

# PATHOPHYSIOLOGY OF CARDIOVASCULAR SYSTEM

For Class- B.Pharmacy 2<sup>nd</sup> Semester

Subject- Pathophysiology (BP204T)

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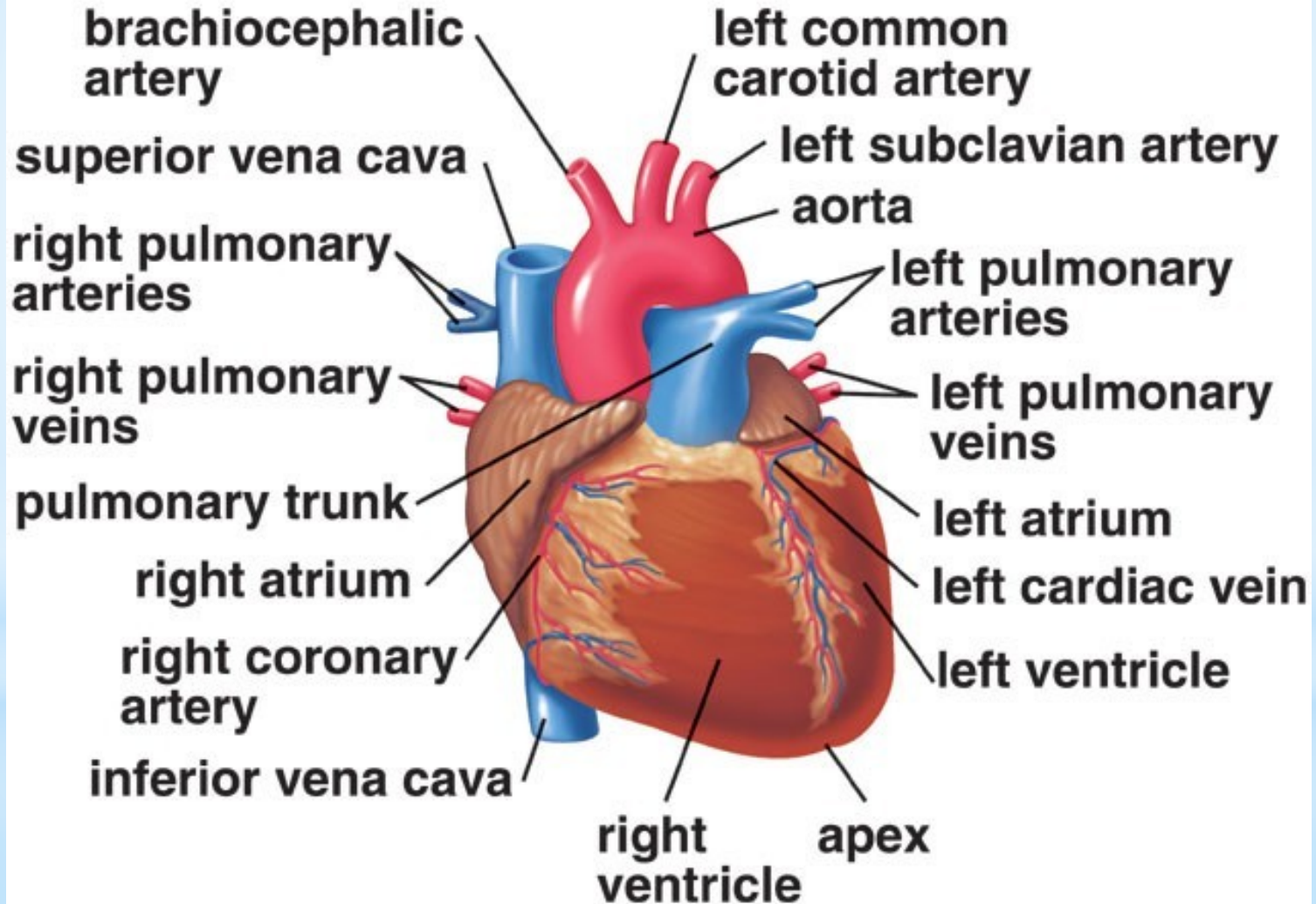
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# \*The Heart

