PHYSIOLOGY

FACULTY OF PHARMACEUTICAL SCIENCES
DR. AMJAAD ZUHIER ALROSAN

امثله على اجهزه تنظيم

HOMEOSTASIS

- Nervous system regulates homeostasis through sending electrical signals known as **nerve impulses** (action potentials) to organs…. *Rapid change*

نبضات عصبيه

جهاز الصماوي او جهاز الغدد الصماء

افراز

- The endocrine system regulates homeostasis through secreting messenger molecules called **hormones** into the blood….. *Slow change*

جزيئات ناقله

- Rapid or slow changes work toward the **negative feedback systems**.

PERIPHERAL NERVOUS SYSTEM

الجهاز العصبي الجسدي

Somatic nervous system (SNS) — skeletal muscles only

الجهاز العصبي الذاتي او اللاارادي

Autonomic nervous system (ANS) — smooth muscles , cardiac muscles and glands

الجهاز العصبي المعوي

Enteric nervous system (ENS) — GI

SOMATIC NERVOUS SYSTEM (SNS) (CONSCIOUSLY CONTROLLED)

1. **Sensory neurons** that convey information to CNS from somatic receptors in the head, body wall, and limbs and from receptors for the special senses of vision, hearing, taste, and smell.

1. الخلايا العصبية الحسية التي تنقل المعلومات إلى الجهاز العصبي المركزي من المستقبلات الجسدية في الرأس وجدار الجسم والأطراف ومن مستقبلات الحواس الخاصة بالرؤية والسمع والتذوق والشم.

2. **Motor neurons** that conduct impulses from the CNS to skeletal muscles only.

2. الخلايا العصبية الحركية التي تنقل النبضات من الجهاز العصبي المركزي إلى العضلات الهيكلية فقط.

AUTONOMIC NERVOUS SYSTEM (ANS) (INVOLUNTARY)

1. **Sensory neurons** that convey information to CNS from autonomic sensory receptors, located primarily in visceral organs such as the stomach and lungs.

1. الخلايا العصبية الحسية التي تنقل المعلومات إلى الجهاز العصبي المركزي من مستقبلات حسية ذاتية، تقع بشكل أساسي في الأعضاء الحشوية مثل المعدة والرئتين.

2. **Motor neurons** that conduct nerve impulses from the CNS to smooth muscle, cardiac muscle, and glands.

2. الخلايا العصبية الحركية التي تنقل النبضات العصبية من الجهاز العصبي المركزي إلى العضلات الملساء وعضلة القلب والغدد.

Note: The motor part of the ANS consists of two branches, the **sympathetic division and the parasympathetic division**.

ملاحظة: يتكون الجزء الحركي من الجهاز العصبي الذاتي من فرعين، القسم الودي والقسم اللاودي.

ENTERIC NERVOUS SYSTEM (ENS) (THE BRAIN OF THE GUT) (INVOLUNTARY)

1. **Sensory neurons** of the ENS monitor chemical changes within the GI tract as well as the stretching of its walls.

