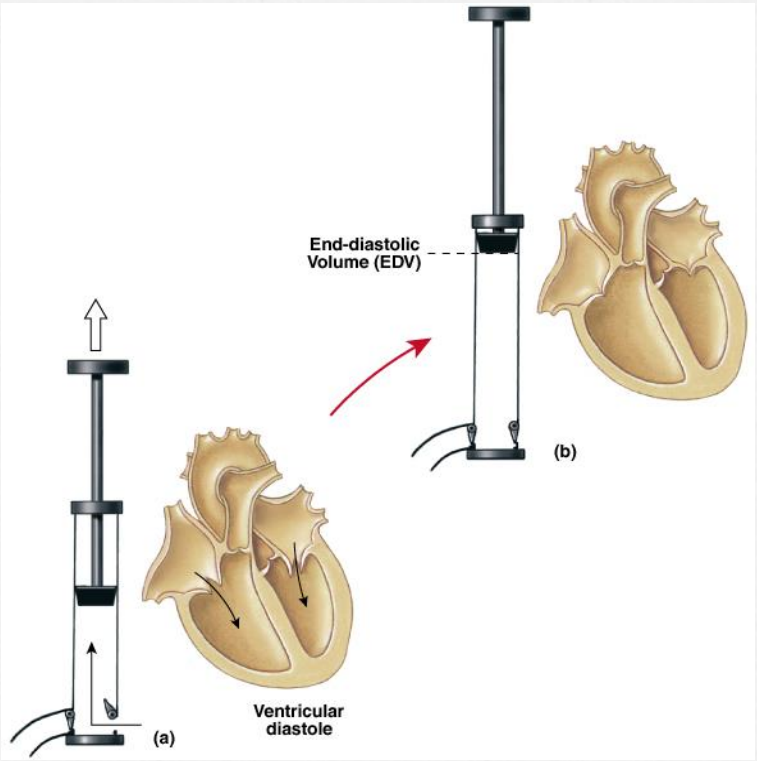


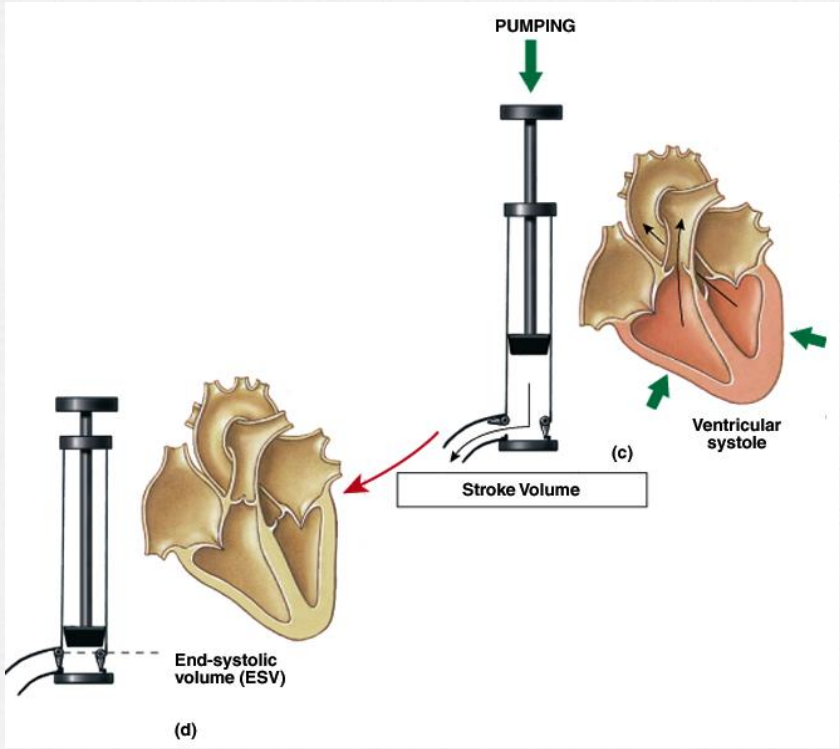
▶ Factors Affecting Neural Control of Cardiovascular Function



PEMBULUH DARAH

POMPA JANTUNG





TEKANAN DARAH

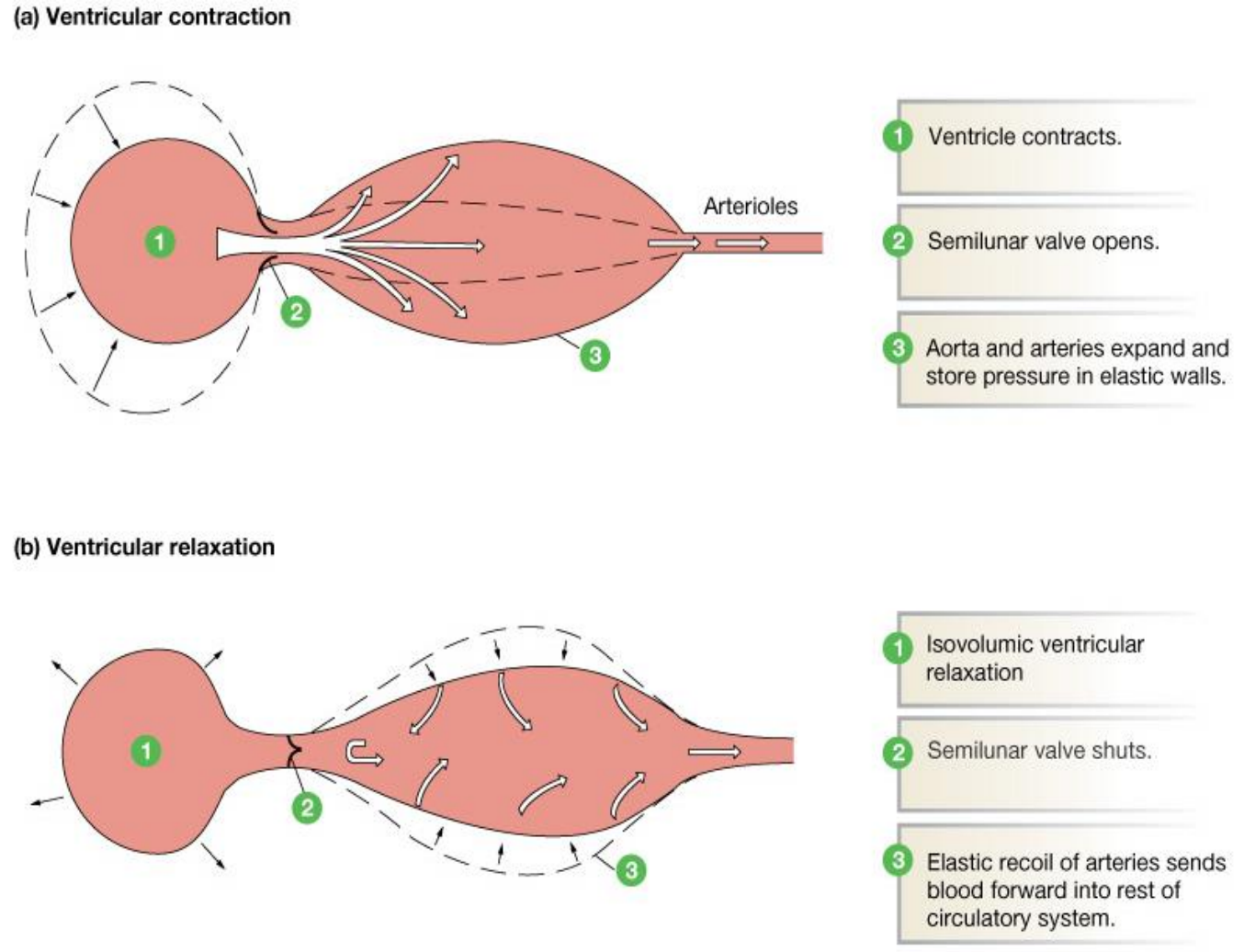


Figure 15-4: Elastic recoil in the arteries

- Arteri dapat dibayangkan seperti balon panjang tanpa lubang terbuka di ujungnya