- The *heart* is a cone-shaped, muscular organ located between the lungs behind the sternum.
- The heart muscle forms the *myocardium*, with tightly interconnect cells of *cardiac muscle* tissue.
- The *pericardium* is the outer membranous sac with lubricating fluid

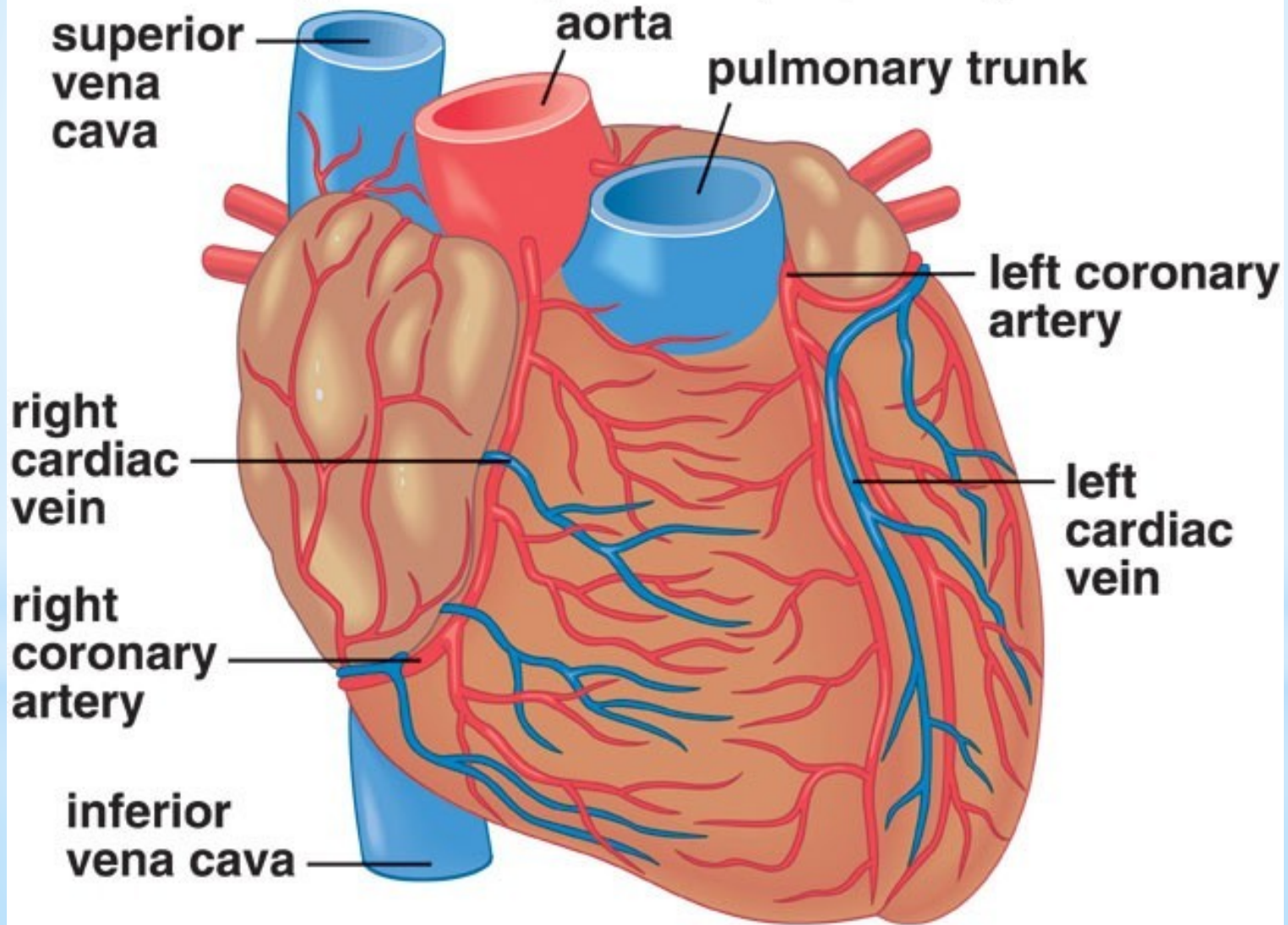
# \* External heart anatomy

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# \*Coronary artery circulation