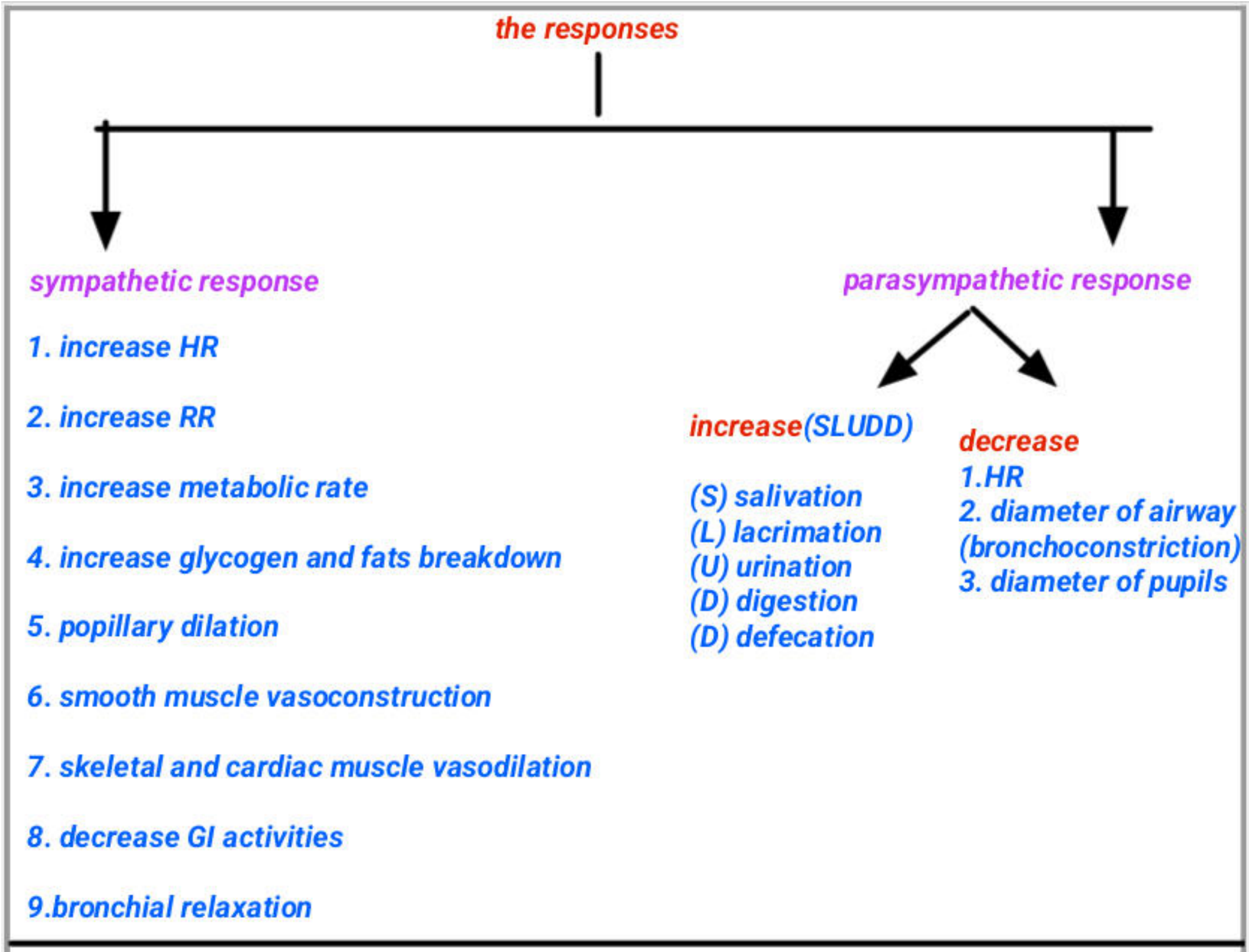
1. تراقب الخلايا العصبية الحسية للجهاز العصبي المعوي التغيرات الكيميائية داخل الجهاز الهضمي بالإضافة إلى تمدد جدرانه.

2. **Motor neurons** govern contractions of GI tract smooth muscle to propel food through the GI tract, secretions of GI tract organs (such as acid from the stomach and hormones from GI tract endocrine cells).

2| تتحكم الخلايا العصبية الحركية في انقباضات العضلات الملساء في الجهاز الهضمي لدفع الطعام عبر الجهاز الهضمي، وإفرازات أعضاء الجهاز الهضمي (مثل الحمض من المعدة والهرمونات من خلايا الغدد الصماء في الجهاز الهضمي).

Table 8–5 FUNCTIONS OF THE AUTONOMIC NERVOUS SYSTEM

Organ	Sympathetic Response	Parasympathetic Response
Heart (cardiac muscle)	• Increase rate	• Decrease rate (to normal)
Bronchioles (smooth muscle)	• Dilate	• Constrict (to normal)
Iris (smooth muscle)	• Pupil dilates	• Pupil constricts (to normal)
Salivary glands	• Decrease secretion	• Increase secretion (to normal)
Stomach and intestines (smooth muscle)	• Decrease peristalsis	• Increase peristalsis for normal digestion
Stomach and intestines (glands)	• Decrease secretion	• Increase secretion for normal digestion
Internal anal sphincter	• Contracts to prevent defecation	• Relaxes to permit defecation
Urinary bladder (smooth muscle)	• Relaxes to prevent urination	• Contracts for normal urination
Internal urethral sphincter	• Contracts to prevent urination	• Relaxes to permit urination
Liver	• Changes glycogen to glucose	• None
Pancreas	• Secretes glucagon	• Secretes insulin and digestive enzymes
Sweat glands	• Increase secretion	• None
Blood vessels in skin and viscera (smooth muscle)	• Constrict	• None
Blood vessels in skeletal muscle (smooth muscle)	• Dilate	• None
Adrenal glands	• Increase secretion of epinephrine and norepinephrine	• None


the responses
sympathetic response
1. increase HR
2. increase RR
3. increase metabolic rate
4. increase glycogen and fats breakdown
5. popillary dilation
6. smooth muscle vasoconstruction
7. skeletal and cardiac muscle vasodilation
8. decrease GI activities
9.bronchial relaxation
parasympathetic response
increase(SLUDD)
(S) salivation
(L) lacrimation
(U) urination
(D) digestion
(D) defecation
decrease
1.HR
2. diameter of airway (bronchoconstriction)
3. diameter of pupils