- Selama masih ada aliran udara, maka balon tetap mengembang

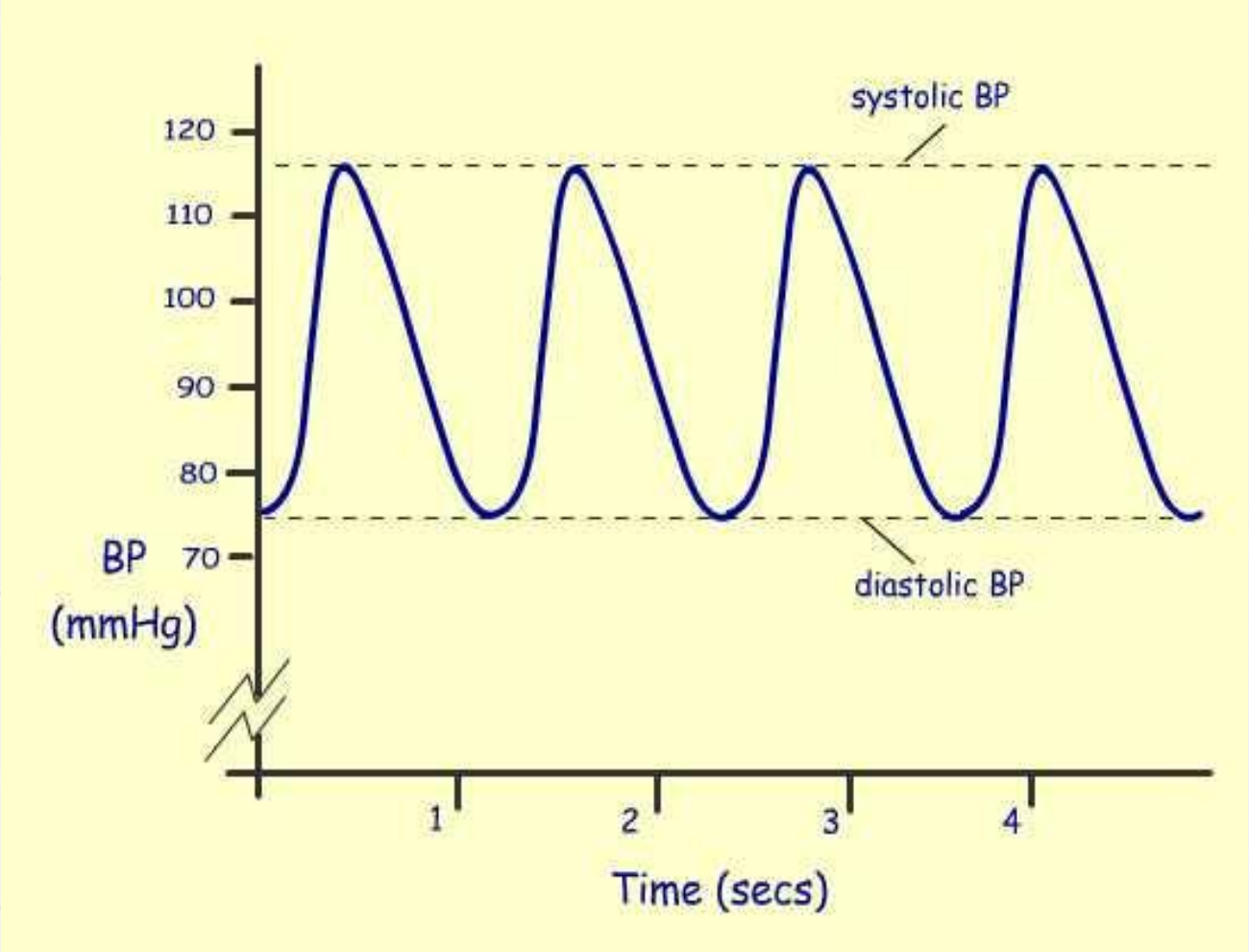
Systole and Diastole

- Kondisi arteri berfluktuasi diantara systole dan diastole
- Saat systole, tekanan di arteri meningkat akibat darah mengalir dari jantung
  - dinding arteri meregang
  - Teraba tegangan di arteri perifer sebagai denyut nadi

Systole and Diastole

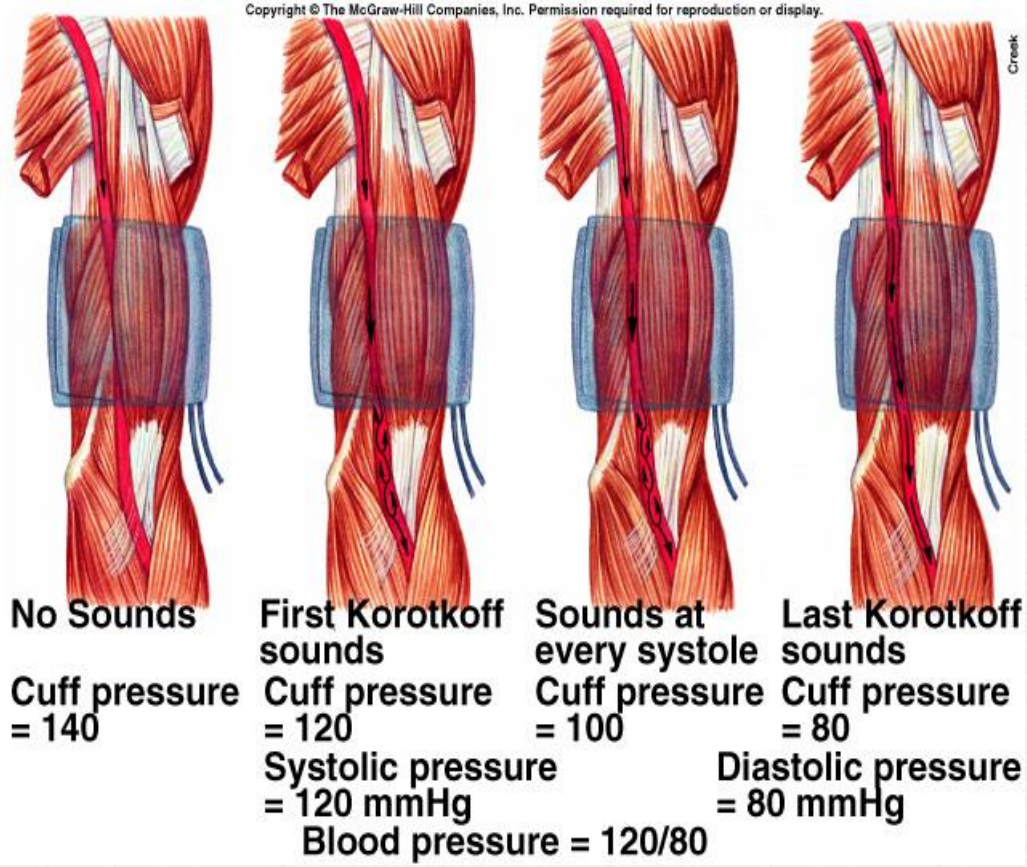
- Saat diastole, elastic recoil arteri mendorong darah masuk kapiler
  - Tekanan di arteri menurun karena darah berpindah
  - Tidak pernah sampai 0 mmHg

Here is a graph of changes in arterial BP



Measurement of Blood Pressure

- Blood pressure cuff is inflated above systolic pressure, occluding the artery.
- As cuff pressure is lowered, the blood will flow only when systolic pressure is above cuff pressure, producing the sounds of Korotkoff.
- Korotkoff sounds will be heard until cuff pressure equals diastolic pressure, causing the sounds to disappear.