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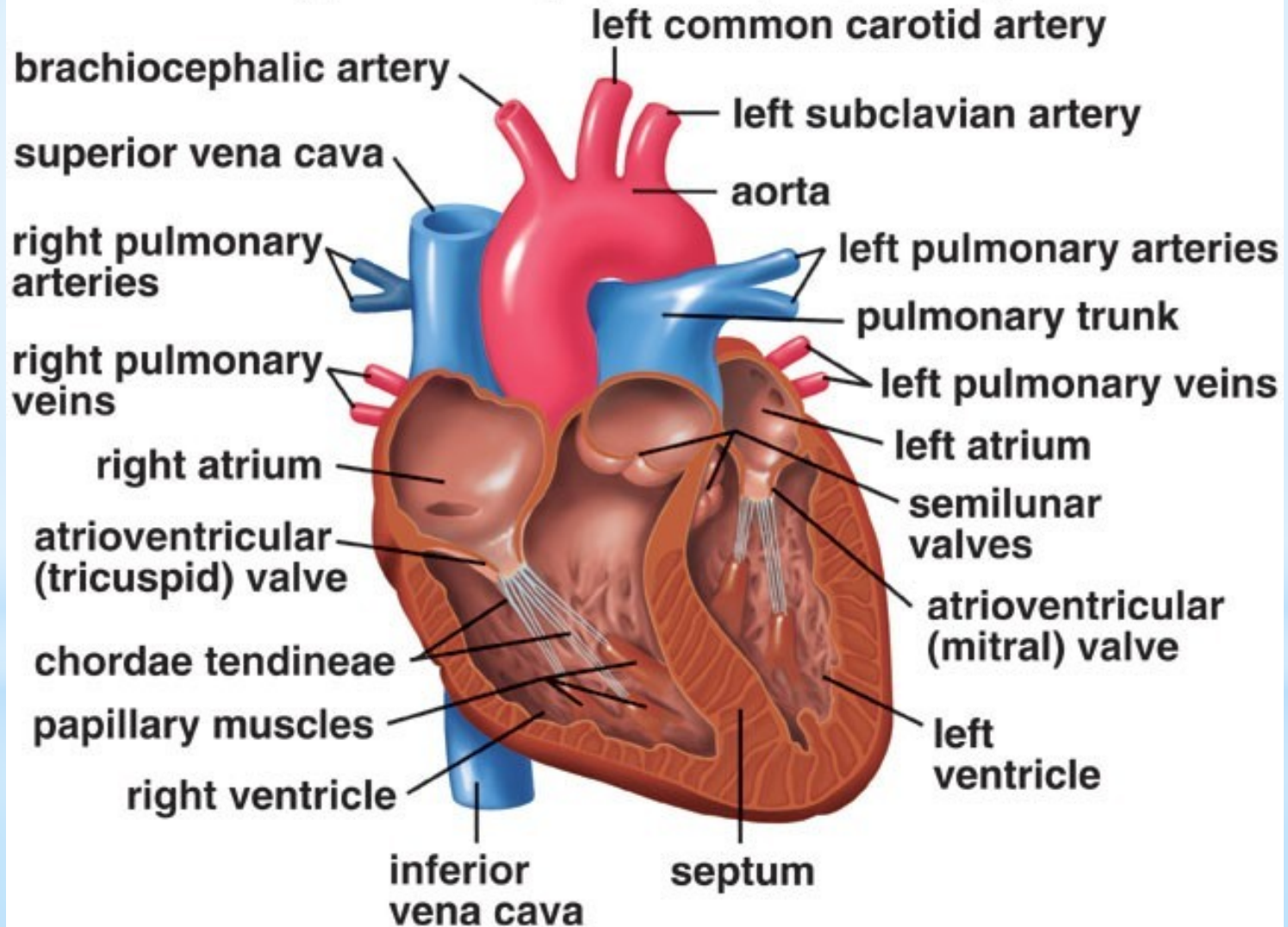