Comparison of Graded Potentials and Action Potentials

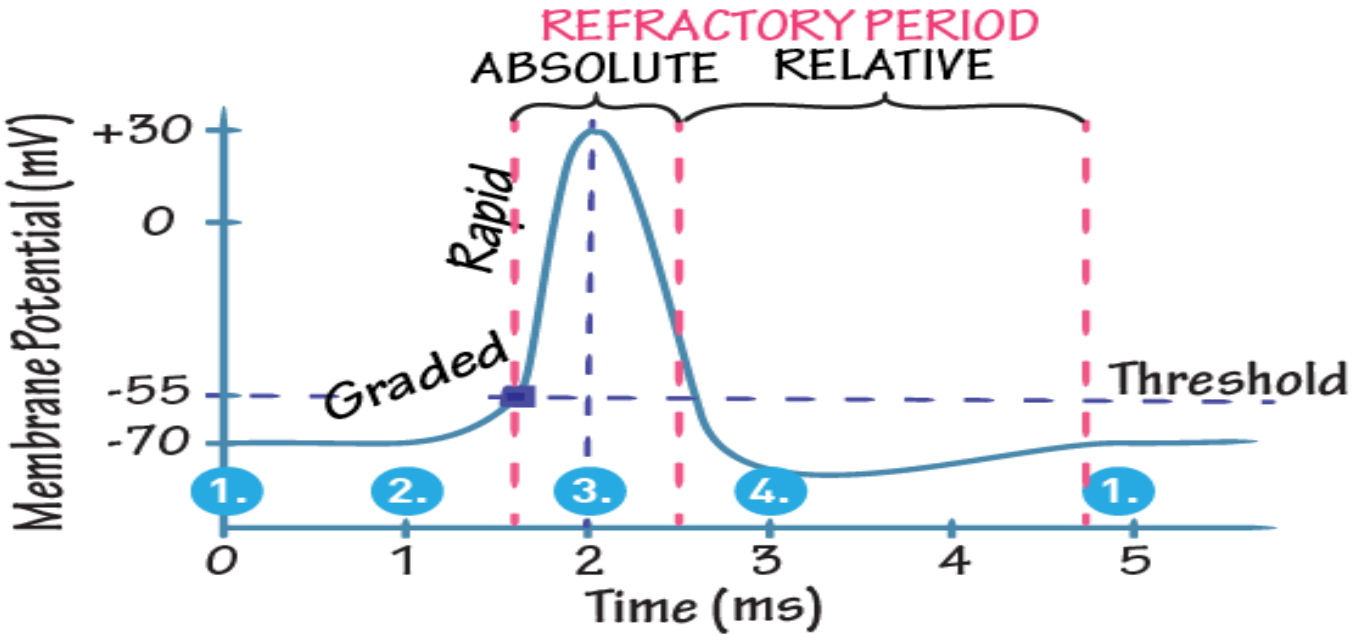
Graded Potential

1. Stimulus does not reach threshold level.
2. Stimulus causes local change in membrane potential e.g. -70 to -60mv
3. It dies down over short distance.
4. Can be summated.
5. Does not obey all or none law.

Action Potential

1. Stimulus reaches threshold level therefore causes AP.
2. Stimulus causes depolarization to threshold level.
3. It is propagated.
4. Can not be summated.
5. Obeys all or none law.

Action Potentials



1. Resting state - All gated ion channels closed
2. Depolarization - Na+ channels open, K+ channels closed
3. Repolarization - Na+ channels inactivated, K+ channels open
4. Hyperpolarization - Na+ channels reset and closed, K+ channels still open

هذا شرح للرسمة

- *the resting membrane potential is -70*
- *once it changed and become -60 for example that means we have a graded potential*
- *once it arrives -55 that's called threshold and the graded potential becomes an action potential*
- *then from -55 to +30 this called depolarization*
- *from +30 to -70 again that's called repolarization or hyperpolarization*
- *sometimes the channel still opened which make it from-70 to -90 and this called after hyperpolarization but it goes back to-70 because of the leak channels which are always open*
- *refractory period is a period of time after an action potential begins and the cell cannot regenerate an another action potential in this period*
- *the last one means that there is no refractory period for the graded potential which is between -70 to -55*

