



# 1<sup>st</sup> year ,Physiology, Humoral control of local blood flow



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# Objective

1. Describe physiological role of vasodilators and vasoconstrictors in humoral control of circulation

Tissues and organs within the body are able to intrinsically regulate, to varying degree, their own blood supply in order to meet their metabolic and functional needs. This is termed local or intrinsic regulation of blood flow. Local regulatory mechanisms act independently of *extrinsic* control mechanisms such as sympathetic nerves and circulating hormones. Therefore, they can be demonstrated in isolated, perfused organs having no neural or hormonal influences. Ultimately, the balance between local regulatory mechanisms and extrinsic factors *in vivo* determines the *vascular tone* and therefore the blood flow within the tissue.

# Control of blood flow

## **Acute control of blood flow**

- Auto regulation
- Hyperemia
- Vasoconstriction
- Vasodilation

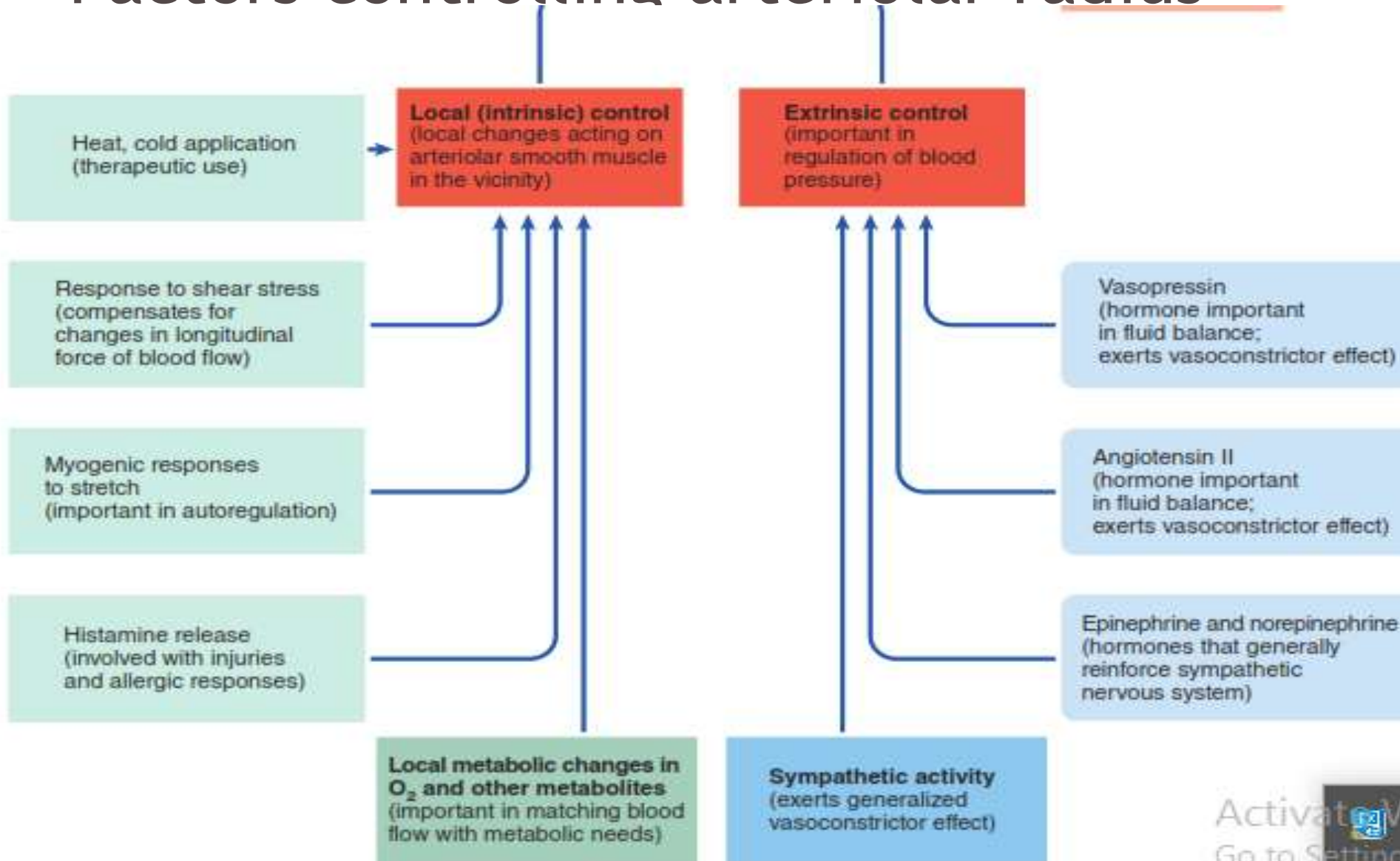
## **Long term control**

- ↑tissue vascularity
- Collateral blood vessels
- Humoral control
- Nervous control

Humoral control of the circulation means control by substances Secreted or absorbed into the body fluids, such as

- hormones
- and locally produced factors.

# Factors controlling arteriolar radius



# Humoral factors

## **vasoconstrictors**

1. Epinephrine and norepinephrine
2. Angiotensin II
3. Vasopressin

## **vasodilators**

1. Bradykinin
2. Histamine



# 1. Epinephrine and norepinephrine

- Site at which released

**Adrenal medulla**

**Sympathetic nerve endings**

# Influence of Epinephrine and Norepinephrine

## norepinephrine

Adrenal medullary norepinephrine combines with the same **a1 receptor** as sympathetically

Released norepinephrine to produce generalized

**Vasoconstriction**

## Epinephrine

abundant of the adrenal medullary hormones,

combines with **both b2 and a1 receptors** but has a much greater affinity for the b2 receptors and cause **vasodilation**

# epinephrine

## Alpha receptors

- Arterioles in digestive organs
- kidneys equipped only with  $\alpha_1$  receptors