# Passage of Blood Through the Heart

- Blood follows this sequence through the heart: superior and inferior vena cava → right atrium → tricuspid valve → right ventricle → pulmonary semilunar valve → pulmonary trunk and arteries to the lungs → pulmonary veins leaving the lungs → left atrium → bicuspid valve → left ventricle → aortic semilunar valve → aorta → to the body.

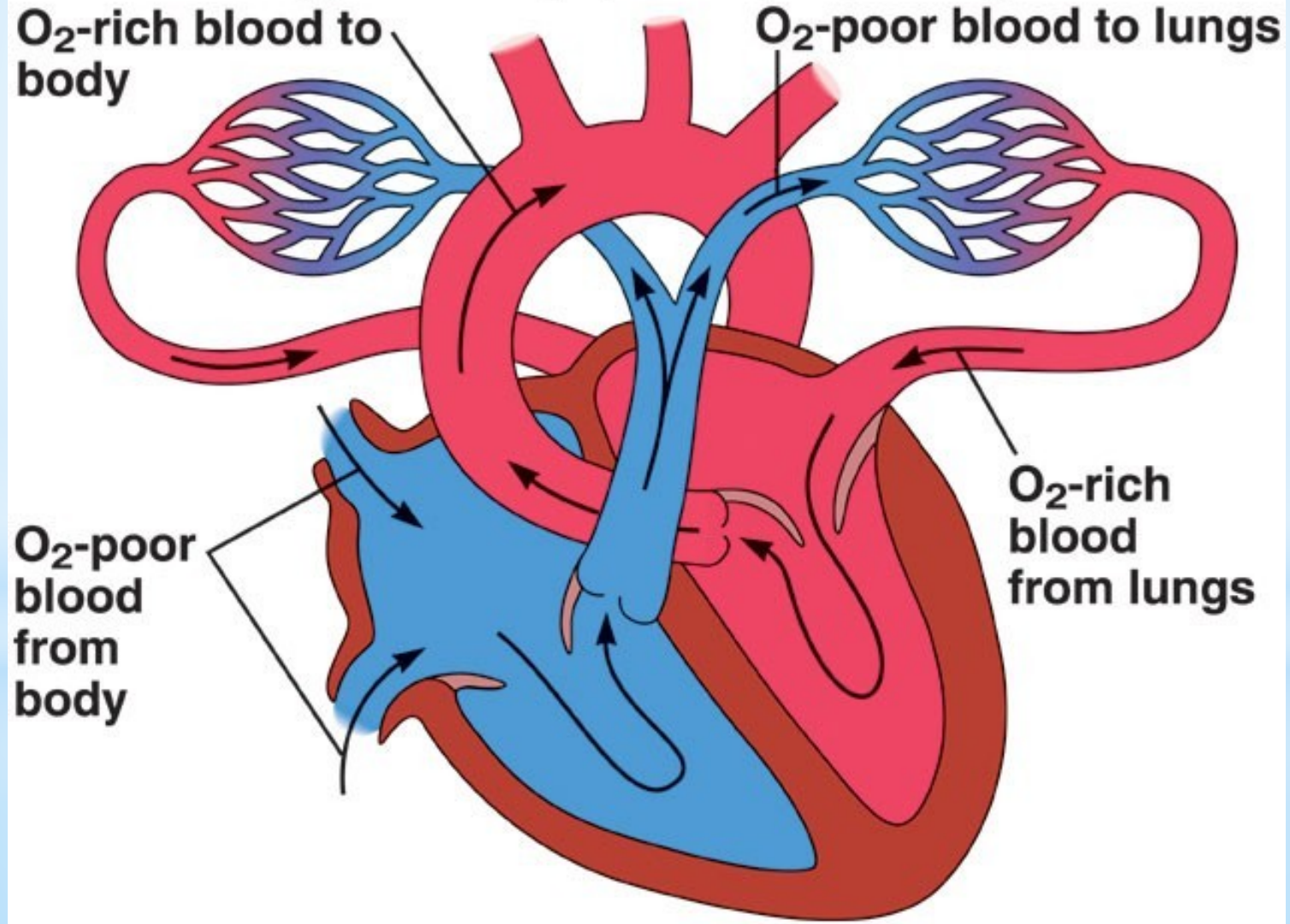
# \* Internal view of the heart

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# Path of blood through the heart

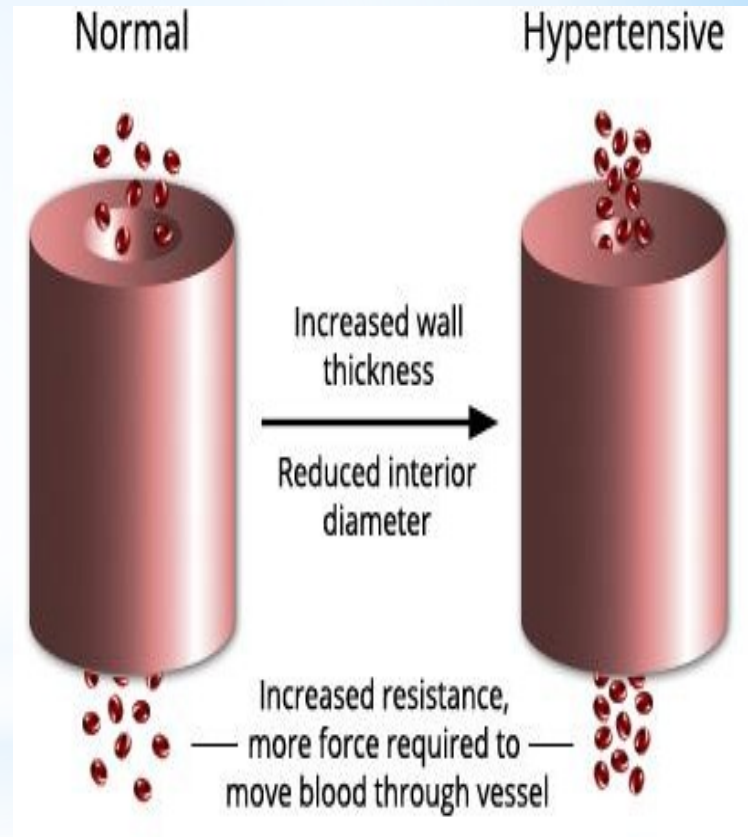
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# HYPERTENSION

- ❑ Blood pressure is the force exerted by the blood against the walls of the blood vessels
- ❑ How great the pressure is depends on the work being done by the heart and the resistance of the blood vessels.
- ❑ How great the pressure is depends on the work being done by the heart and the resistance of the blood vessels.
- ❑ Narrow arteries increase resistance. The narrower your arteries are, the higher your blood pressure will be. Over the long term, increased pressure can cause health issues, including heart disease





## ■ Types Of Hypertension

- ◆ **Essential hypertension.** This type of hypertension is diagnosed after a doctor notices that your blood pressure is high on three or more visits and eliminates all other causes of hypertension. Usually people with essential hypertension have no symptoms, but you may experience frequent headaches, tiredness, dizziness, or nose bleeds. Although the cause is unknown, researchers do know that obesity, smoking, alcohol, diet, and heredity all play a role in essential hypertension.
- ◆ **Secondary hypertension.** The most common cause of secondary hypertension is an abnormality in the arteries supplying blood to the kidneys. Other causes include airway obstruction during sleep, diseases and tumors of the adrenal gland, hormone abnormalities, thyroid disease, and too much salt or alcohol in the diet. Drugs can cause secondary hypertension, including over-the-counter medications such as **ibuprofen**