Figure 10.6 The Contraction Cycle

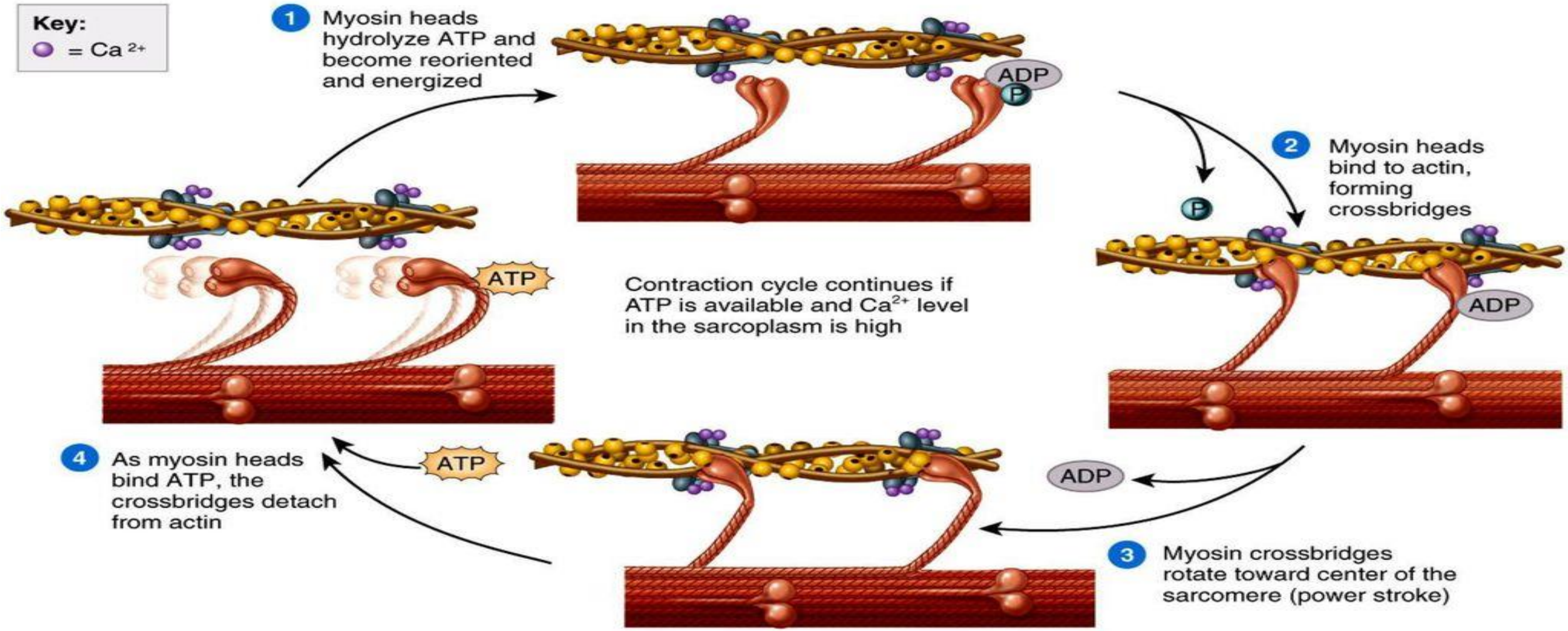


Figure 10.07 Tortora - PAP 12/e

muscle contraction:(the sliding filament mechanism)

we need for contraction
- ATP hydrolysis
- actin
- myosin
- calcium ions

the contraction cycle
- ATP hydrolysis
- cross-bridges
- power stroke
- the deattachment of myosin and actin

1_ ATP hydrolysis to ADP and phosphate a group and that was Faith group attach to Myosin and make energized myosin

2_ the energized myosin will try to attach to the myosin binding site on actin but this it will be busy by tropomyosin

3_ here we need the calcium, the calcium will attach to troponin and activate it and this will make the troponin attached to tropomyosin