Arterial blood pressure

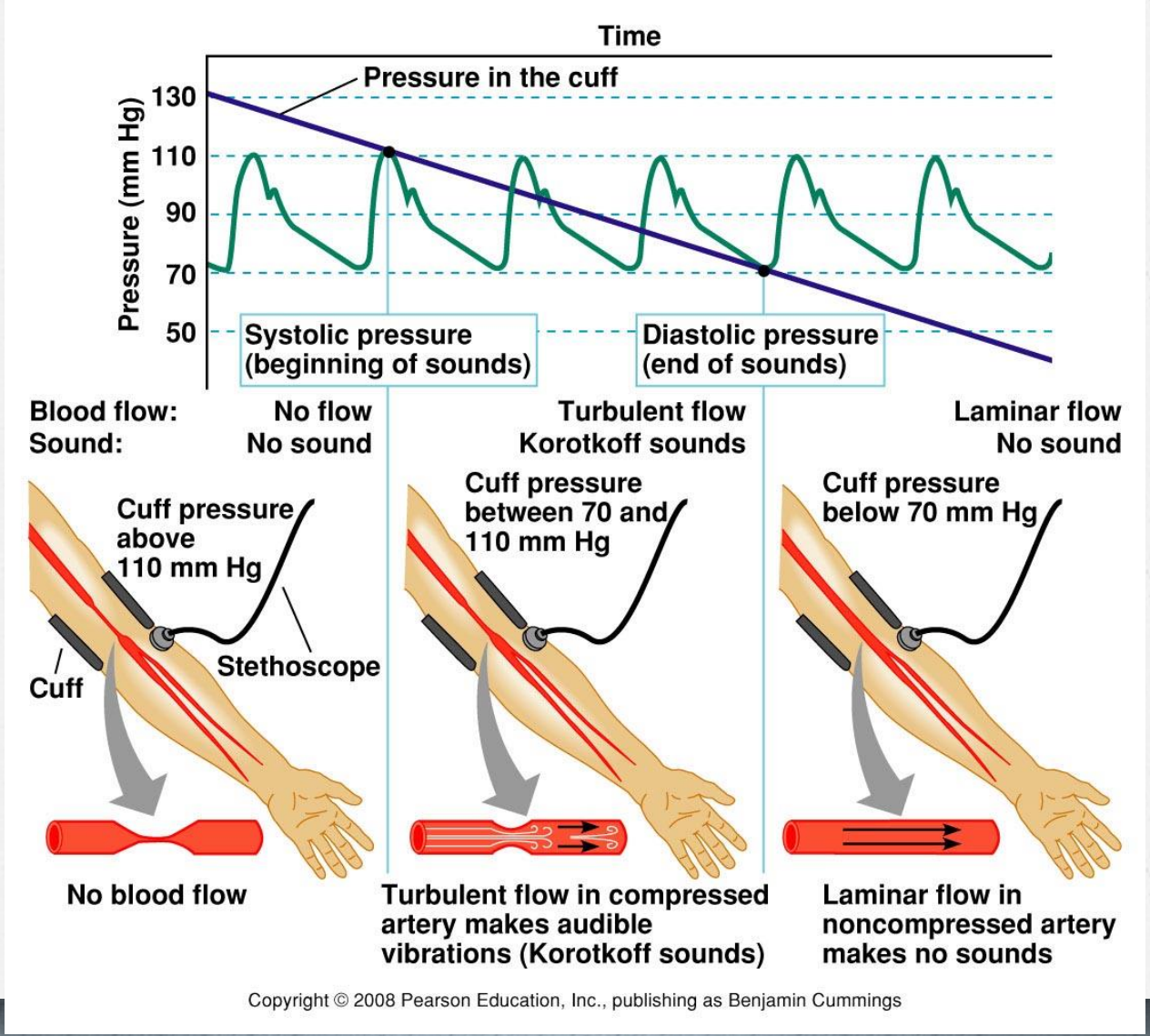
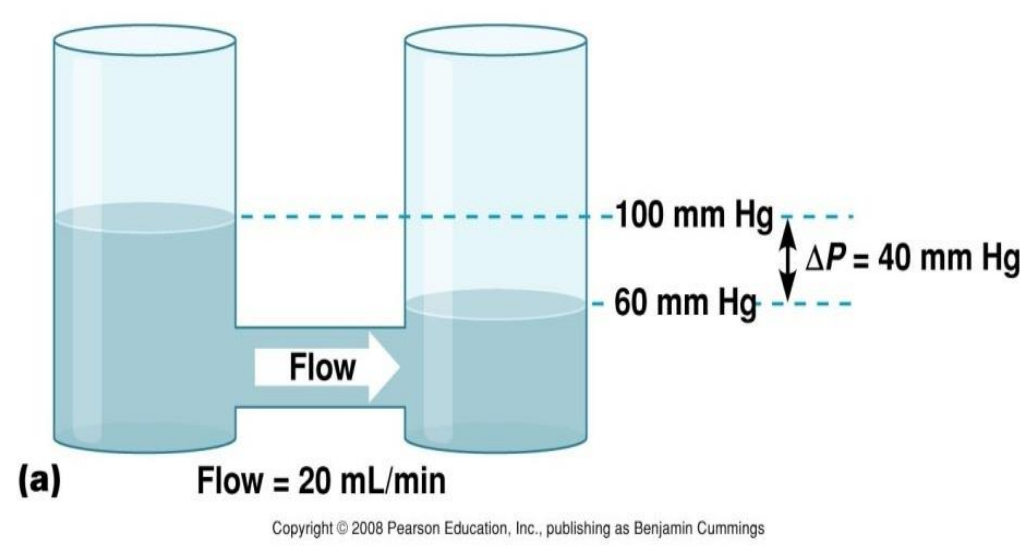


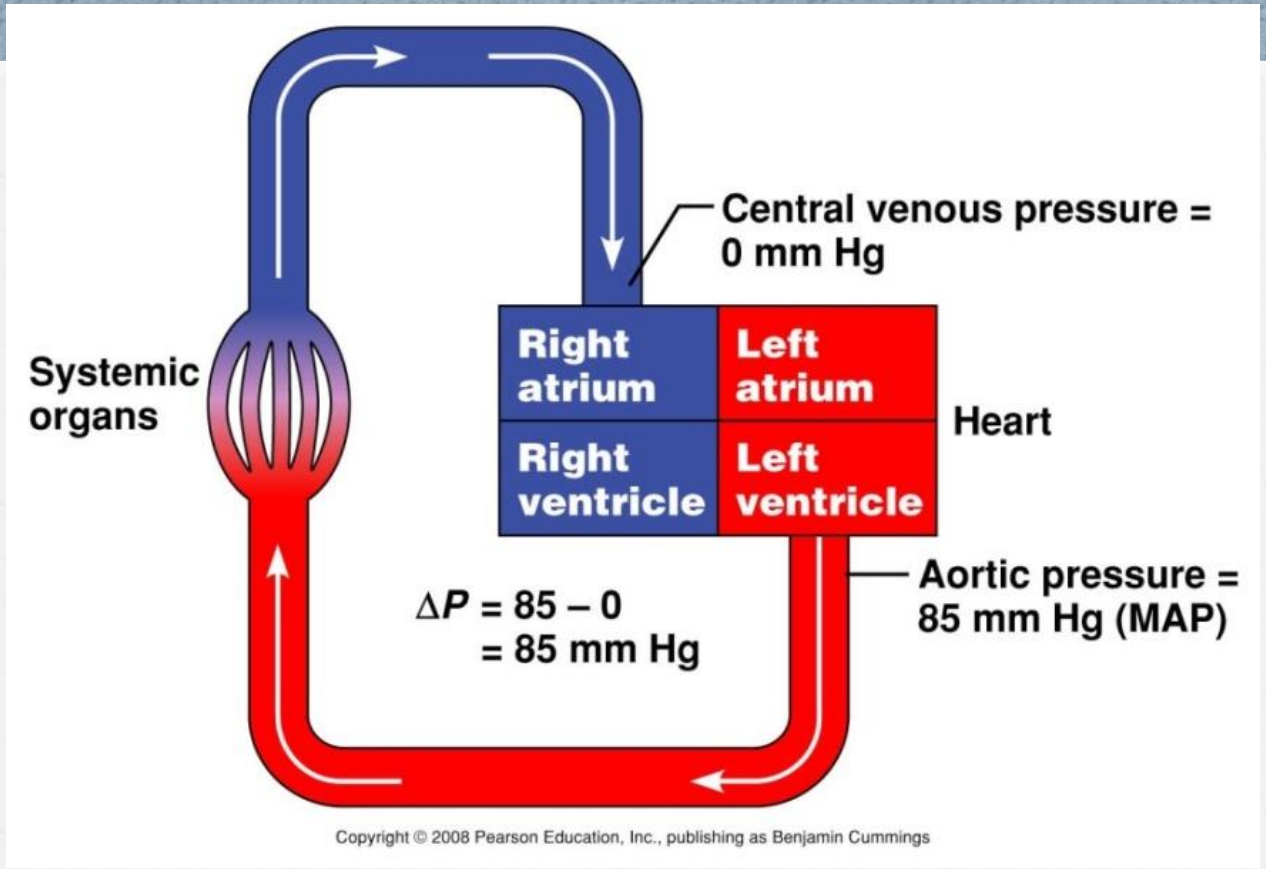
Figure 14.8

Physical laws governing blood flow and blood pressure

Flow of blood through out body =

pressure gradient within vessels X resistance to flow





Pressure gradient:

aortic pressure – central venous pressure

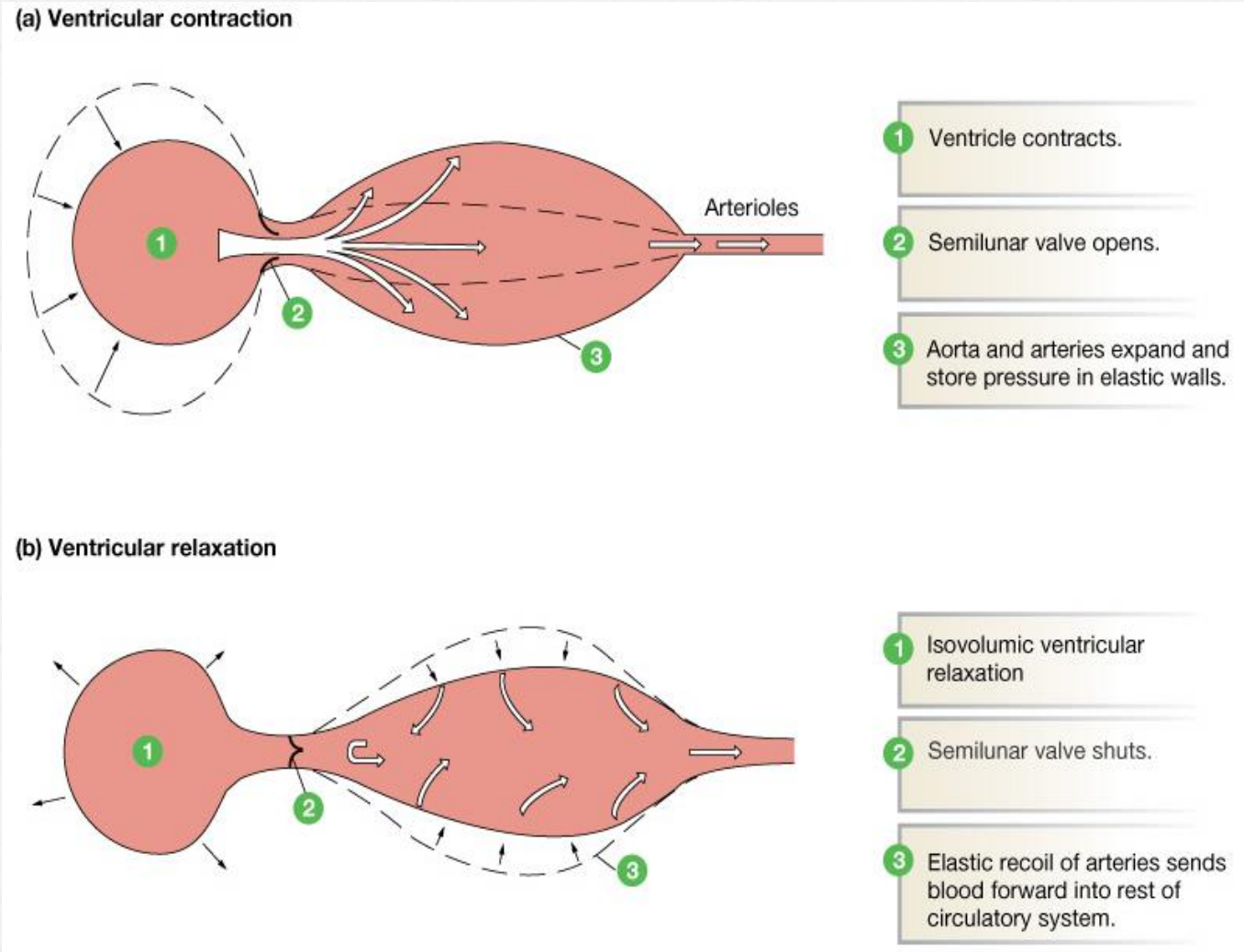
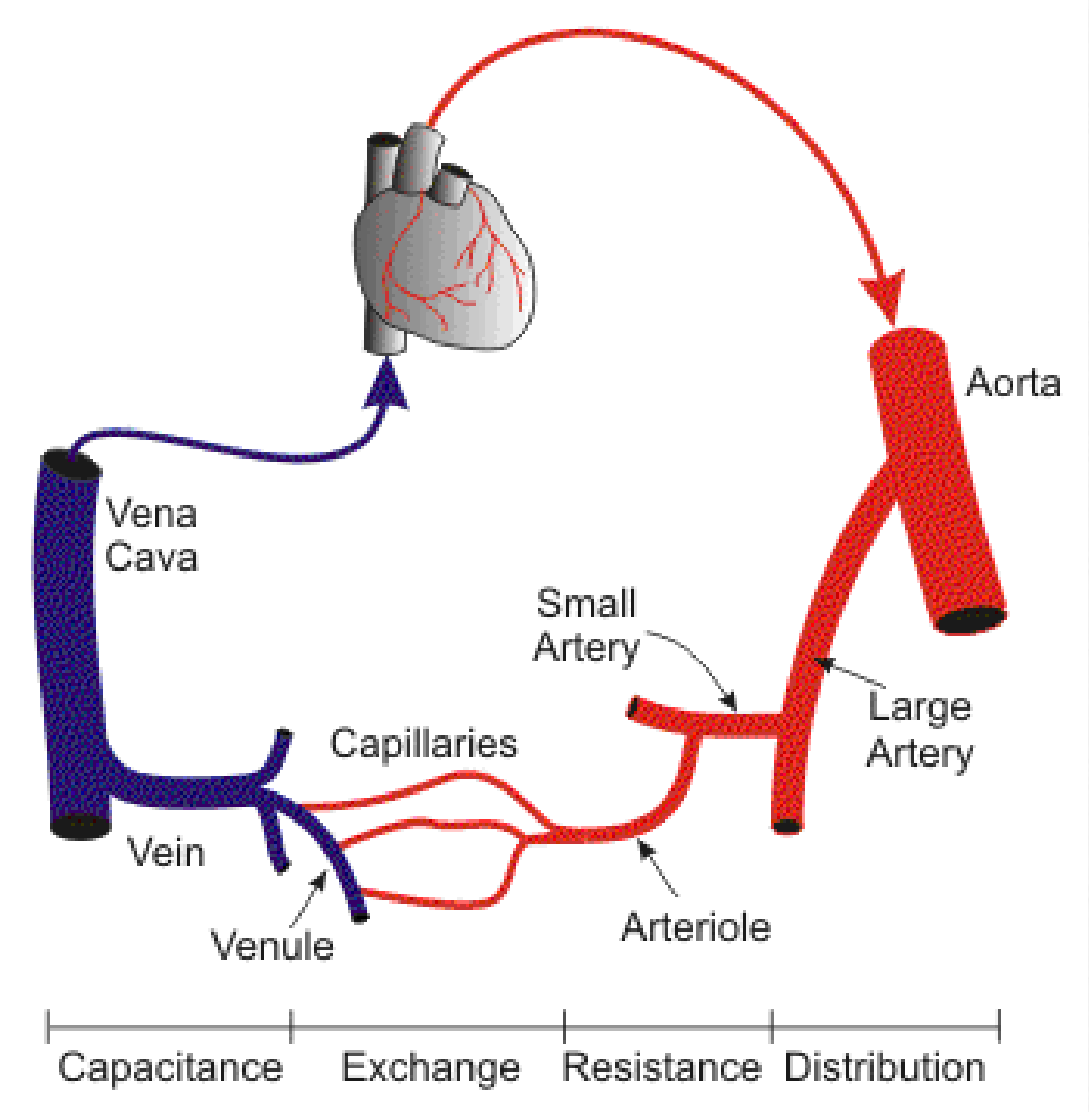
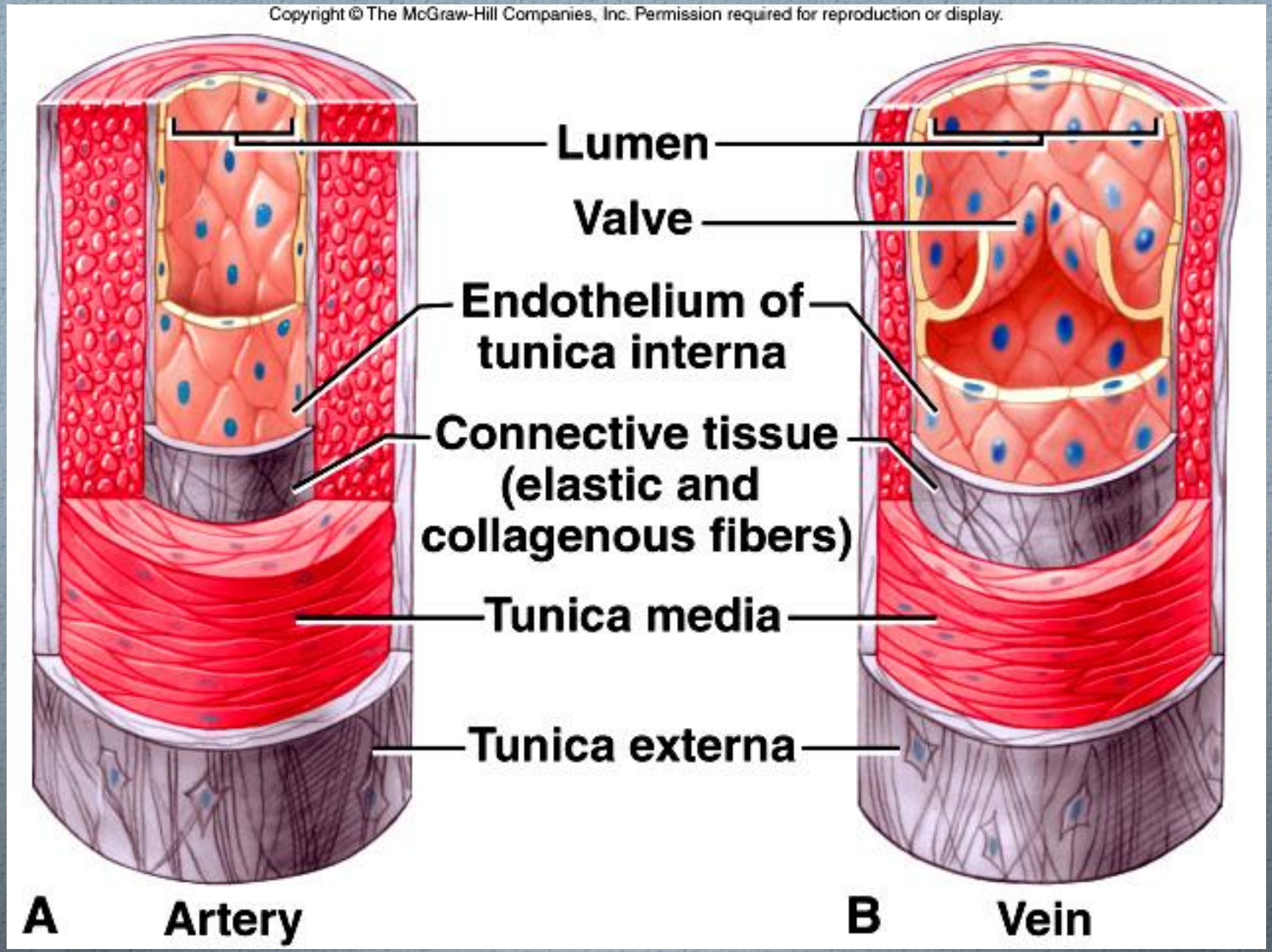