# ■ Causes Of Hypertension

Smoking and stress

Overweight or lack of physical activity

Alcohol Consumption

Genetics

Adrenal or thyroid disorder

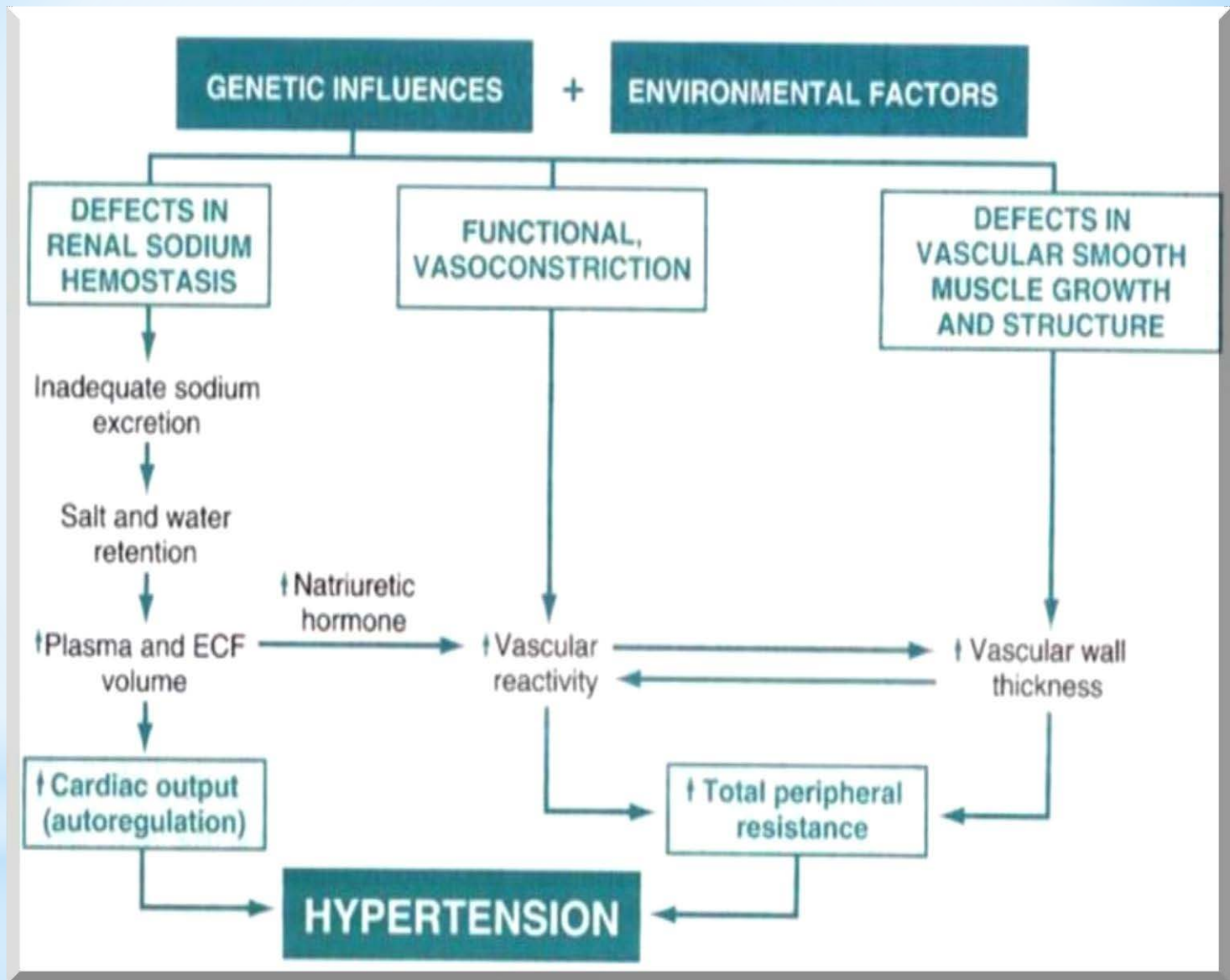
Excess intake of sodium



## ■ Pathogenesis of Hypertension

- ✓ Initially, an elevation in cardiac output and a relatively normal systemic vascular resistance(SVR)
- ✓ Later, obese subjects is an elevation in SVR in Hypertension.
- ✓ Increased activation of the renin-angiotensin aldosterone system.
- ✓ These hemodynamic alterations plus abnormalities in lipid and glucose metabolism appear to be related to fat distribution as well as to total body weight
- ✓ In particular, the risk is greatest in those patients with abdominal obesity, which is major components of the metabolic syndrome





# ■ Management of Hypertension

## ✓ Non - Pharmacological Therapy

- ① Lifestyle modification
- ② Dietary modification
- ③ Exercise

## ✓ Pharmacological Therapy

- ① Calcium Channel Blocker
- ② Beta - Blocker
- ③ Diuretics
- ④ Angiotensin Converting Enzyme
- ⑤ Angiotensin Receptor Blocker



# ✓ **Non - Pharmacological Therapy**

## Life Style changes:

- **reducing salt intake:** reduce dietary sodium intake to no more than 100 m mol per day (2.4gm sodium of 6 gm sodium chloride) reducing fat intake