4_ the energized myosin will attach to myosin binding site on actin

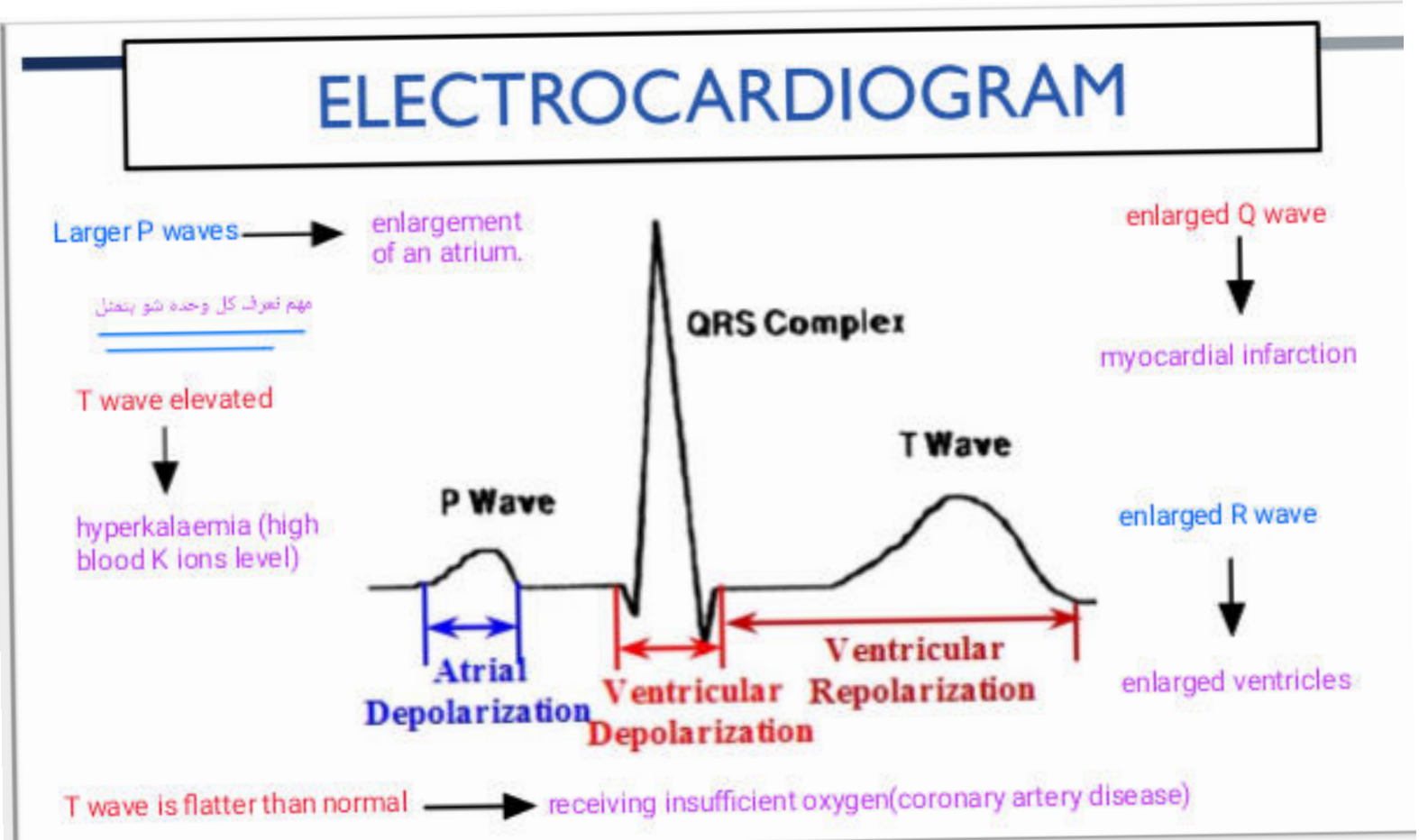
طبعا لا تنسوا تدرسوا شو بصير ب I band , z line , H zone الى آخره

معلومه مهمه :

the type of synapse in the skeletal muscles is chemical synapse

الدكتورة حاطه بس الصورة بس ما بتعرف
يمكن تسأل عن كل شي بخصها

ELECTROCARDIOGRAM



segments or intervals of ECG

P-Q interval

beginning of the P wave to the beginning of the QRS complex.

beginning of atrial excitation to the beginning of ventricular excitation.

S-T segment

end of the S wave and to the beginning of the T wave

ventricular contractile fibers are depolarized during the plateau phase of the action potential

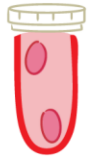
Q-T interval

the beginning of the QRS complex to the end of the T wave.

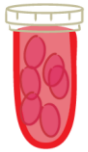
the beginning of ventricular depolarization to the end of ventricular repolarization

Determinants of Resistance:

Blood Viscosity (η) $\propto$ Resistance

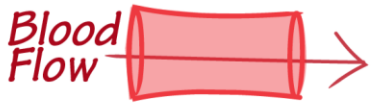


↓Resistance



↑Resistance

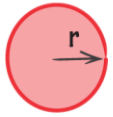
Vessel Length (l) $\propto$ Resistance



↓Resistance

↑Resistance

Vessel Radius (r) $\propto$ Resistance



↓Resistance

↑ Resistance

Vascular resistance → the opposition to blood flow due to friction between blood and the walls of blood vessels.

depends on:
- (1) size of the blood vessel lumen ↓
- (2) blood viscosity ↑
- (3) total blood vessel length ↑

the blood viscosity → depends on
- ratio of red blood cells to plasma (fluid) volume
- the concentration of proteins in plasma.

viscosity increase → blood pressure increase
(dehydration)
(polycythemia : unusually high number of red blood cells)

depletion of plasma proteins or red blood cells(viscosity decrease) → blood pressure decrease
(anemia)
(hemorrhage)

Systemic vascular resistance (SVR), (total peripheral resistance)(TPR) → all of the vascular resistances offered by systemic blood vessels.