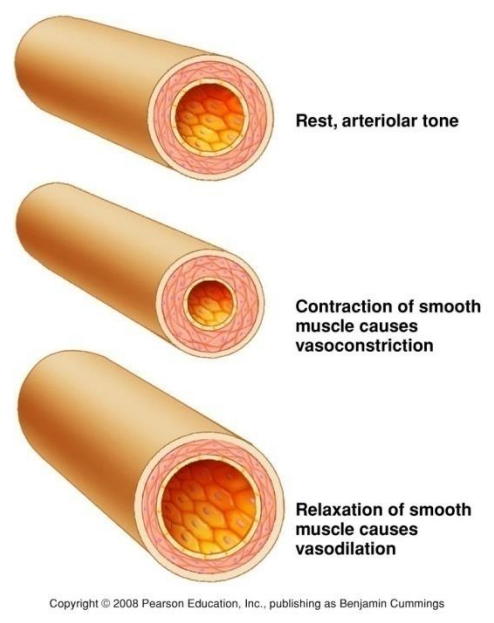
Figure 15-4: Elastic recoil in the arteries


Aorta
Vena
Cava
Small
Artery
Large
Artery
Capillaries
Vein
Venule
Arteriole
Capacitance
Exchange
Resistance
Distribution



Regulation of blood flow in arteries

- It is important to adjust blood flow to organ needs → Flow of blood to particular organ can be regulated by varying resistance to flow (or blood vessel diameter)
- Vasoconstriction of blood vessel smooth muscle is controlled both by the ANS and at the local level.
- Four factors control arterial flow at the organ level:
  - change in metabolic activity
  - changes in blood flow
  - stretch of arterial smooth muscle
  - local chemical messengers



Intrinsic control of local arterial blood flow

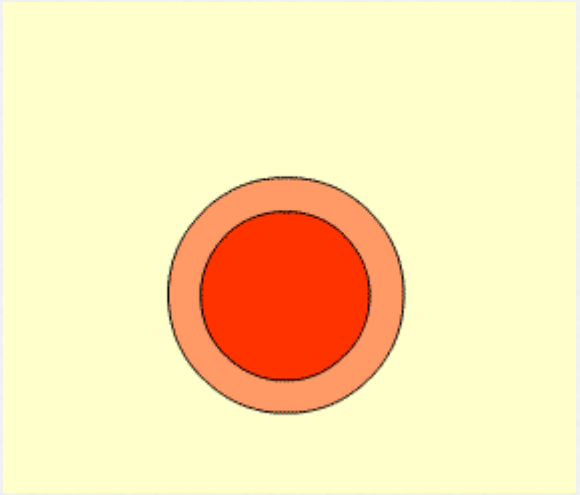
- Change in metabolic activity
  - Usually linked to CO_2 and O_2 levels (↑ CO_2 → vasodilation →↑ blood flow) intrinsic control
- Changes in blood flow

  - decreased blood flow → increased metabolic wastes → vasodilation
- Stretch of arterial wall = myogenic response

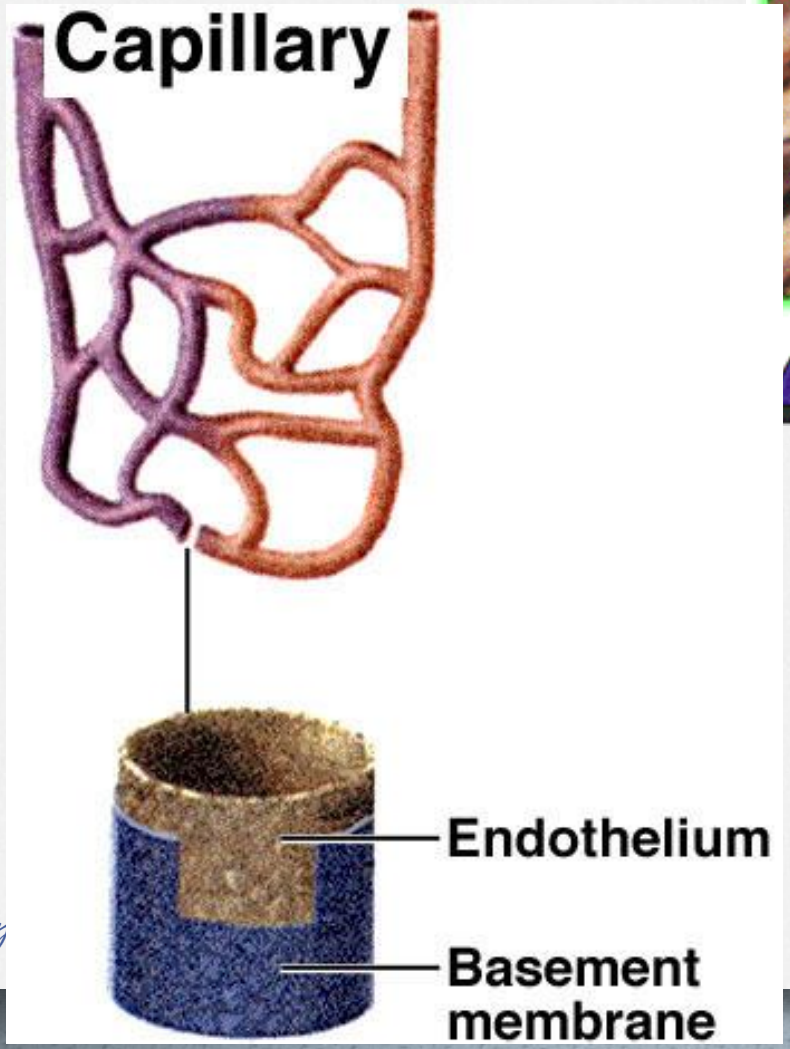
  - Stretch of arterial wall due to increased pressure → reflex constriction
- Locally secreted chemicals can promote vasoconstriction or most commonly vasodilation

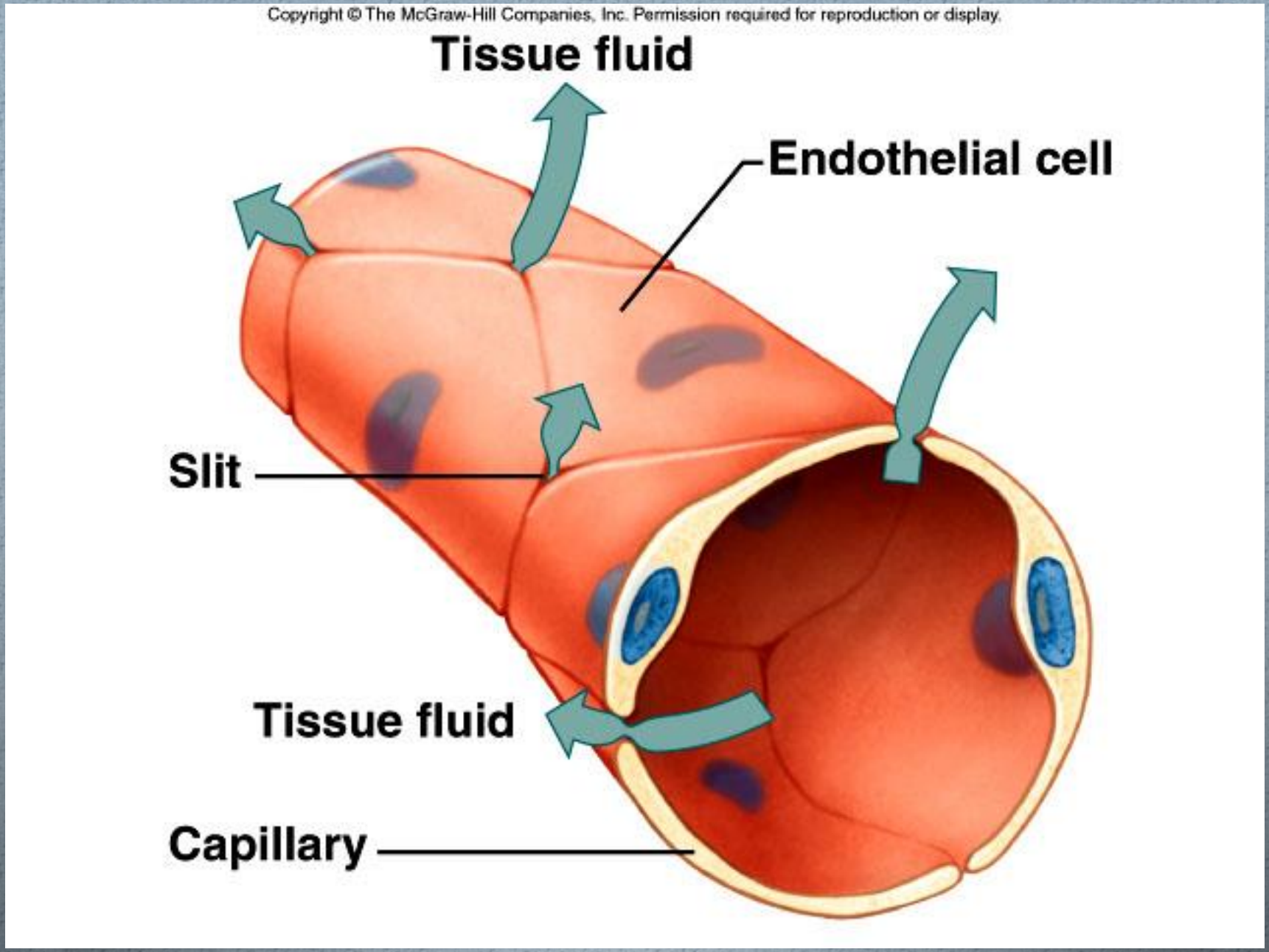
  - inflammatory chemicals, (nitric oxide, CO_2)

