فیزیولوژی دو، جلسه ششم:

۱- تنظیم های عمومی و موضعی گردش خون

۲- معرفی نقش های فیزیولوژیکی کلیه ها

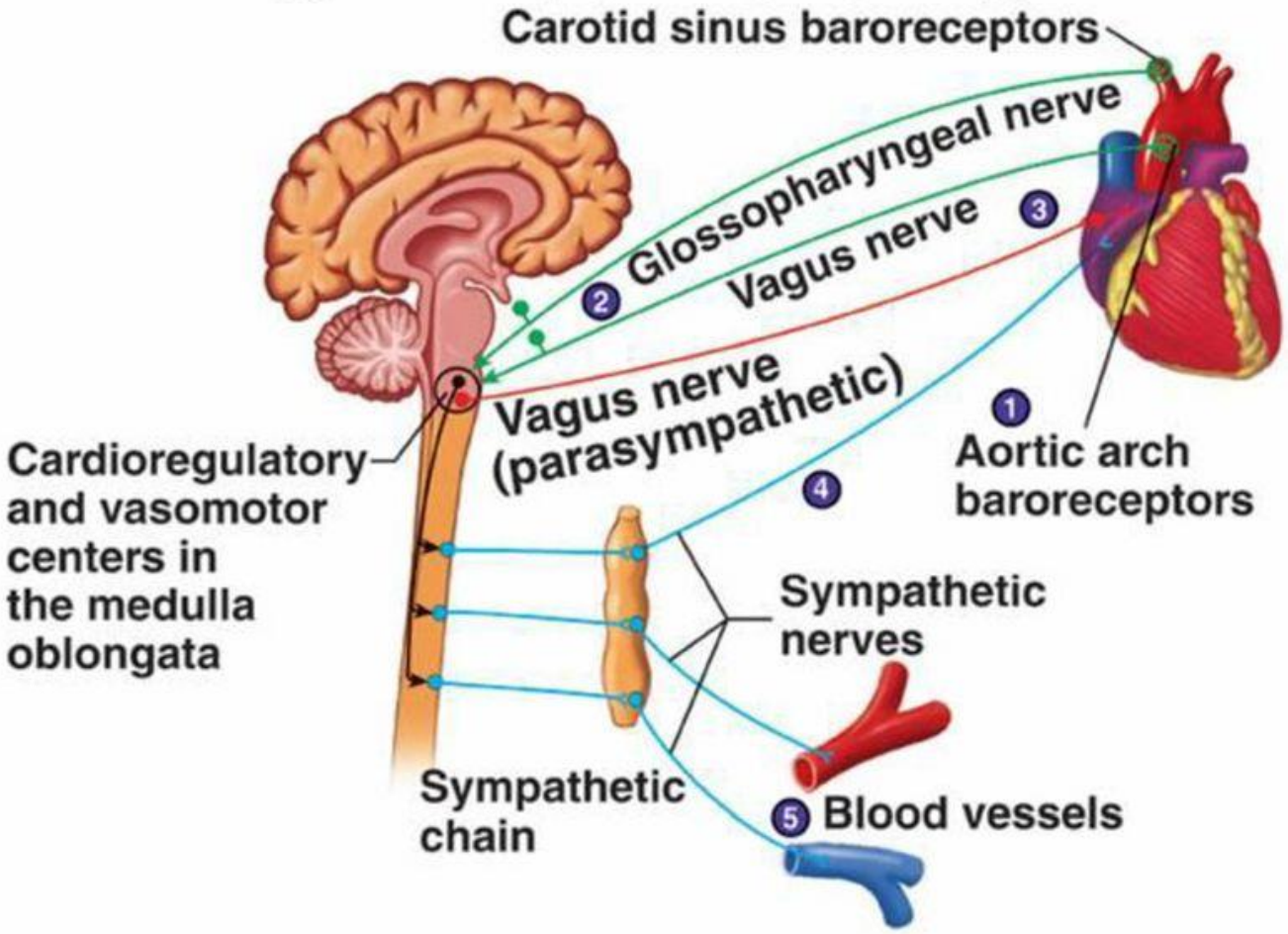
۳- تشریح فیزیولوژیکی کلیه

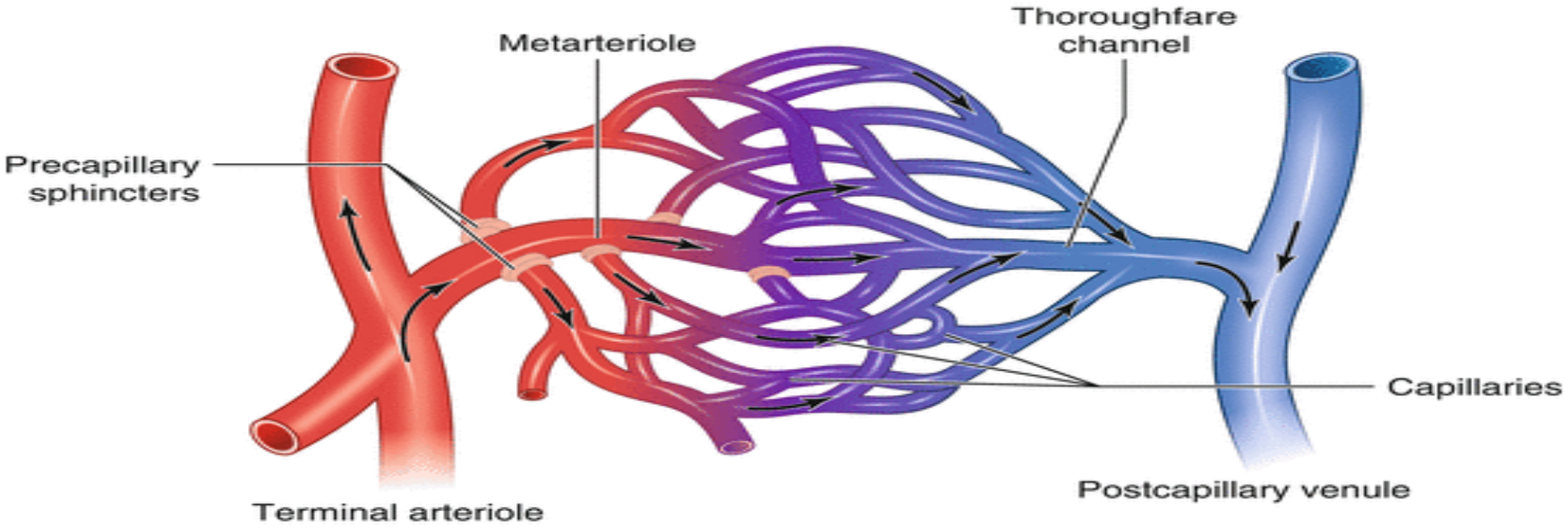
۴- ارکان عملکردی نفرون های کلیوی(تصفیه، بازجذب و ترشح)