↓ The speed or velocity of blood flow (in cm/sec) → inversely related to the cross-sectional area ↑

Factors that Increase Blood Pressure

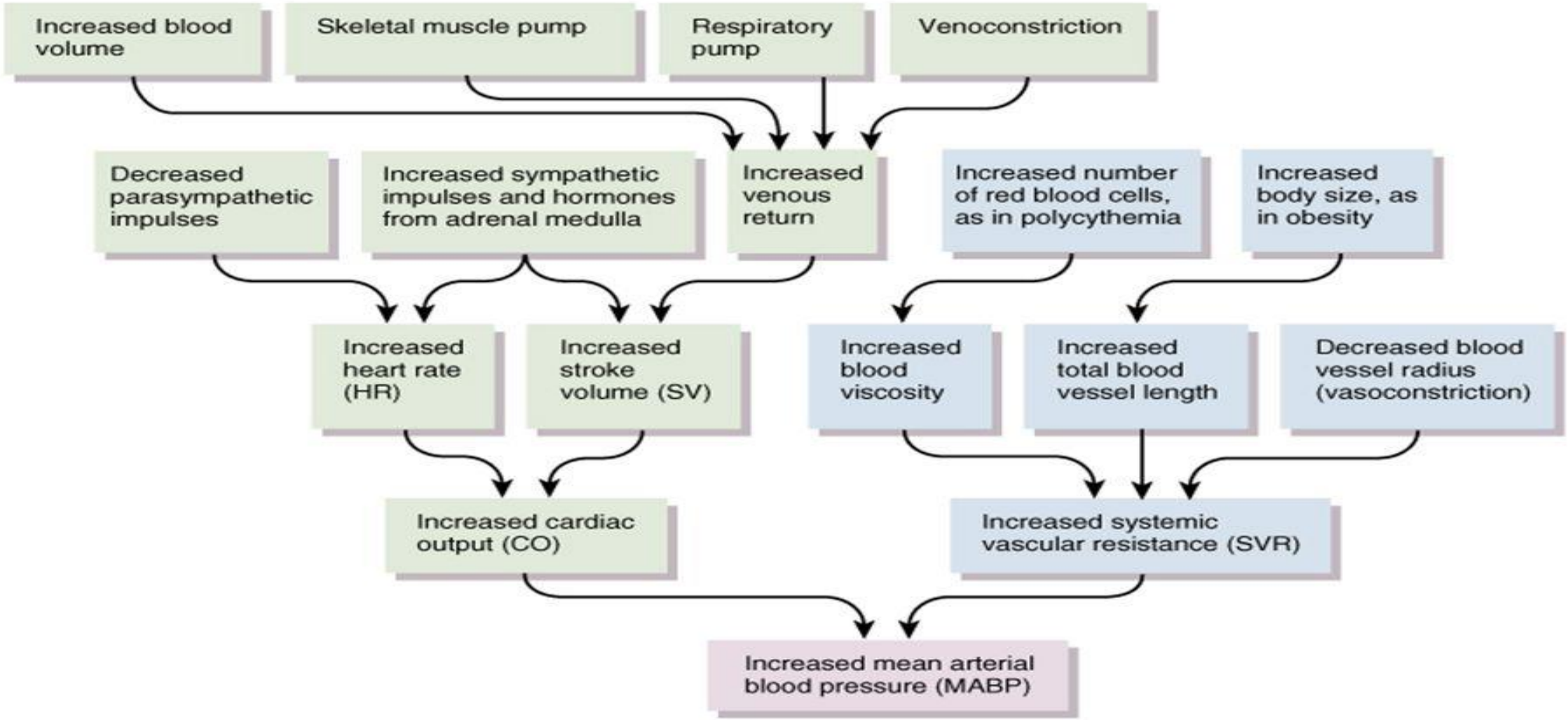


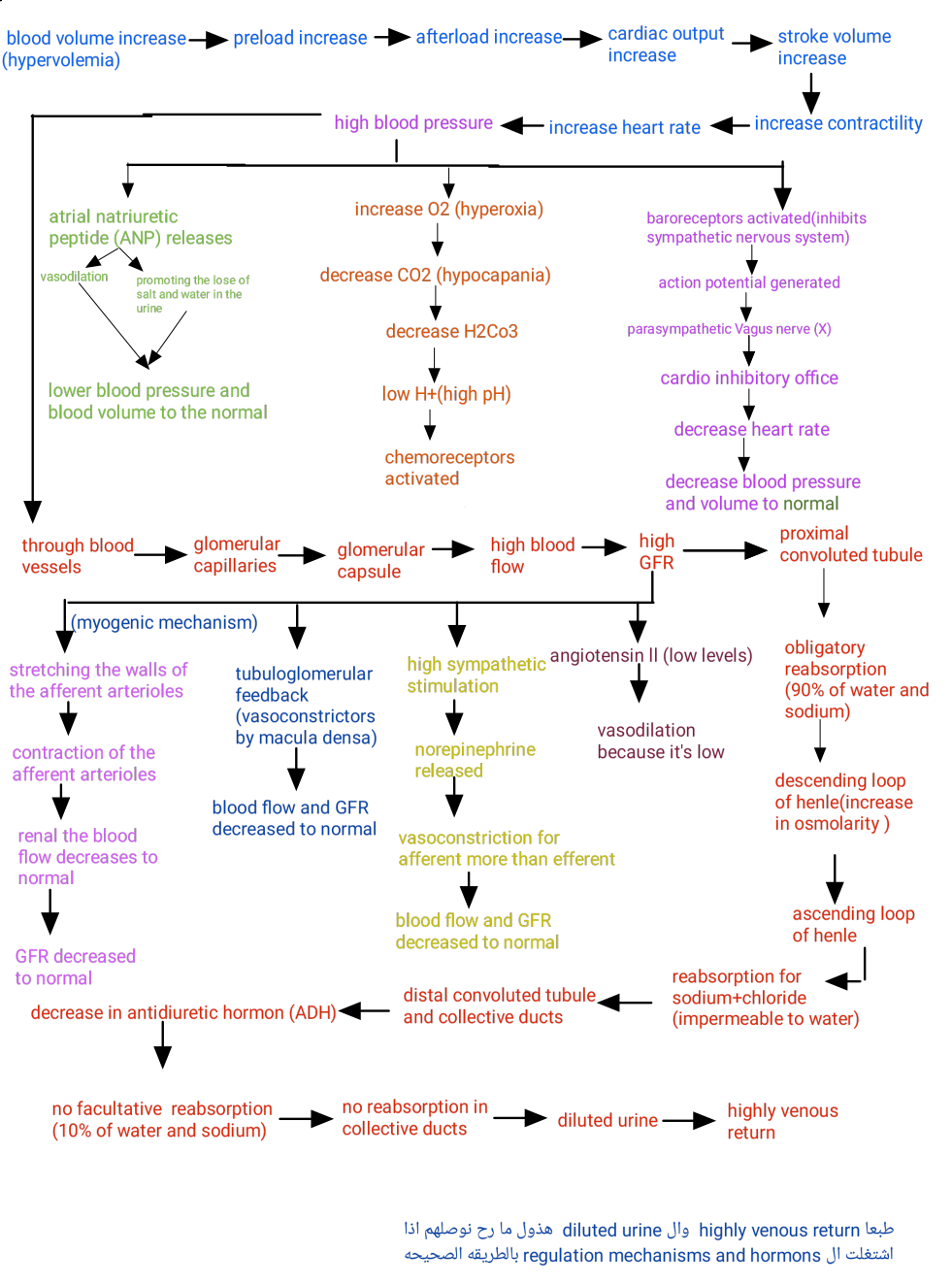
TABLE 26.4

Hormonal Regulation of Tubular Reabsorption and Tubular Secretion

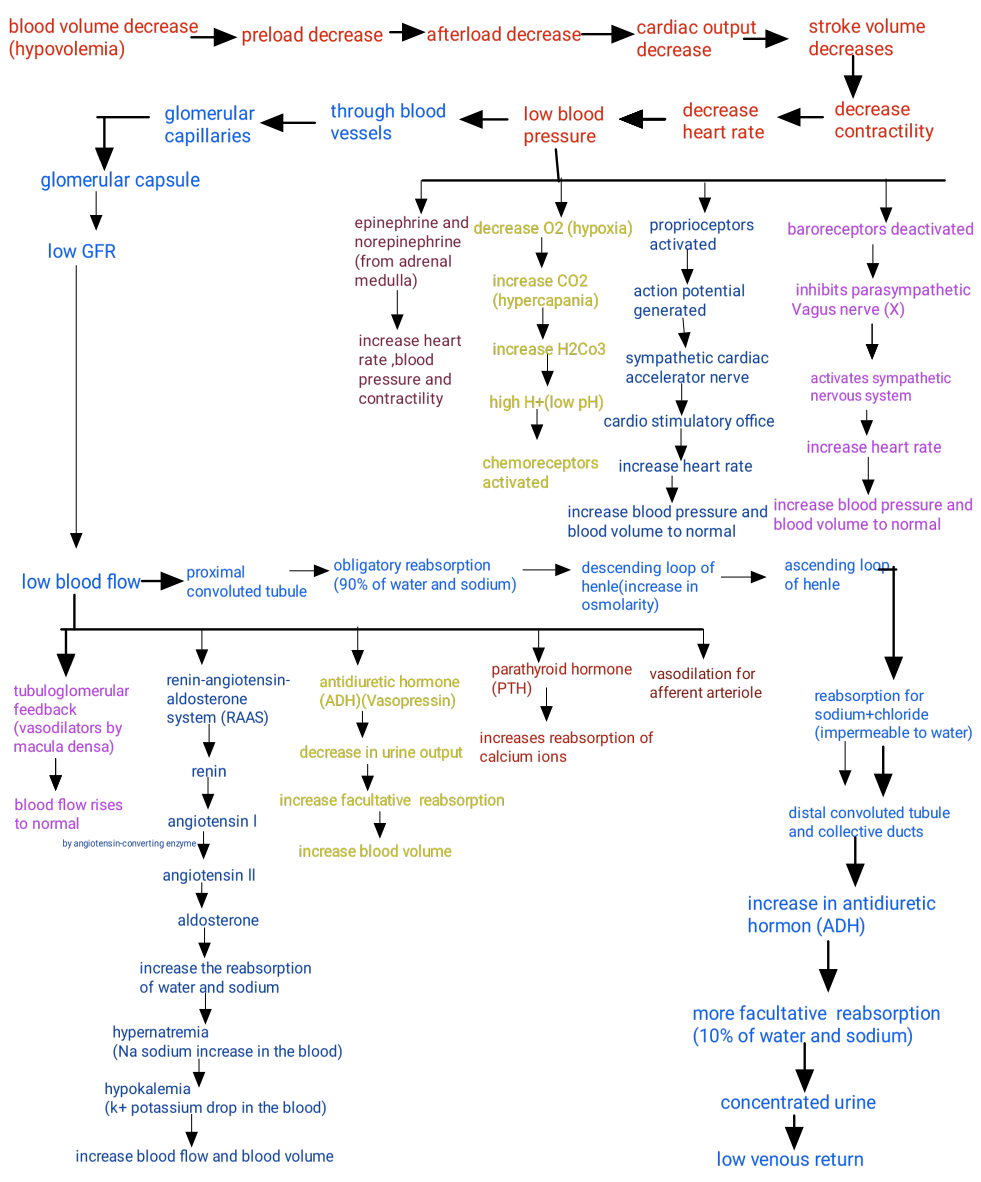
HORMONE	MAJOR STIMULI THAT TRIGGER RELEASE	MECHANISM AND SITE OF ACTION	EFFECTS
Angiotensin II	Low blood volume or low blood pressure stimulates renin-induced production of angiotensin II.	Stimulates activity of Na^+–H^+ antiporters in proximal tubule cells.	Increases reabsorption of Na^+, other solutes, and water, which increases blood volume and blood pressure.