- **losing weight :** maintain normal body weight (BMI kg/meter square)
- **getting regular exercise :** 30 minutes of daily aerobic exercise
- **quitting smoking :** strictly
- **reducing alcohol consumption :** not more than 2 drinks / day for men and 1 drink per day for women



## Dietary Modification

Dietary Approaches to Stop Hypertension - low in saturated fat, cholesterol, and total fat, and that emphasizes fruits, vegetables, and low fat dairy foods, whole grain products, fish, poultry, and nuts

### Daily Nutrient Goals used in the DASH Studies (for a 2,100 Calorie Eating Plan)

<b>Total fat</b>	27% of calories	<b>Sodium</b>	2,300 mg*
<b>Saturated fat</b>	6% of calories	<b>Potassium</b>	4,700 mg
<b>Protein</b>	18% of calories	<b>Calcium</b>	1,250 mg
<b>Carbohydrate</b>	55% of calories	<b>Magnesium</b>	500 mg
<b>Cholesterol</b>	150 mg	<b>Fiber</b>	30g

\* 1,500 mg sodium was a lower goal tested and found to be even better for lowering blood pressure. It was particularly effective for middle-aged and older individuals, African Americans, and those who already had high blood pressure.

# \*Exercise

- Reduced visceral fat
- Improved sodium elimination due to altered renal function
- Reduced plasma renin and catecholamine activity
- Reduced sympathetic and increased parasympathetic tone