۵- میزان تصفیه گلومرولی

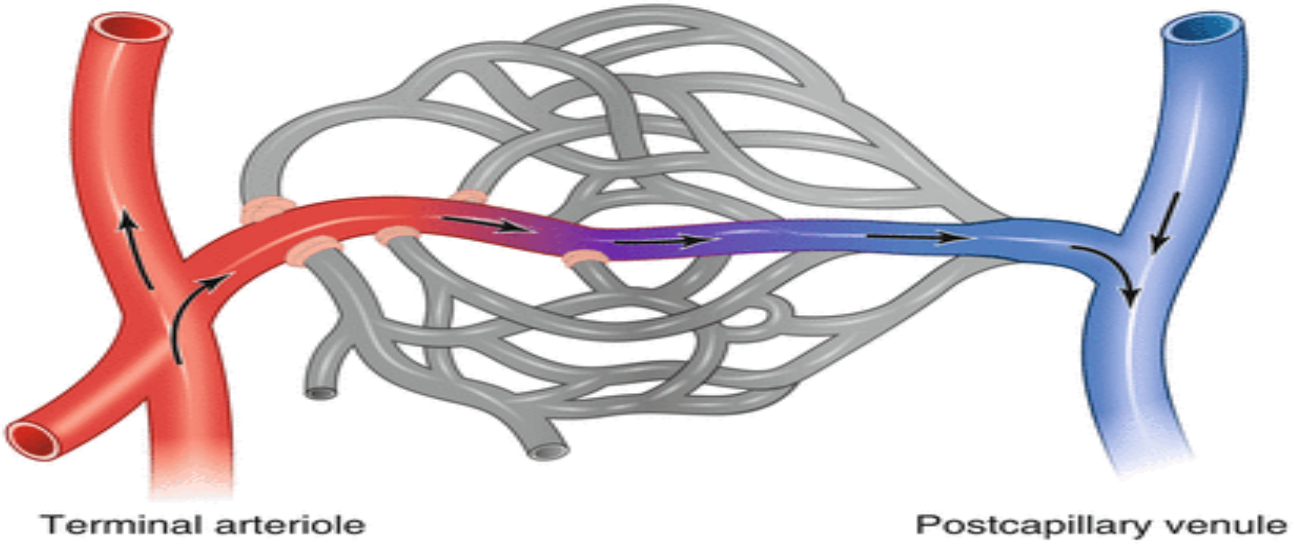
۶- خودتنظیمی کلیوی و اهمیت آن

VASOMOTOR CENTER





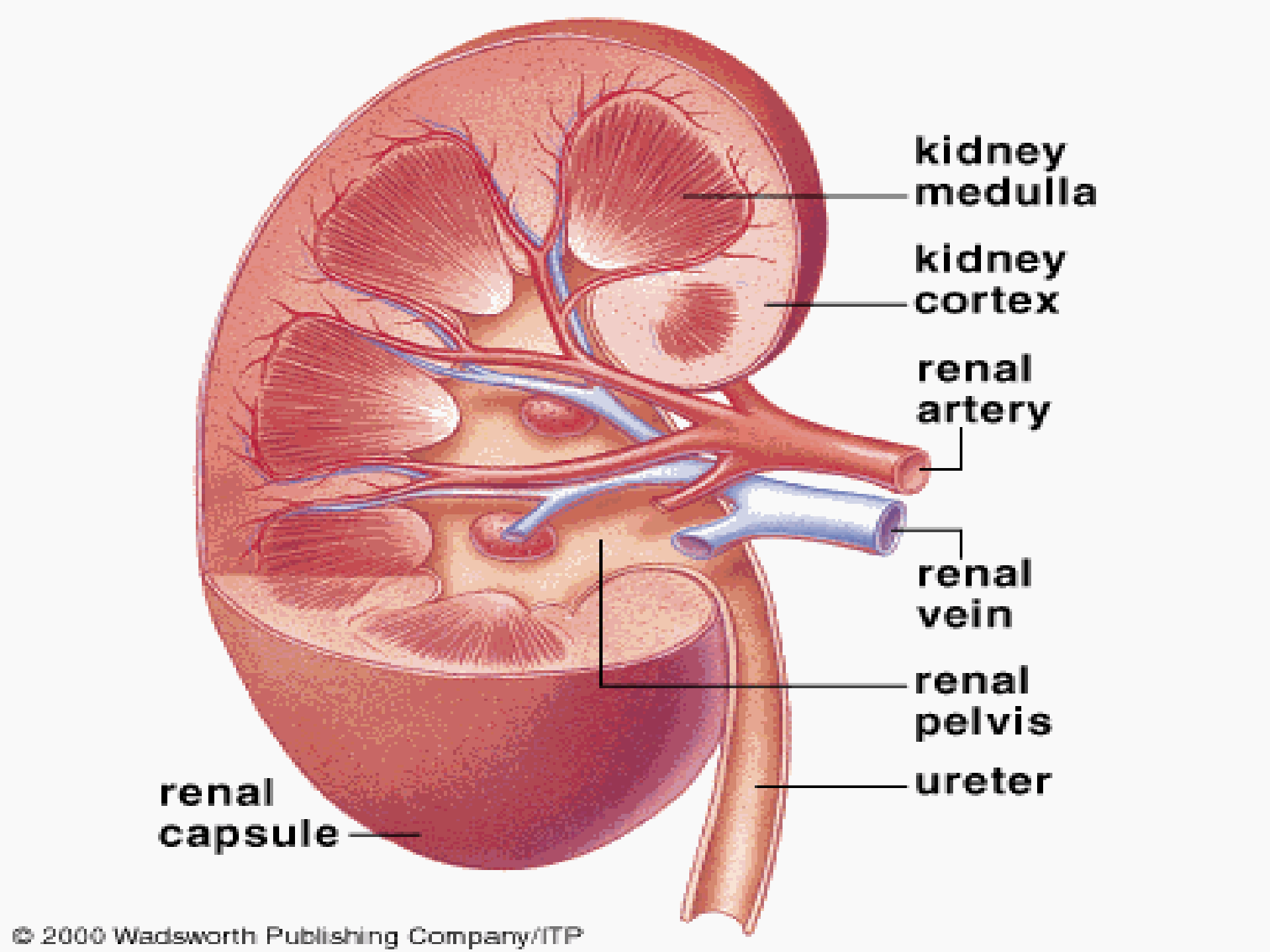
Precapillary sphincters open

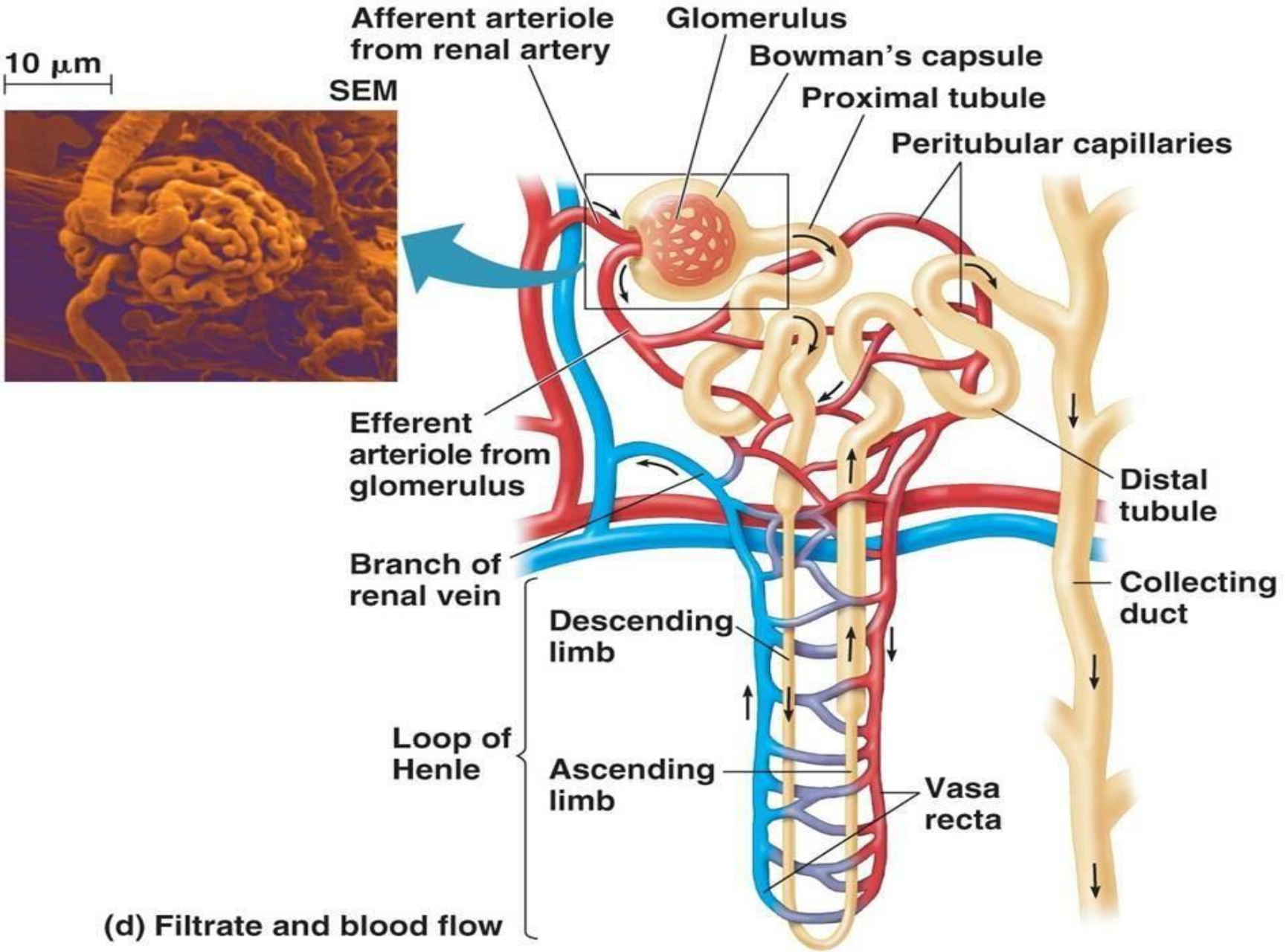


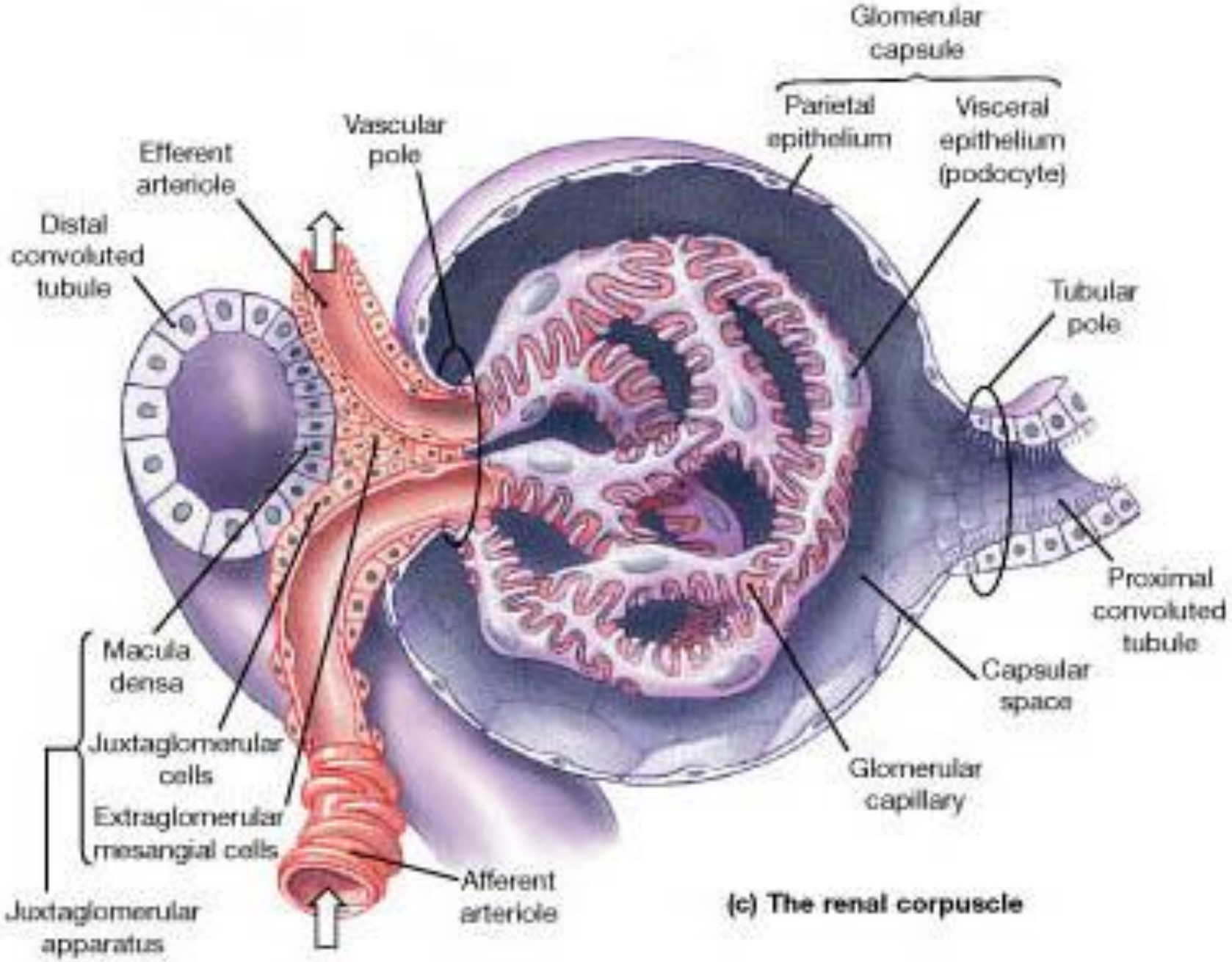
Precapillary sphincters closed

Functions of kidney:

1- Excretion
2- Regulation of water & electrolytes balance
3- Regulation of osmolality
4- Regulation of blood pressure
5- Regulation of acid-base balance
6- Endocrine function
7- Activation of vitamin D3
8- Gluconeogenesis