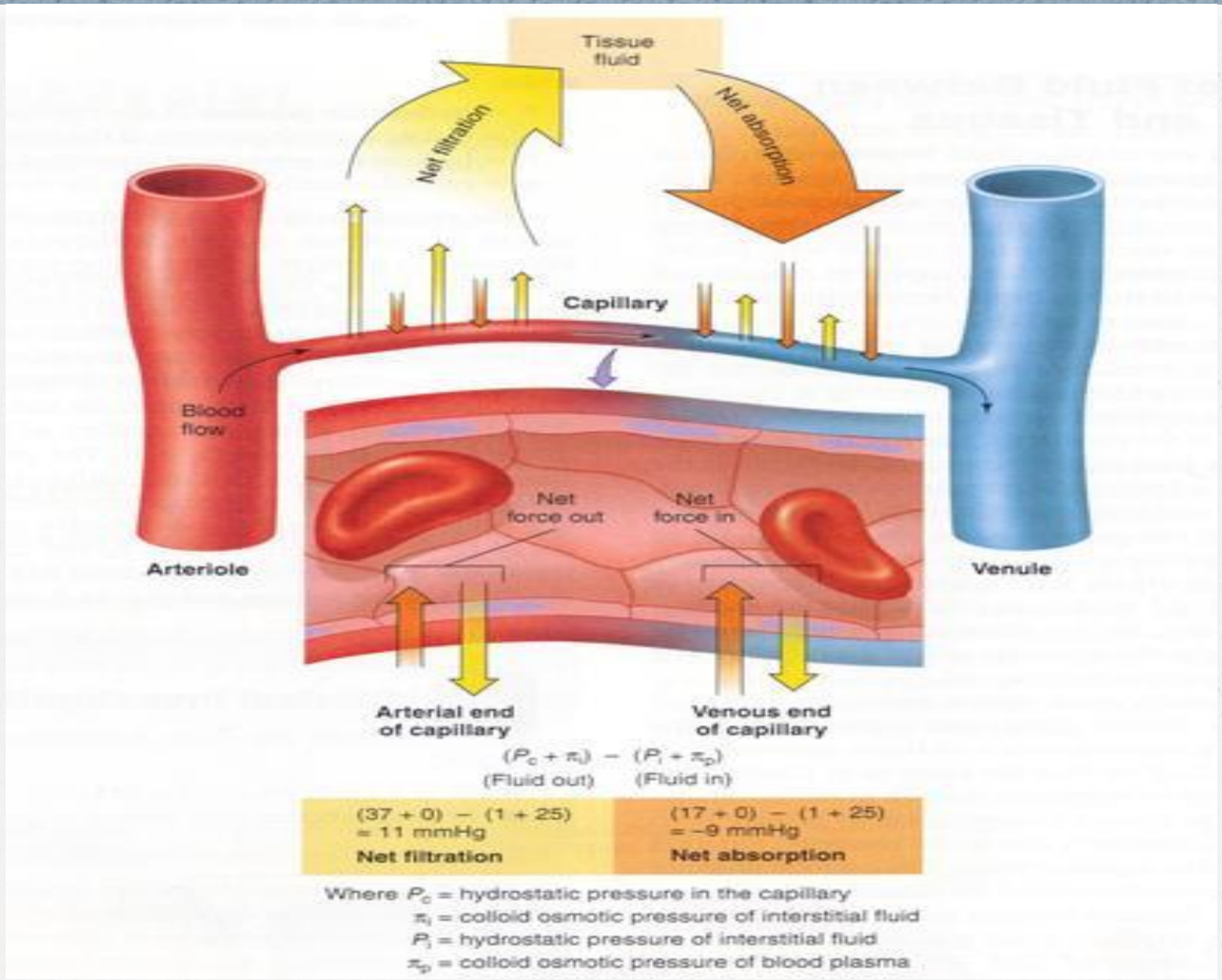
Artery in systole and diastole



Kapiler



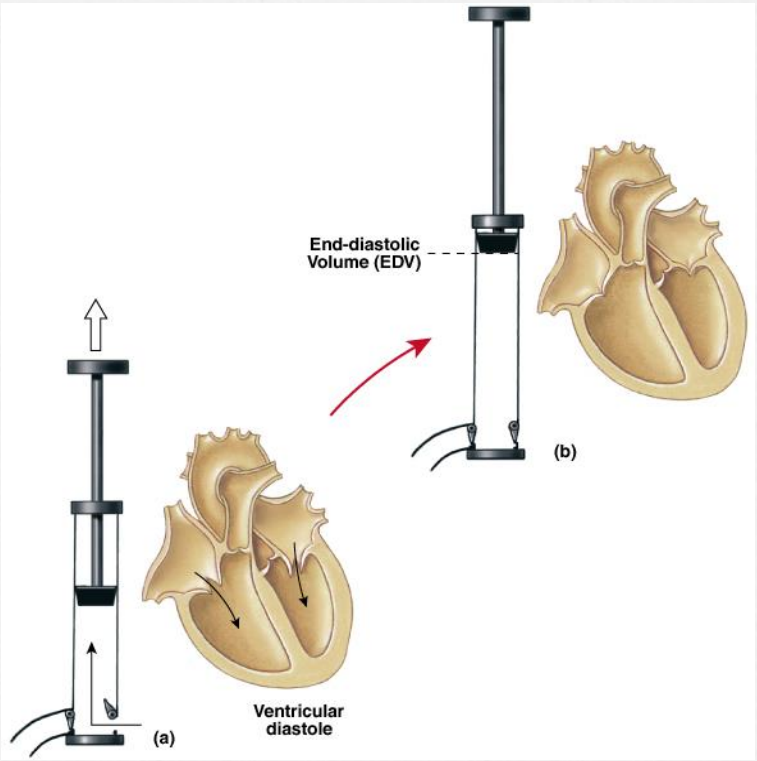


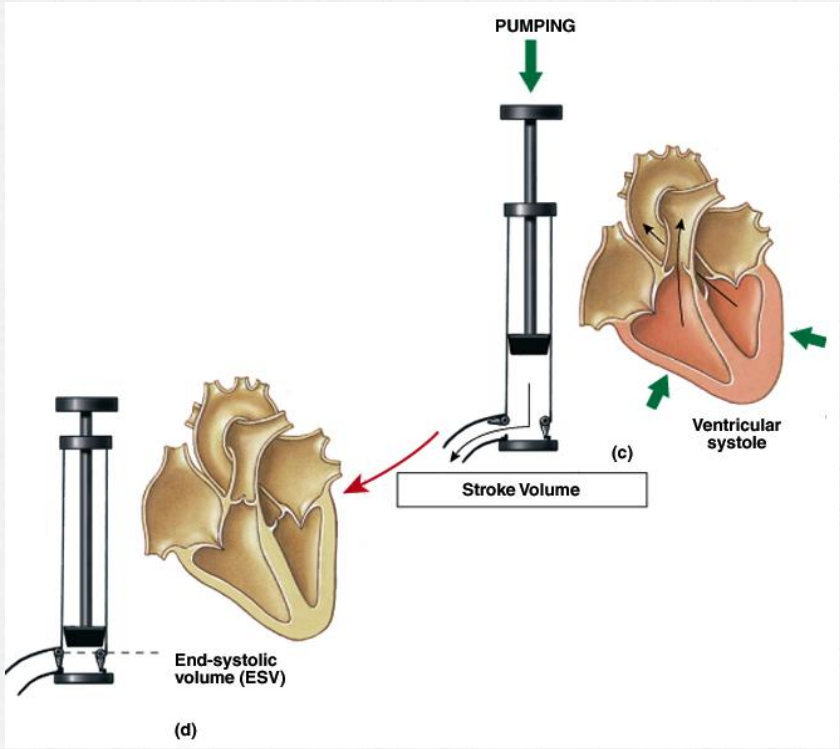

Tissue fluid
Net filtration
Net absorption
Capillary
Blood flow
Arteriole
Venule
Net force out
Net force in
Arterial end of capillary
Venous end of capillary
$(P_c + \pi_i) - (P_i + \pi_p)$
(Fluid out) (Fluid in)
(37 + 0) − (1 + 25) = 11 mmHg
Net filtration
(17 + 0) − (1 + 25) = −9 mmHg
Net absorption
Where P_c = hydrostatic pressure in the capillary
π_i = colloid osmotic pressure of interstitial fluid
P_i = hydrostatic pressure of interstitial fluid
π_p = colloid osmotic pressure of blood plasma