Aldosterone	Increased angiotensin II level and increased level of plasma K^+ promote release of aldosterone by adrenal cortex.	Enhances activity of sodium–potassium pumps in basolateral membrane and Na^+ channels in apical membrane of principal cells in collecting duct.	Increases secretion of K^+ and reabsorption of Na^+, Cl^-; increases reabsorption of water, which increases blood volume and blood pressure.
Antidiuretic hormone (ADH)	Increased osmolarity of extracellular fluid or decreased blood volume promotes release of ADH from posterior pituitary gland.	Stimulates insertion of water channel proteins (aquaporin-2) into apical membranes of principal cells.	Increases facultative reabsorption of water, which decreases osmolarity of body fluids.
Atrial natriuretic peptide (ANP)	Stretching of atria of heart stimulates ANP secretion.	Suppresses reabsorption of Na^+ and water in proximal tubule and collecting duct; inhibits secretion of aldosterone and ADH.	Increases excretion of Na^+ in urine (natriuresis); increases urine output (diuresis) and thus decreases blood volume and blood pressure.
Parathyroid hormone (PTH)	Decreased level of plasma Ca^{2+} promotes release of PTH from parathyroid glands.	Stimulates opening of Ca^{2+} channels in apical membranes of early distal tubule cells.	Increases reabsorption of Ca^{2+}.

هدول عشان اخر سلايدين

physiology from heart to urinary system (scenarios)



طبعا highly venous return وال diluted urine هذول ما رح نوصلهم اذا اشتغلت ال regulation mechanisms and hormons بالطريقه الصحيحه



طبعا low venous return واال concentrated urine هذول ما رح نوصلهم

اذا اشتغلت ال regulation mechanisms and hormons بالطريقه الصحيحه