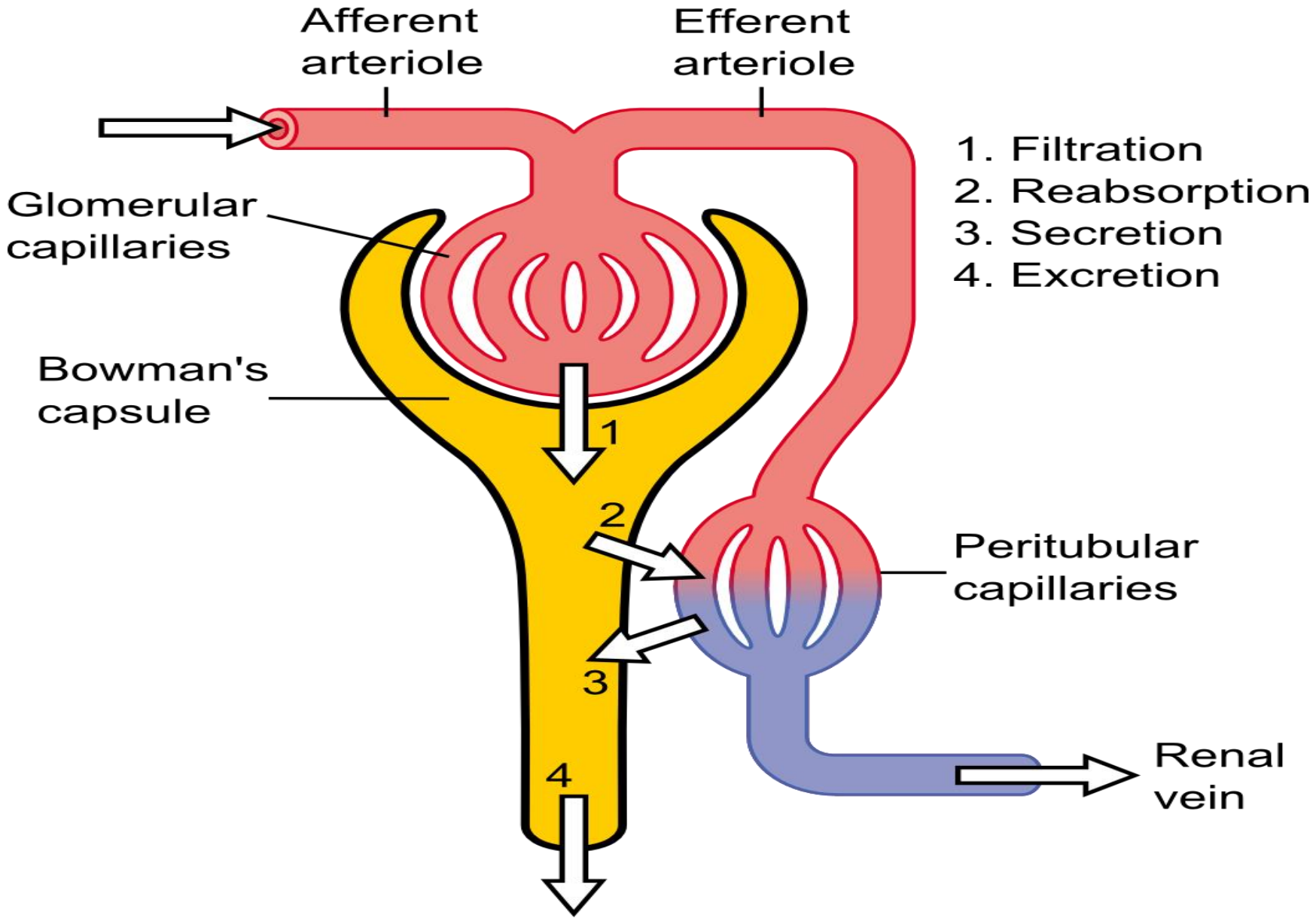






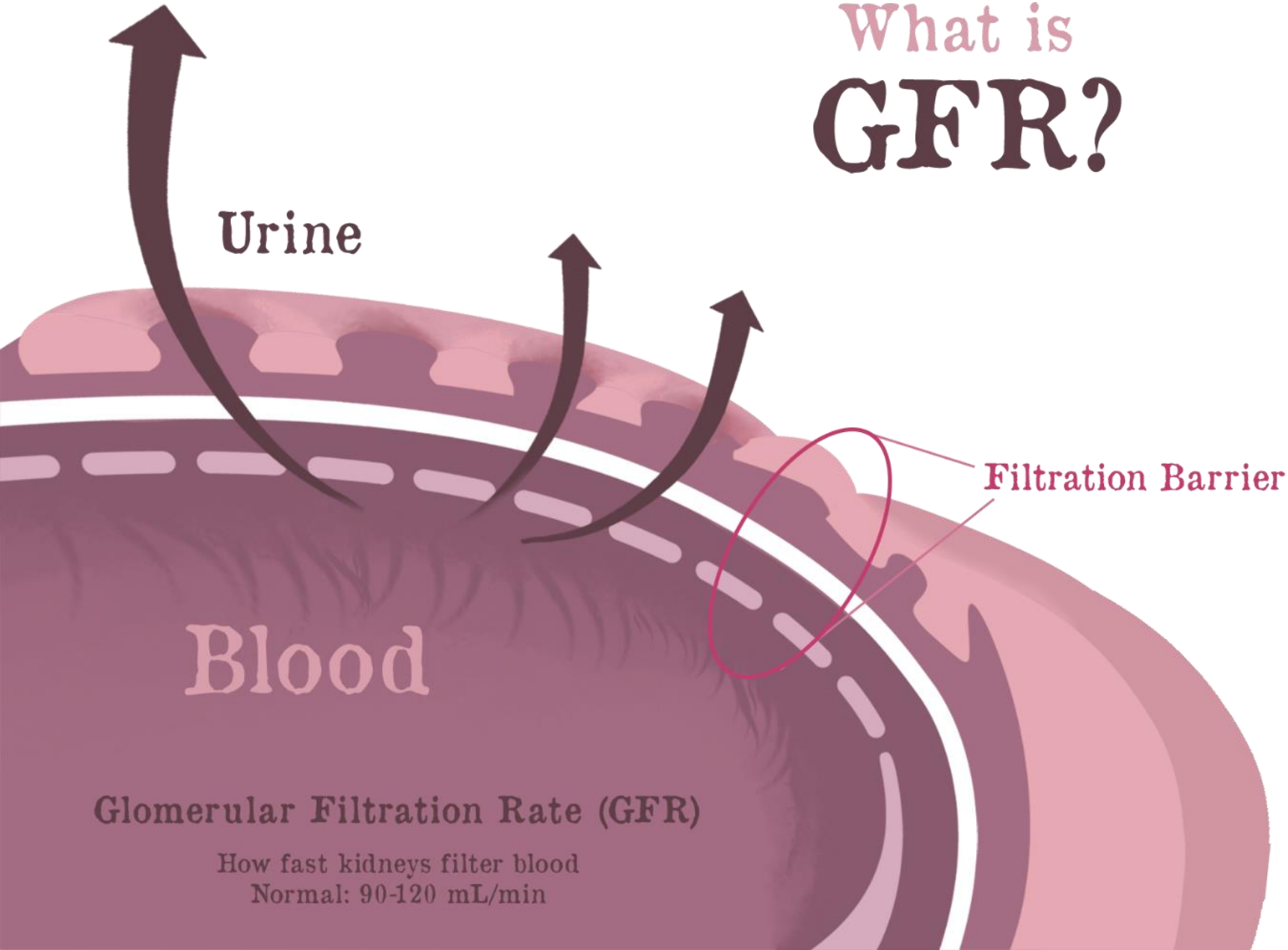
(c) The renal corpuscle

Filtration, Reabsorption, Secretion



Excretion = Filtration – Reabsorption + Secretion

What is GFR?


Urine
Filtration Barrier
Blood
Glomerular Filtration Rate (GFR)
How fast kidneys filter blood
Normal: 90-120 mL/min

Renal Autoregulation of GFR

فیزیولوژی دو، جلسه هفتم:

