
بسم الله الرحمن الرحيم

LONG TERM CONTROL OF BP

Dr Zubia Shah

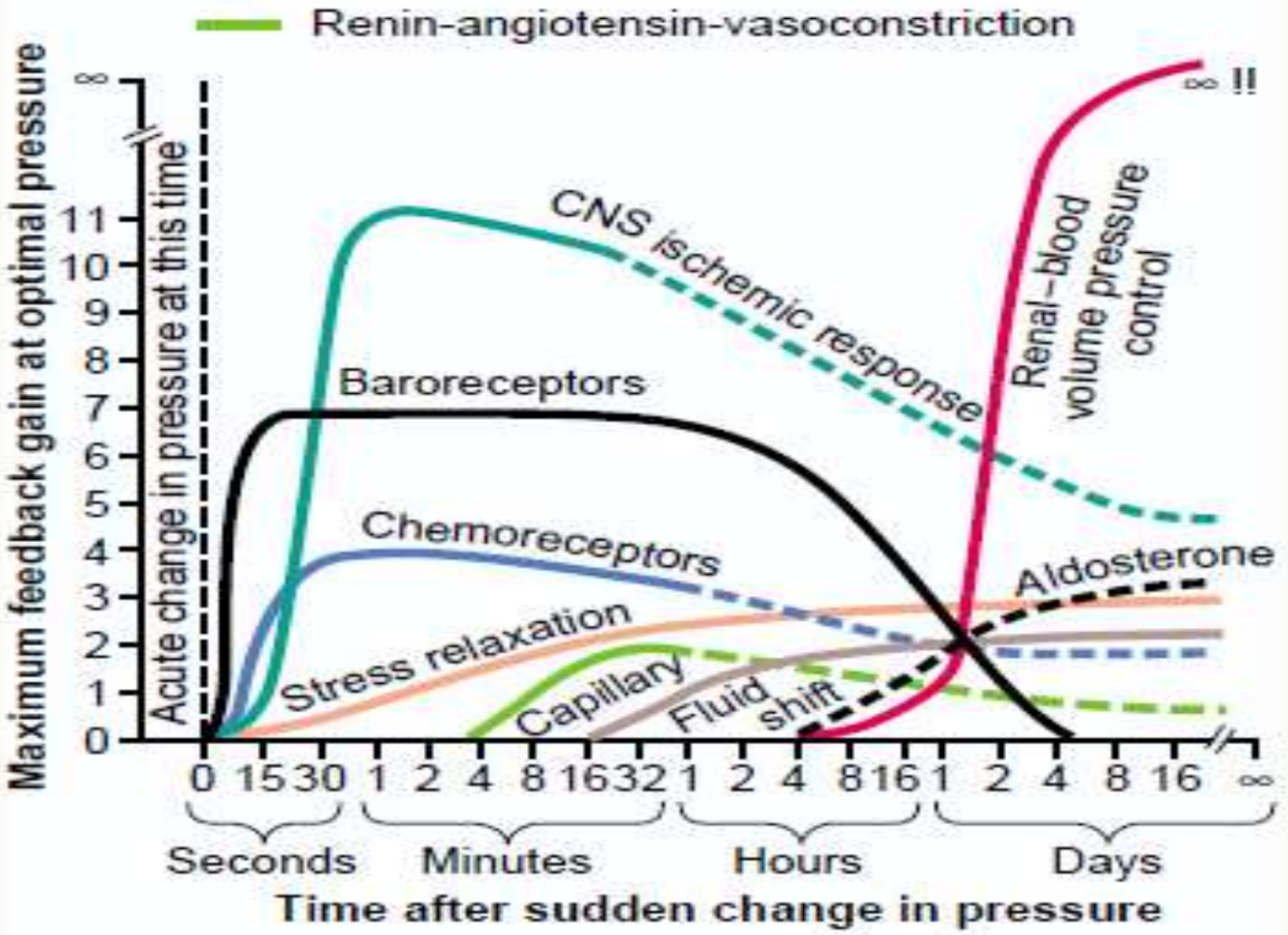
Renal–Body Fluid System for Arterial Pressure Control