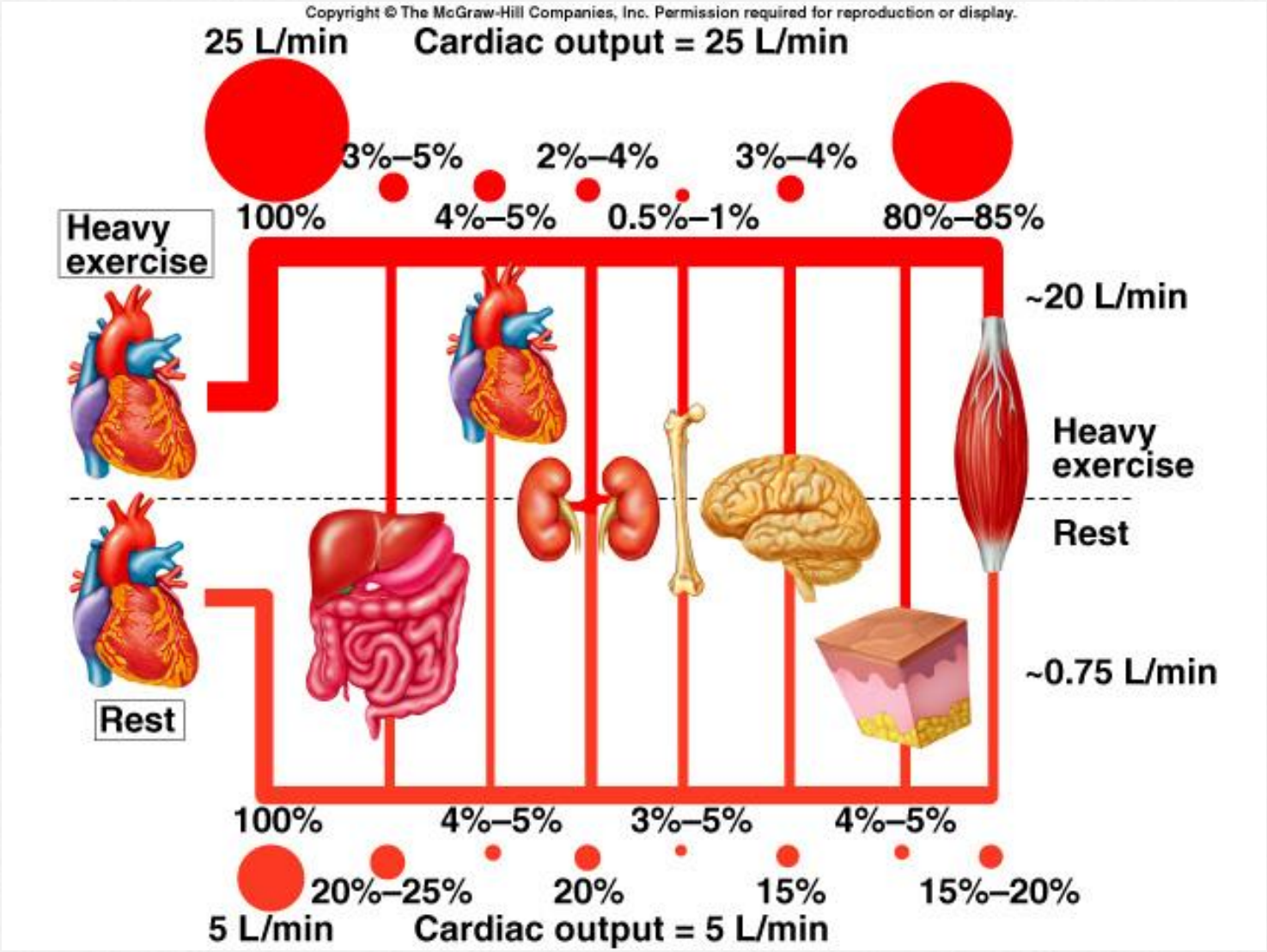
VOLUME DARAH

Stroke volume
End-diastolik volume
End-sistolik volume
Cardiac output
Ejection fraction

POMPA JANTUNG



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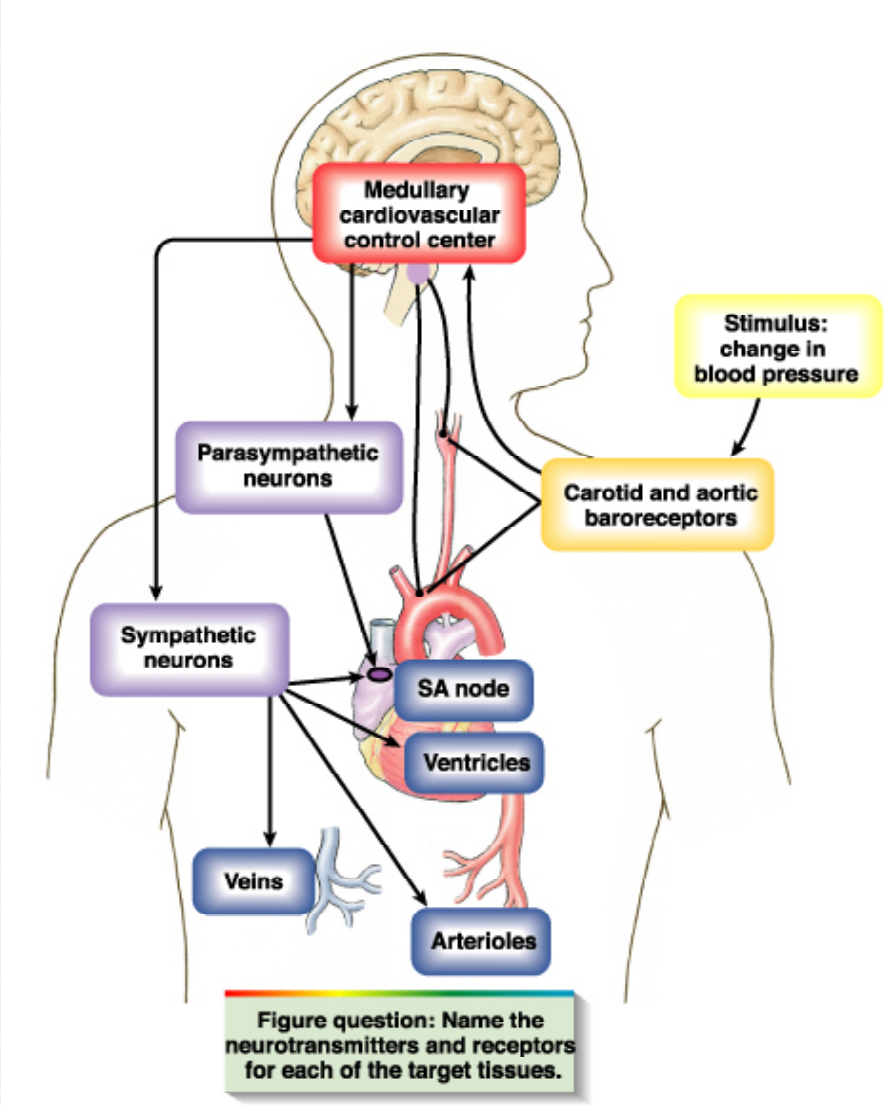
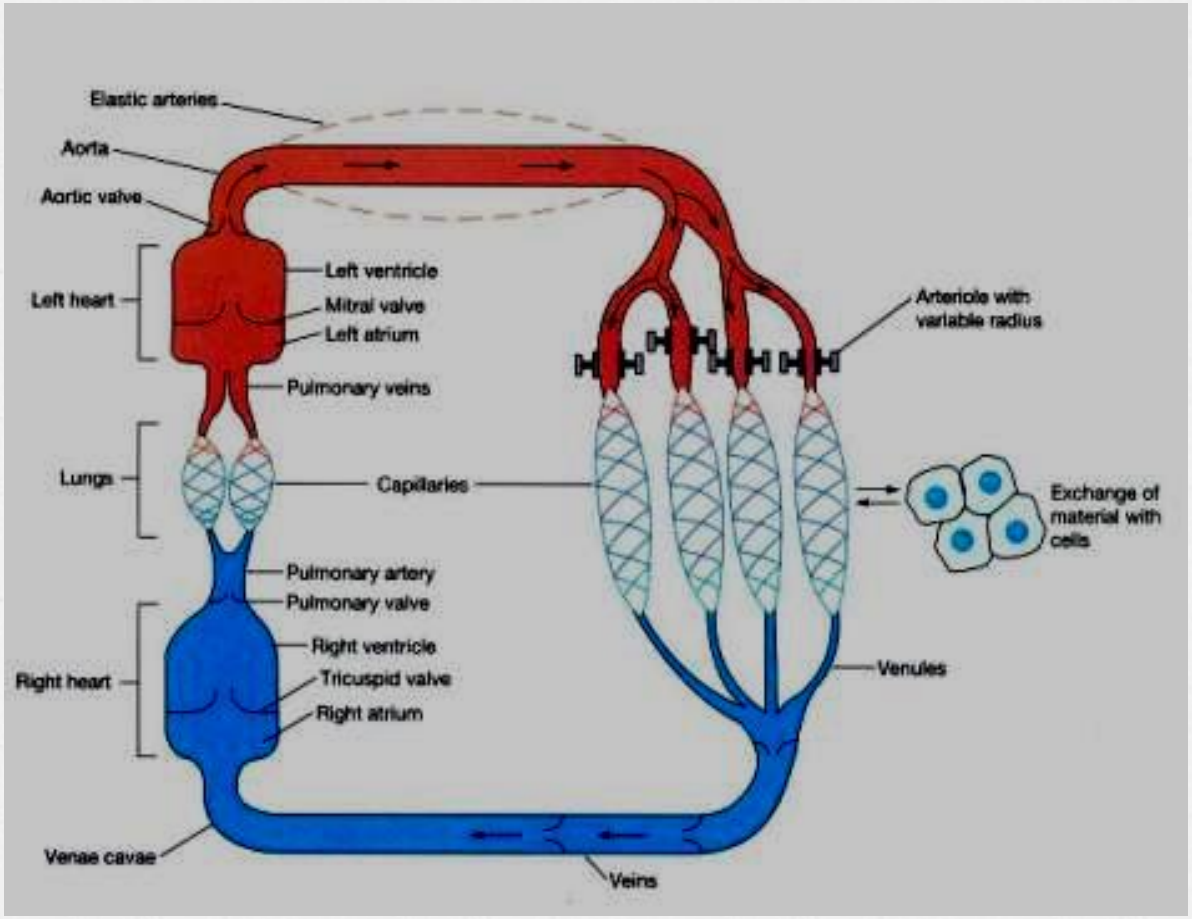
25 L/min
Cardiac output = 25 L/min
3%–5%
2%–4%
3%–4%
100%
4%–5%
0.5%–1%
80%–85%
Heavy exercise
~20 L/min
Heavy exercise
Rest
~0.75 L/min
Rest
100%
4%–5%
3%–5%
4%–5%
20%–25%
20%
15%
15%–20%
5 L/min
Cardiac output = 5 L/min