۱- مکانیسم های خود تنظیمی کلیوی

۲- پردازش کلیوی مواد

۳- تنظیم فشار اسمزی مایع برون سلولی

۴- تنظیم تعادل اسید و باز مایعات بدن

۵- کلیرانس کلیوی

I. Renal autoregulation

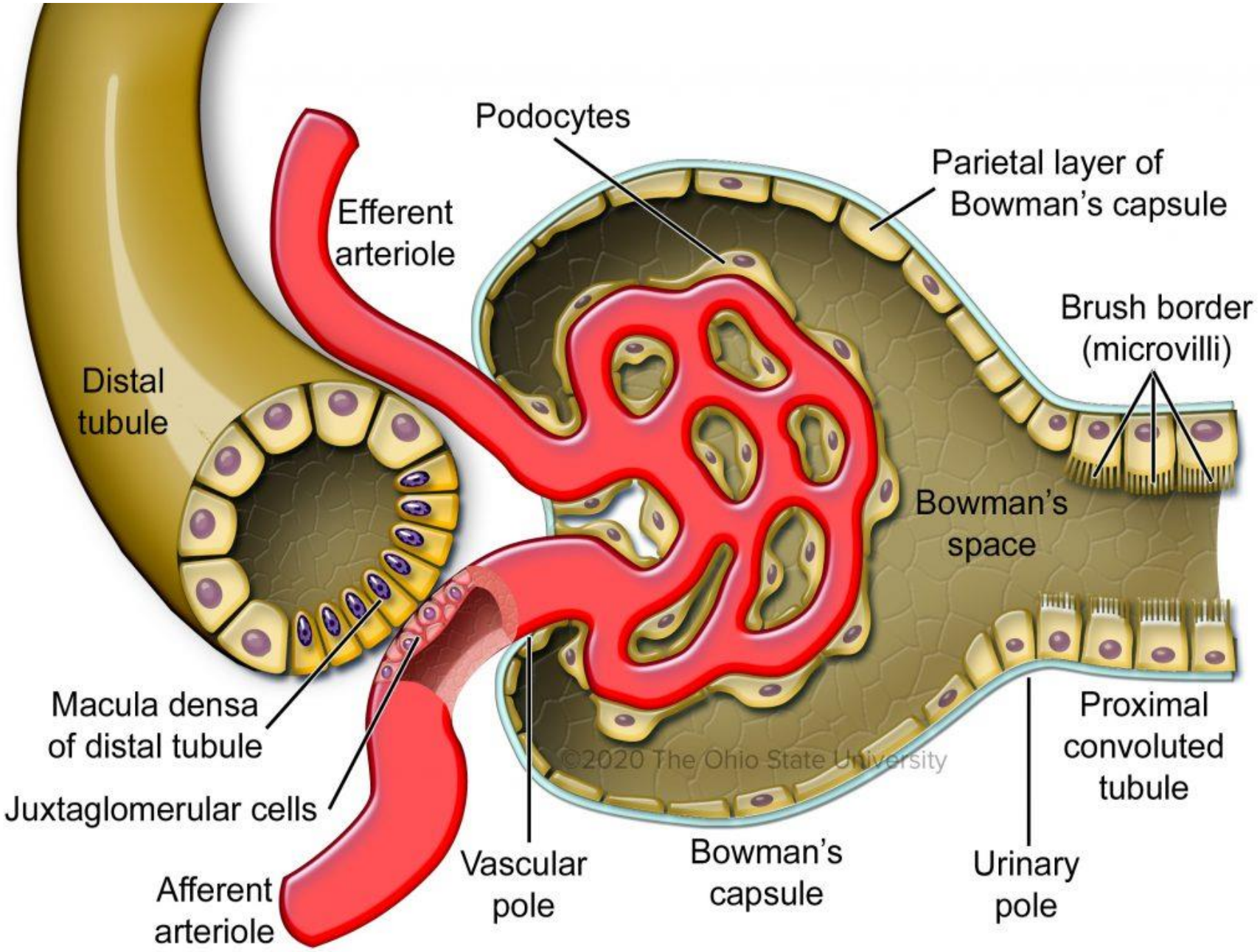
consists of two mechanisms—

1. myogenic mechanism
2. tubuloglomerular feedback.

Working together, they can maintain nearly constant GFR over a wide range of systemic blood pressures.

Myogenic mechanism

- Contraction of vascular smooth muscle when stretched (due to ↑ arterial pressure)
  - ↑ arterial pressure (↑ GFR & renal blood flow) → ↑ stretch → contraction → ↑ resistance → ↓ blood flow (restoration of GFR & renal blood flow)


Podocytes
Parietal layer of Bowman's capsule
Efferent arteriole
Brush border (microvilli)
Distal tubule
Bowman's space
Macula densa of distal tubule
Proximal convoluted tubule
Juxtaglomerular cells
Vascular pole
Bowman's capsule
Urinary pole
Afferent arteriole
©2020 The Ohio State University

Renin-Angiotensin-Aldosterone System

Key:
✚ =stimulatory effect
▬ = inhibitory effect

liver

kidney

Increase in renal perfusion

▬ Juxtaglomerular apparatus

✚

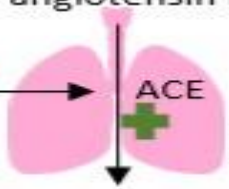
Decrease in renal perfusion

angiotensinogen

✚ renin

angiotensin I

ACEi ▬

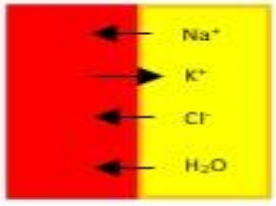


ACE in found in lung and renal endothelium

angiotensin II

✚ Increased sympathetic drive

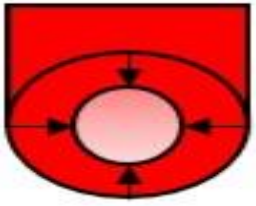
✚ Tubular Na^+ Cl^- reabsorption and K^+ excretion. H_2O retention