## ✓ **Pharmacological Therapy**

### **Calcium Channel Blocker**

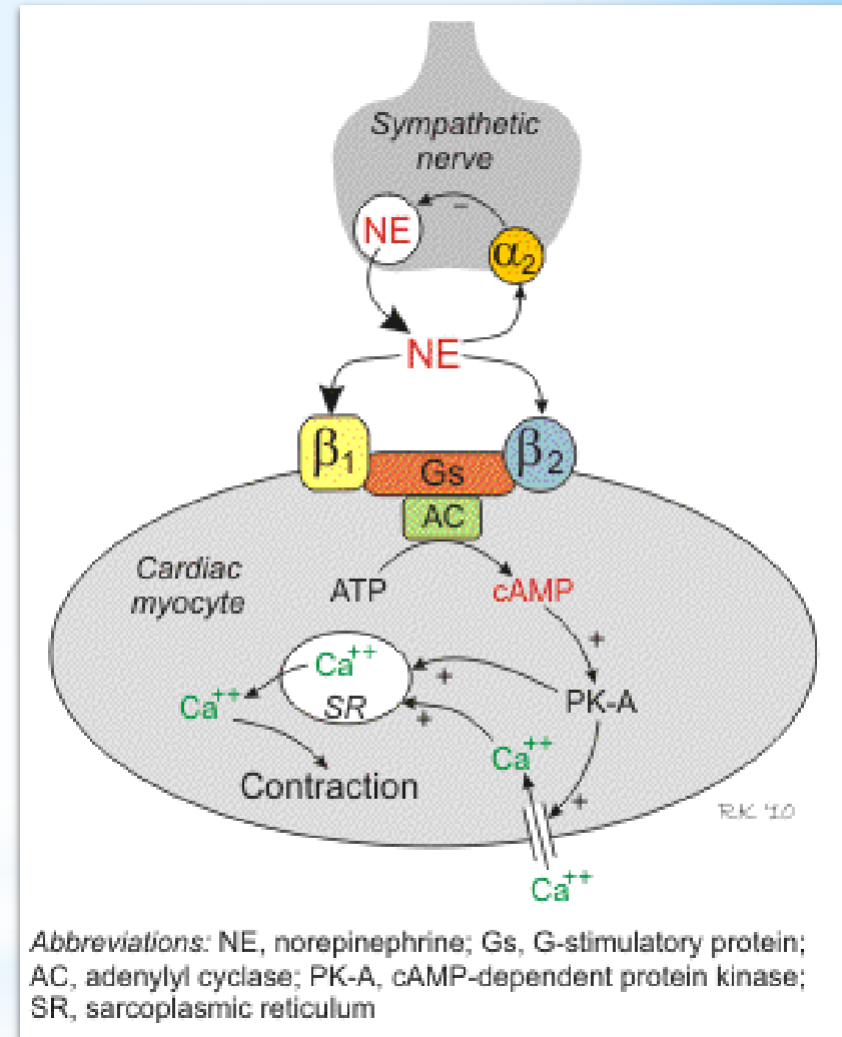
- Calcium channel blockers prevent calcium from entering cells of the heart and blood vessel walls, resulting in lower blood pressure.
- Calcium channel blockers, also called calcium antagonists, relax and widen blood vessels by affecting the muscle cells in the arterial walls.
- Some calcium channel blockers have the added benefit of slowing your heart rate, which can further reduce blood pressure, relieve chest pain (angina) and control an irregular heartbeat
- **E.g - Amlodipine, Diltiazem or Nicardipine etc.**



## ■ Beta Blocker

❖ exactly known how they work in hypertension – but they ↓ cardiac output, and block the action of stress hormones that constrict the blood vessels in the heart, brain and body

❖ E.g - Atenolol



## ■ Diuretics

- Stop the resorption of sodium hence promoting its excretion leading to more urine being produced. Flushes excess fluids and minerals from the body
- Act within 1-2 hours of administration and generally have a duration of action of 12-24 hours
- **E.g - Bendroflumethiazide, Indapamide e.t.c**

# ■ Angiotensin Converting Enzyme (ACE)

- ✓ Vasodilation (arterial & venous)
  - reduce arterial & venous pressure
  - reduce ventricular after load & preload
  
- ✓ Decrease blood volume
  - natriuretic
  - diuretic
  
- ✓ Depress sympathetic activity
  
- ✓ Inhibit cardiac and vascular hypertrophy
  
- ✓ **E.g -benazepril, captopril, enalapril, fosinopril**

## ▪ **Angiotensin II receptor antagonists**

➤ **Angiotensin II receptor antagonists**, also known as angiotensin receptor **blockers** (ARBs), AT1-receptor antagonists or sartans, are a group of pharmaceuticals that modulate the renin–angiotensin system.

➤ Their main uses are in the treatment of hypertension (high blood pressure), diabetic nephropathy (kidney damage due to diabetes) and congestive heart failure.