## Beta receptors

- skeletal muscles and
- heart to reinforce local vasodilator mechanisms

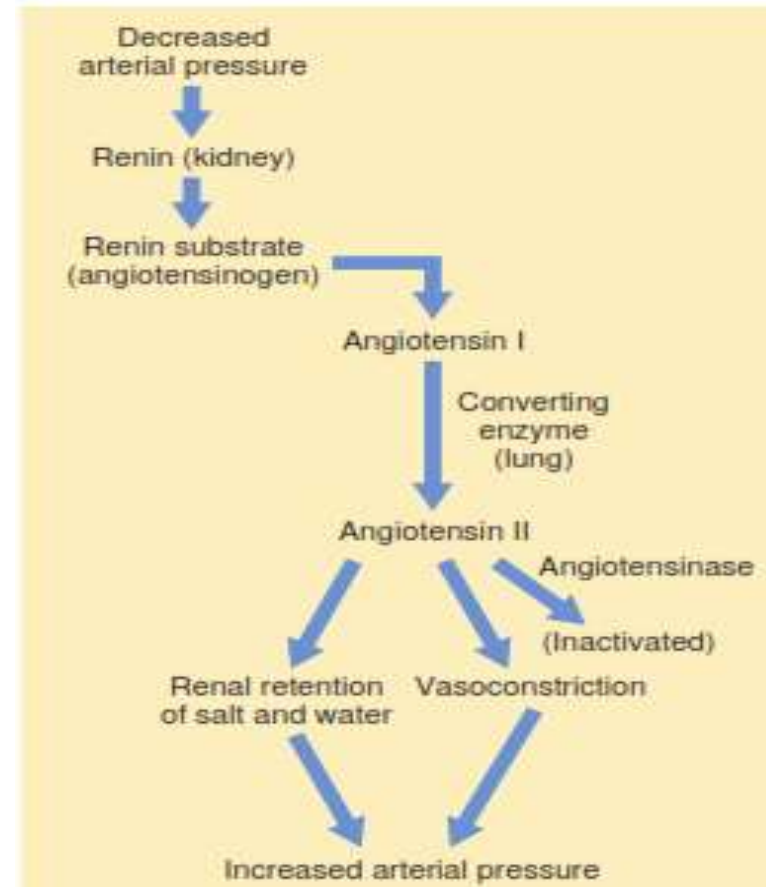
# In situation of stress or exercise

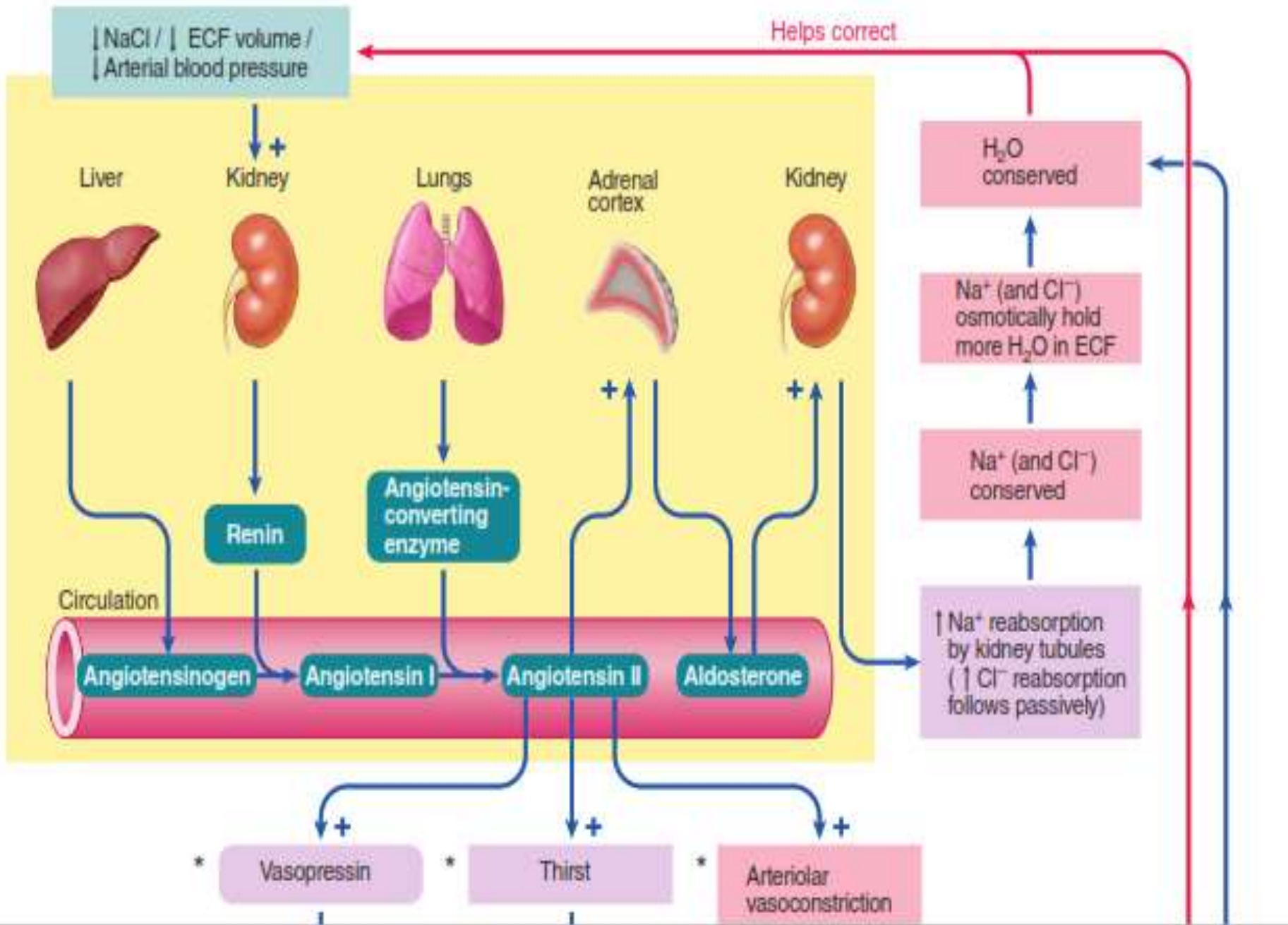
vasoconstriction in renal and GIT circulations  
(alpha receptors)

Vasodilation in skeletal muscles (beta stimulation)

## 2. Angiotensin II.

- As little as one millionth of a gram can increase the arterial pressure of a human being 50 mm Hg or more
- acts on many of the arterioles of the body at the same time to
  - increase the total peripheral resistance and
  - decrease sodium and water excretion by the kidneys, thereby increasing the arterial pressure.