✚ Adrenal Cortex

Aldosterone Secretion

✚ Arteriole vasoconstriction leading to increase in BP

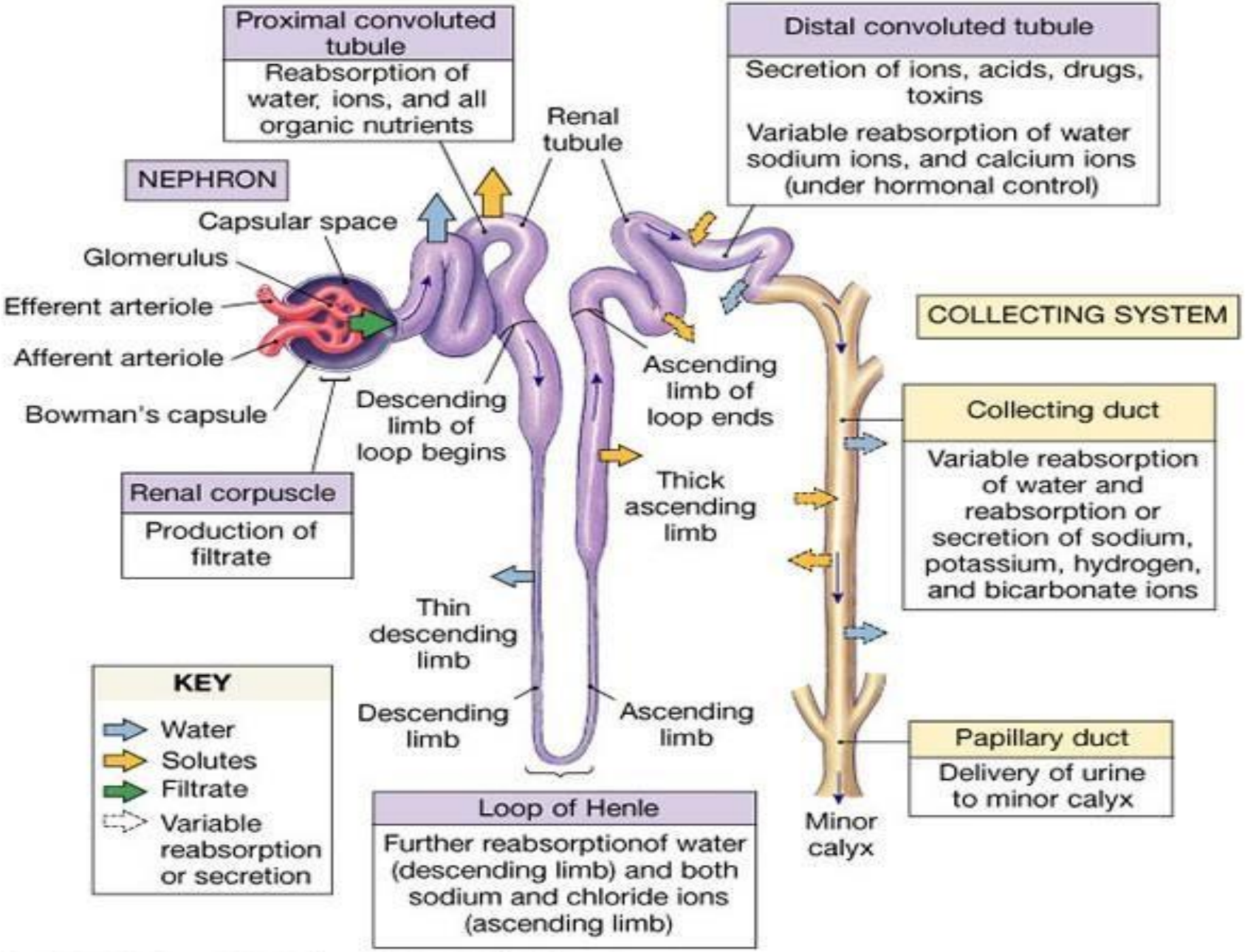


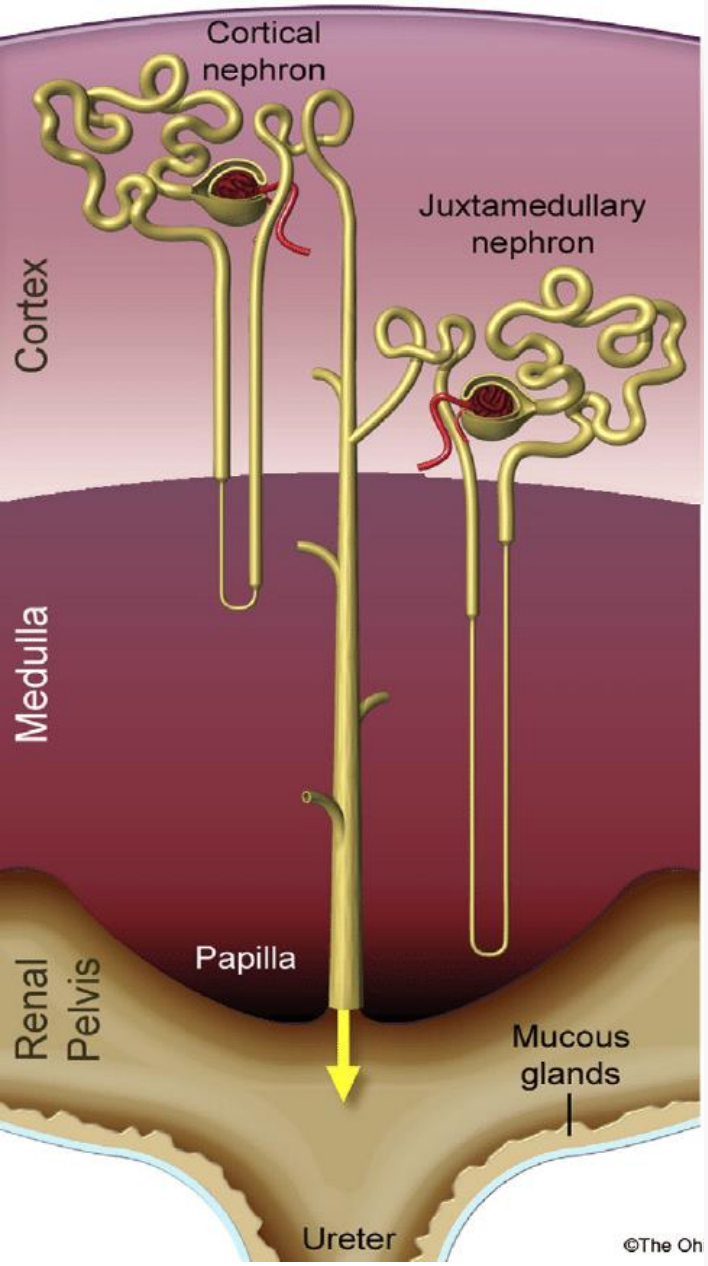
✚ Posterior pituitary

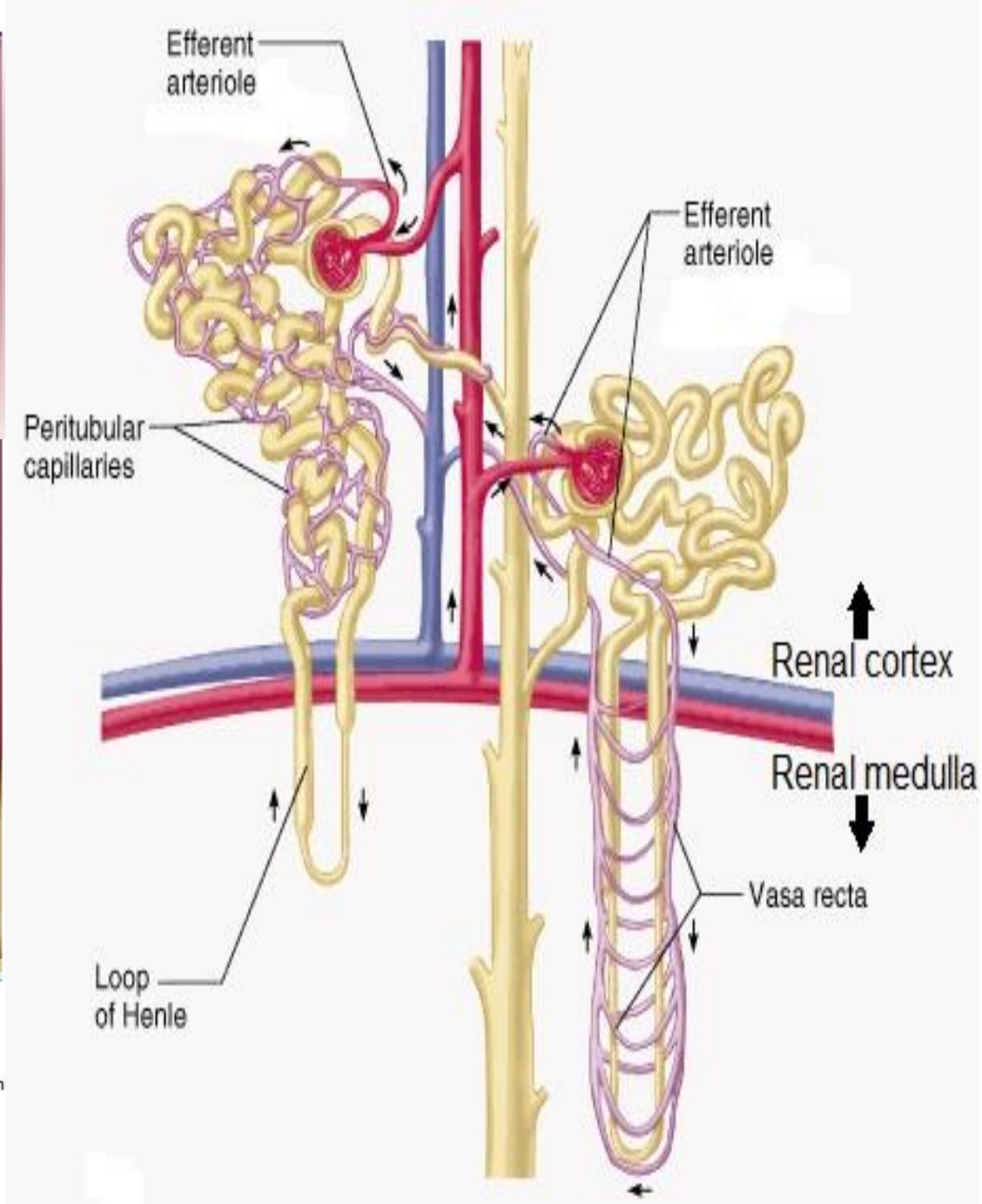
Anti-diuretic hormone secretion

Collecting duct water reabsorption

Water and salt retention increases circulating volume.
Increases juxtaglomerular apparatus perfusion




Cortical nephron
Juxtamedullary nephron
Cortex
Medulla
Papilla
Renal Pelvis
Mucous glands
Ureter
©The Oh


Efferent arteriole
Efferent arteriole
Peritubular capillaries
Renal cortex
Renal medulla
Vasa recta
Loop of Henle