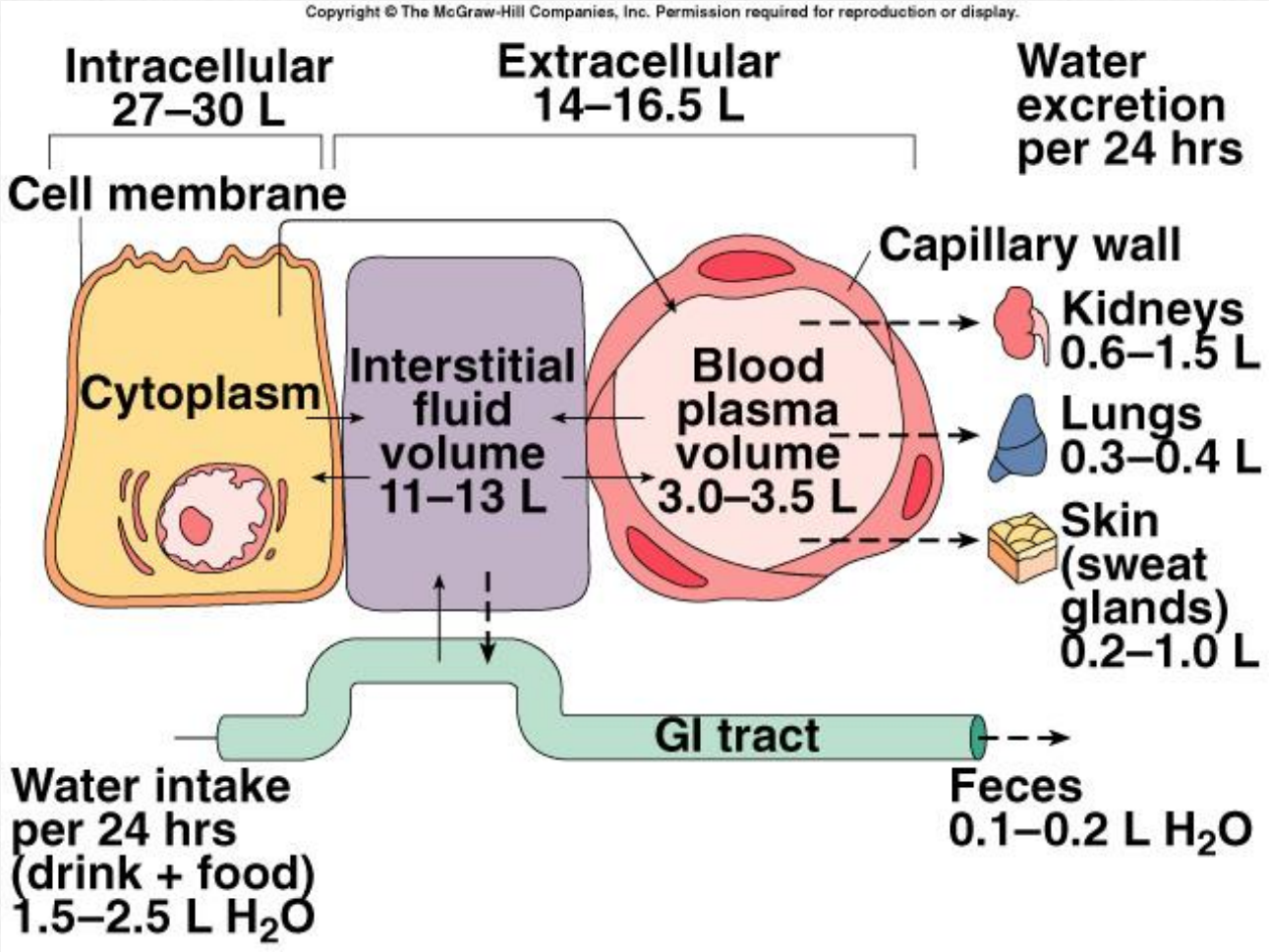
Regulation of Blood Pressure

- Main coordinating center is in the medulla oblongata of the brain; medullary cardiovascular control center
- Reflex control of blood pressure
    - Baroreceptor reflex

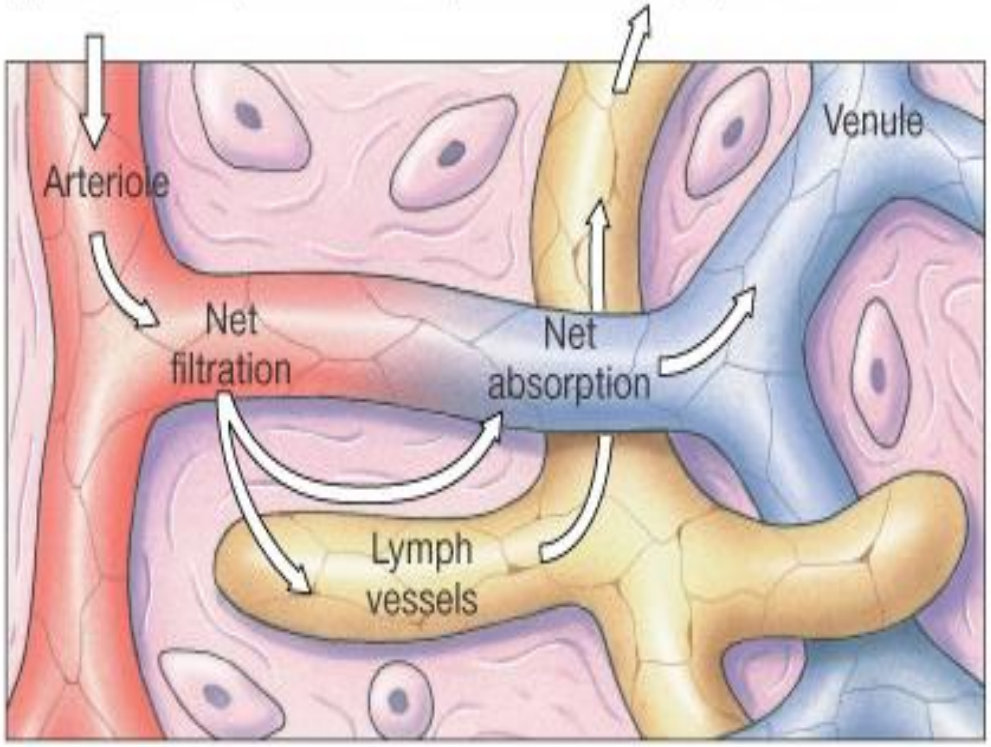



Elastic arteries
Aorta
Aortic valve
Left heart
Left ventricle
Mitral valve
Left atrium
Pulmonary veins
Lungs
Capillaries
Pulmonary artery
Pulmonary valve
Right heart
Right ventricle
Tricuspid valve
Right atrium
Venae cavae
Veins
Arteriole with variable radius
Exchange of material with cells
Venules

Blood Volume



(b) Relationship between capillaries and lymph vessels



The excess water and solutes that filter out of the capillary are picked up by the lymph vessels and returned to the circulation.

fungsi