↓ NaCl / ↓ ECF volume /  
↓ Arterial blood pressure

Helps correct

Liver

Kidney

Lungs

Adrenal cortex

Kidney

H<sub>2</sub>O conserved

Na<sup>+</sup> (and Cl<sup>-</sup>) osmotically hold more H<sub>2</sub>O in ECF

Na<sup>+</sup> (and Cl<sup>-</sup>) conserved

↑ Na<sup>+</sup> reabsorption by kidney tubules (↓ Cl<sup>-</sup> reabsorption follows passively)

\* Vasopressin

\* Thirst

\* Arteriolar vasoconstriction

Renin

Angiotensin-converting enzyme

Angiotensin I

Angiotensin II

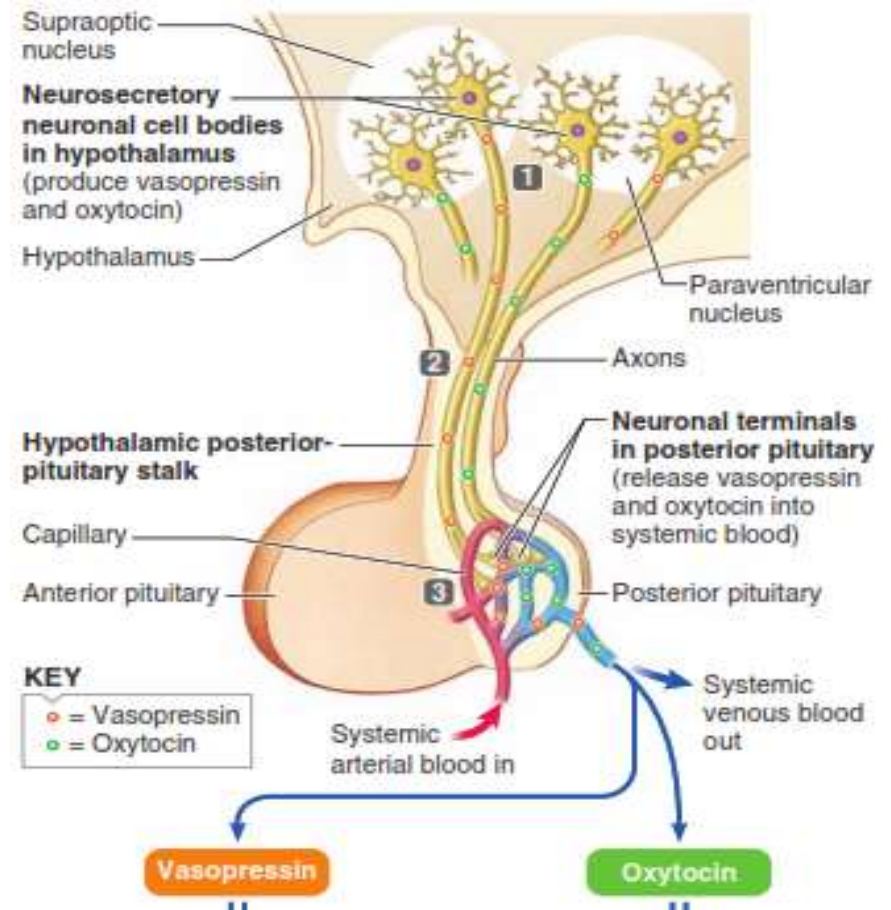
Aldosterone

Circulation

Angiotensinogen

### 3. Vasopressin (antidiuretic hormone)

- more powerful than angiotensin II
- formed in nerve cells in the hypothalamus
- transported downward by nerve axons to the posterior pituitary
- Minute amounts of vasopressin are secreted in most physiological conditions, but in severe hemorrhage its concentration increases and can raise BP by 60mmHg