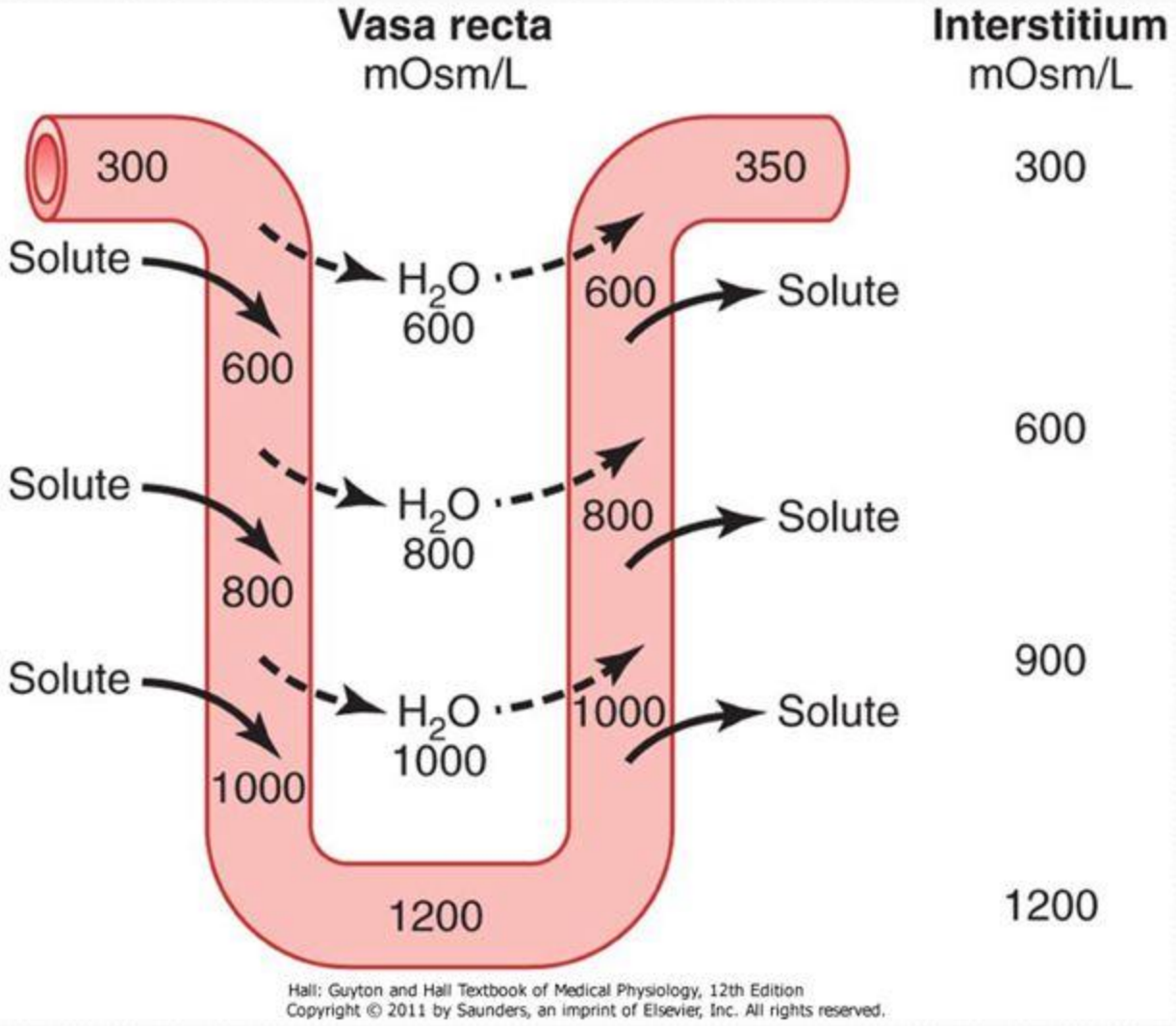


Fig. 28.7 Countercurrent exchange in the vasa recta

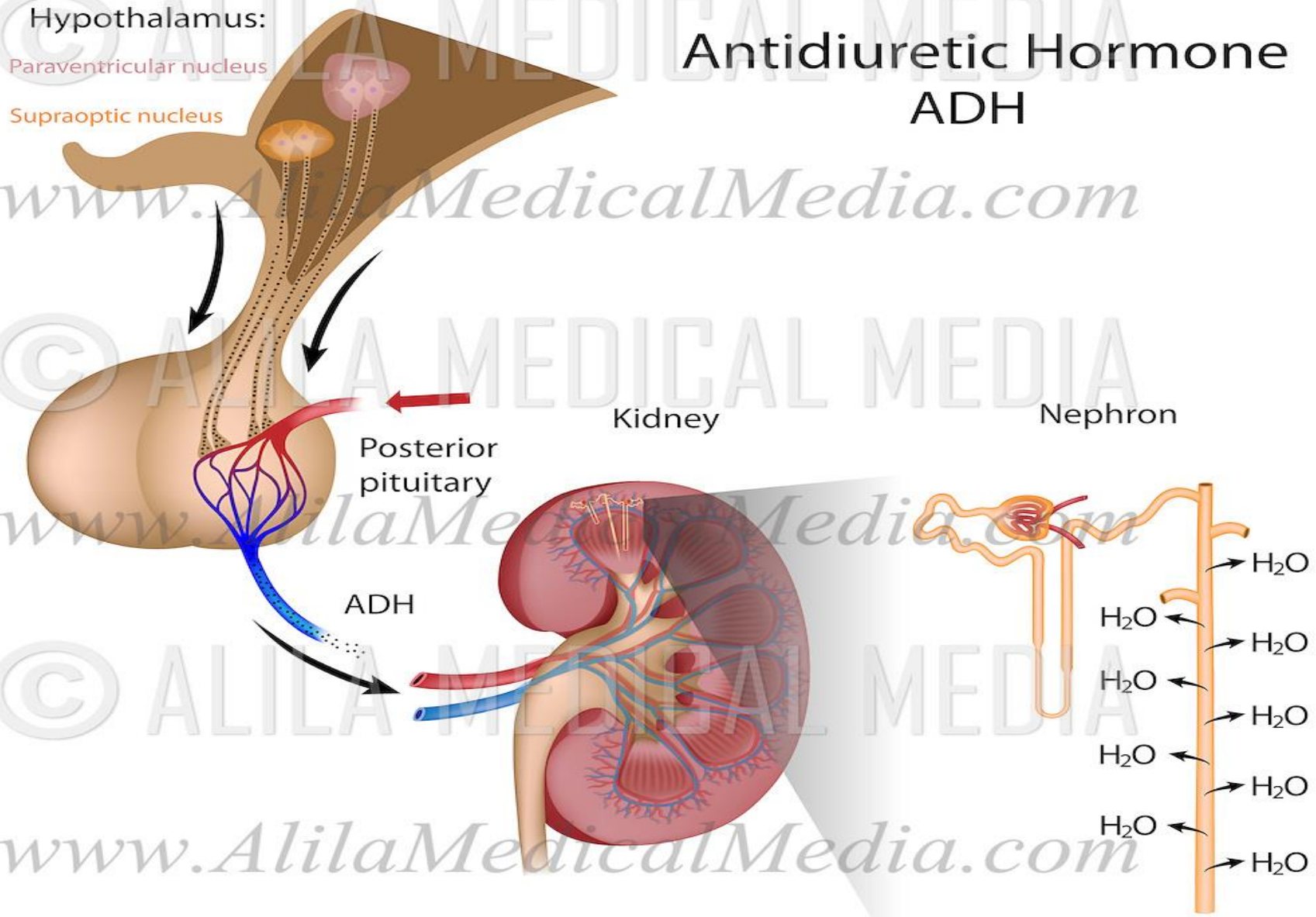
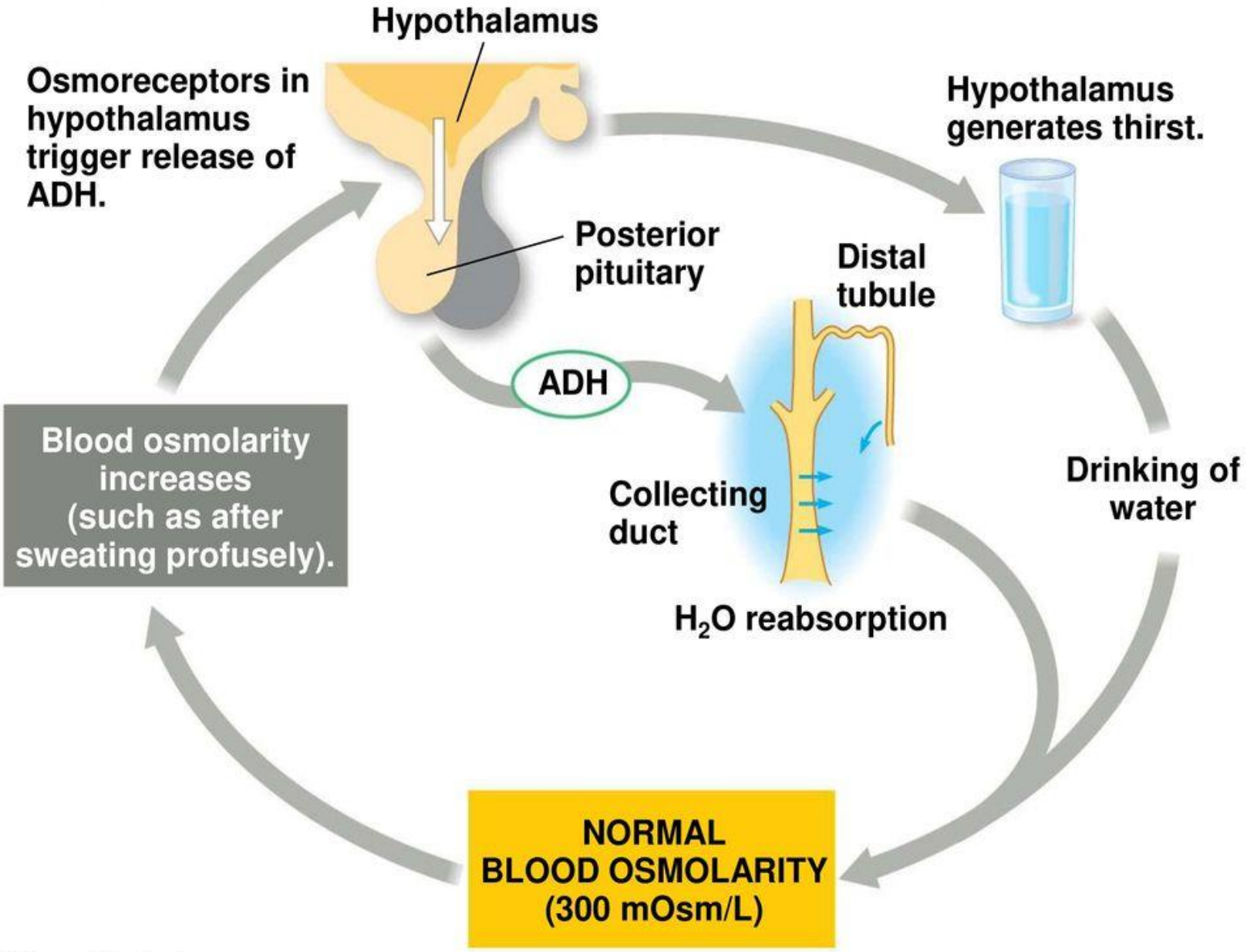
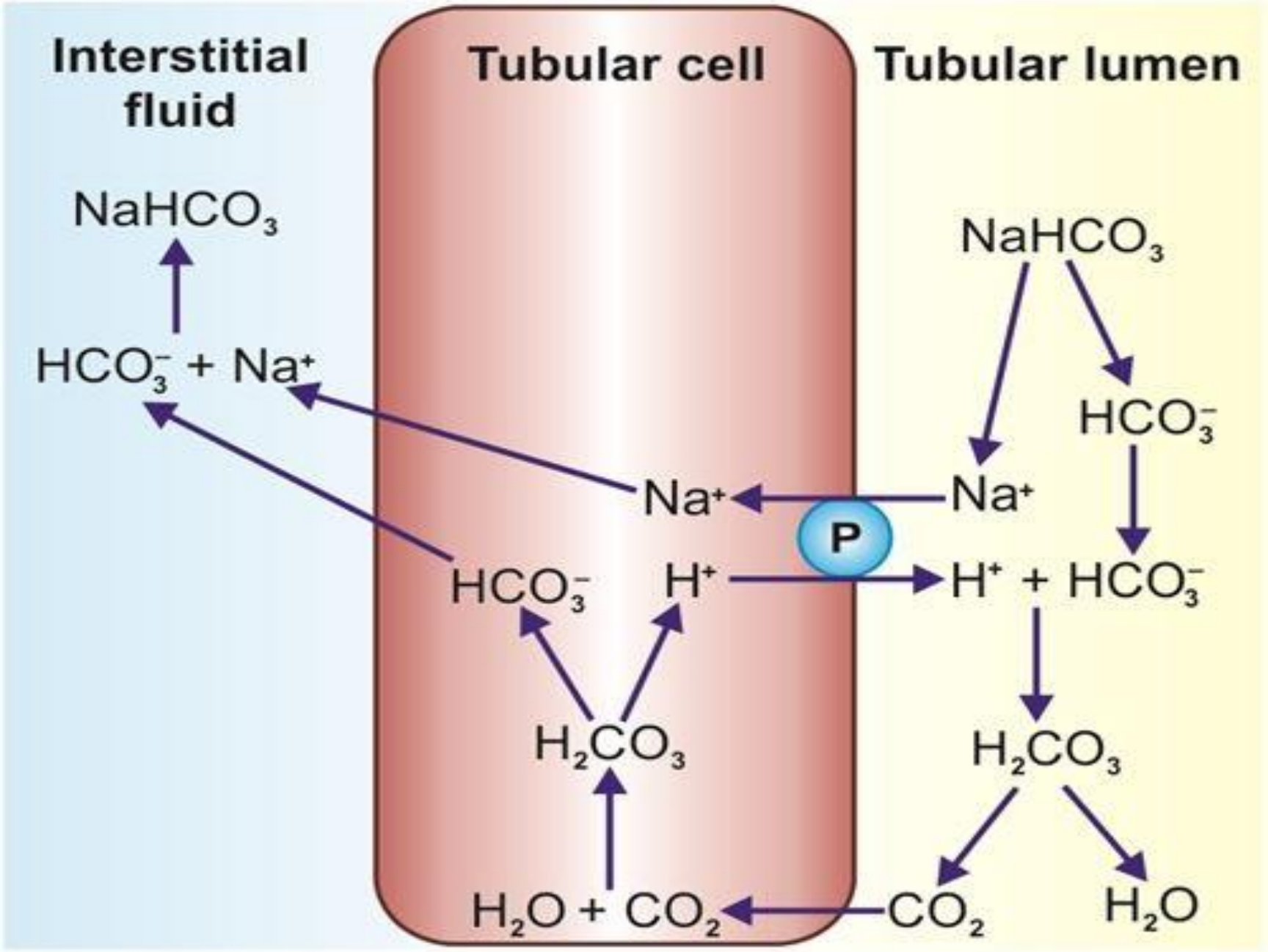


Figure 32.24-s3




Interstitial fluid
Tubular cell
Tubular lumen
NaHCO3
HCO3- + Na+
NaHCO3
HCO3-
Na+
Na+
P
HCO3-
H+
H+ + HCO3-
H2CO3
H2CO3
H2O + CO2
CO2
H2O

Renal Clearance

Definition:

Is the volume of plasma completely cleared of a substance by the kidneys per unit time.

The higher the renal clearance, the more plasma that is cleared of the substance.

Unit: ml/min

Equation for renal clearance

$$C_x = \frac{U_x \times V}{P_x}$$

Where x = substance

C_x = clearance of substance

U_x = urine concentration of substance

P_x = plasma concentration of substance

V = urine flow rate (ml/min)

Amount of substance excreted = (filtered – reabsorbed + secreted)

$U_x V = GFR \times P_x \pm T_x$