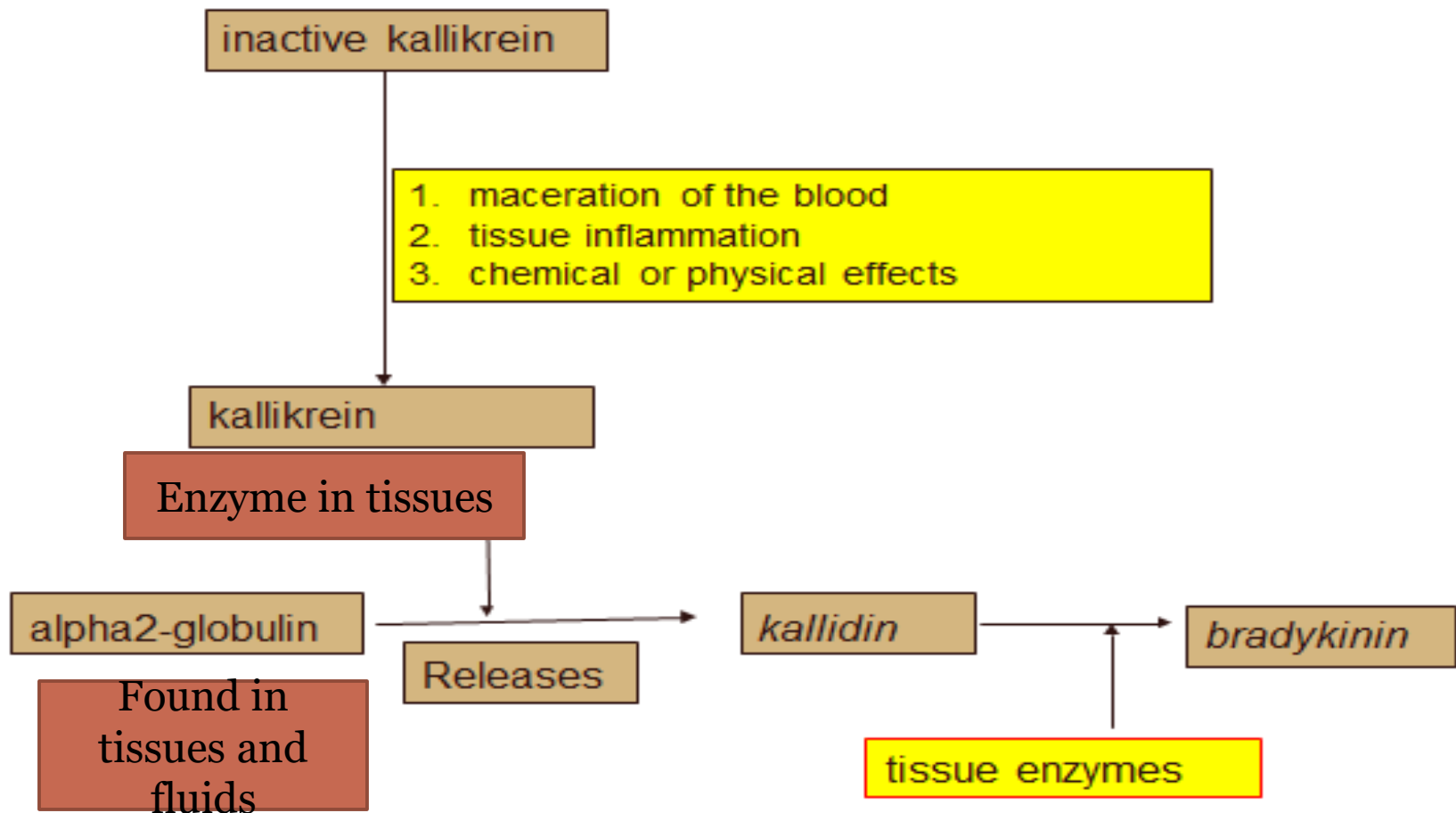


# VASODILATOR AGENTS

- 1. Bradykinin
- special role in regulating blood flow and capillary leakage of fluids in inflamed tissues.
- normal role to help regulate blood flow in the skin, as well as in the salivary and gastrointestinal glands.



# Formation of Bradykinin



- bradykinin persists for only a few minutes because it is inactivated by the enzyme carboxypeptidase

## **Actions**

- arteriolar dilation
- increased capillary permeability

# VASODILATORS

## **2. Histamine**

Released in response to

- Damage or inflammation
- in an allergic reaction.

Derived from

- mast cells in the damaged tissues and
- from basophils in the blood

# QUIZ TIME

- Injection of 1 microgram of bradykinin into the brachial artery of a person causes
- 1) .....
- 2).....

**STAY BLESSED AND  
HEALTHY**