Learning Objectives

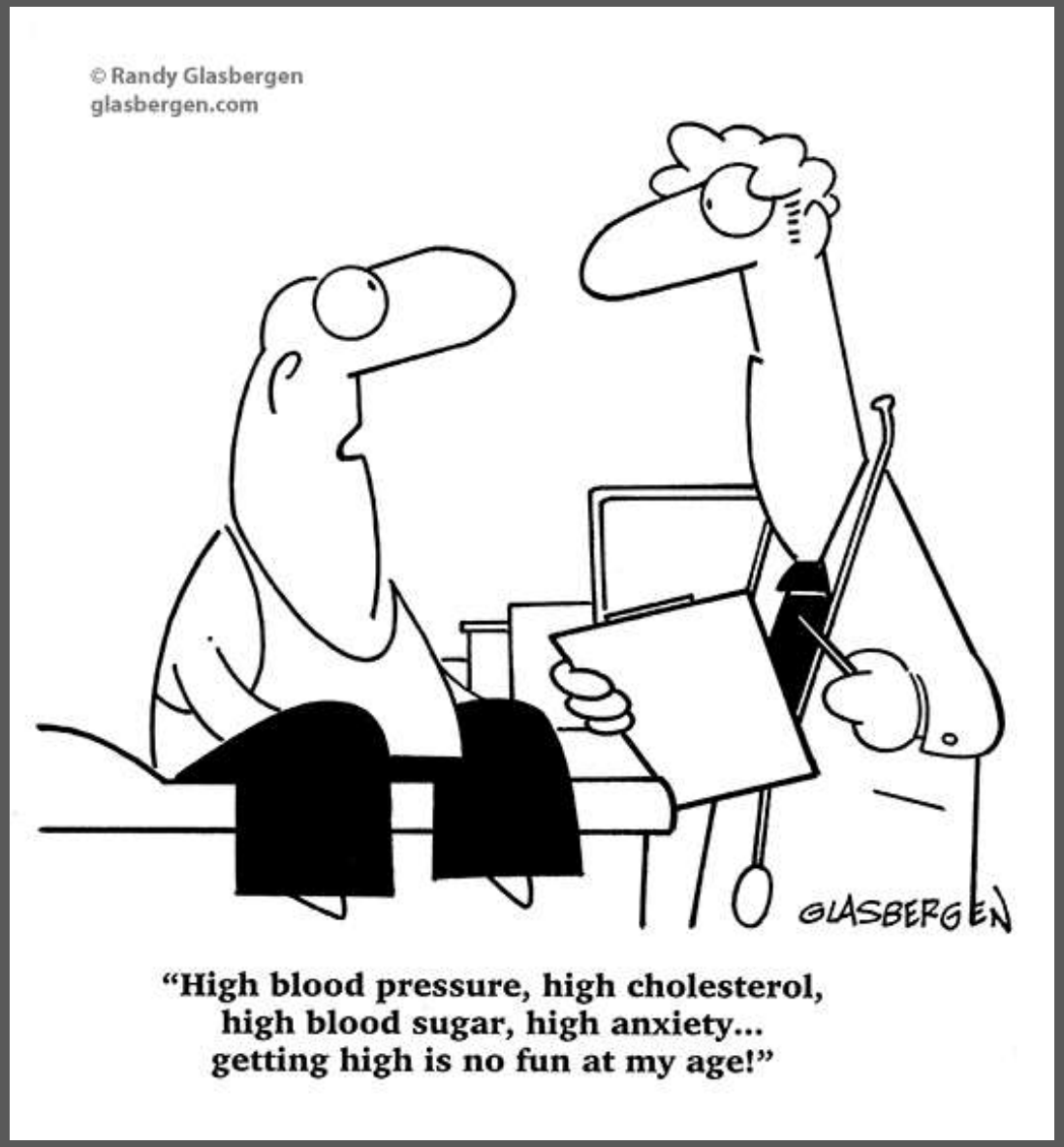
- Describe the intermediate mechanisms for arterial pressure control.
- Describe the Long-Term control of Arterial Pressure.

Rapidly Acting Pressure Control Mechanisms	Intermediate Arterial Pressure Control Mechanisms	Long Term Arterial Pressure Control Mechanisms
Seconds to Minutes	**Act after many minutes**	**After a Few Hours**
Autonomic Nervous system Reflex Mechanisms Baroreceptor Feedback Mechanism Chemoreceptor Mechanism Voume, Atrial and Bainbridge Reflexes CNS Ischemic Response	**1. Renin angiotensin Vasoconstrictor Mechanism** **2. Stress Relaxation of Vasculature** **3. Capillary Fluid Shift**	Renin Angiotensin Aldosterone System

Arterial Pressure Control Mechanisms At Different Time Intervals




My doctor's concerned about my high blood pressure. I told him next time don't leave me sitting in the waiting room for two hours.
www.facebook.com/maxine maxine.com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"High blood pressure, high cholesterol, high blood sugar, high anxiety... getting high is no fun at my age!"

Asma is 35-year-old with heavy menstrual bleeding for the last 2 years. Her B.P is 120/90. what is the most likely mechanism responsible for maintaining her B.P?

LONG TERM CONTROL OF BP

Renin Angiotensin System

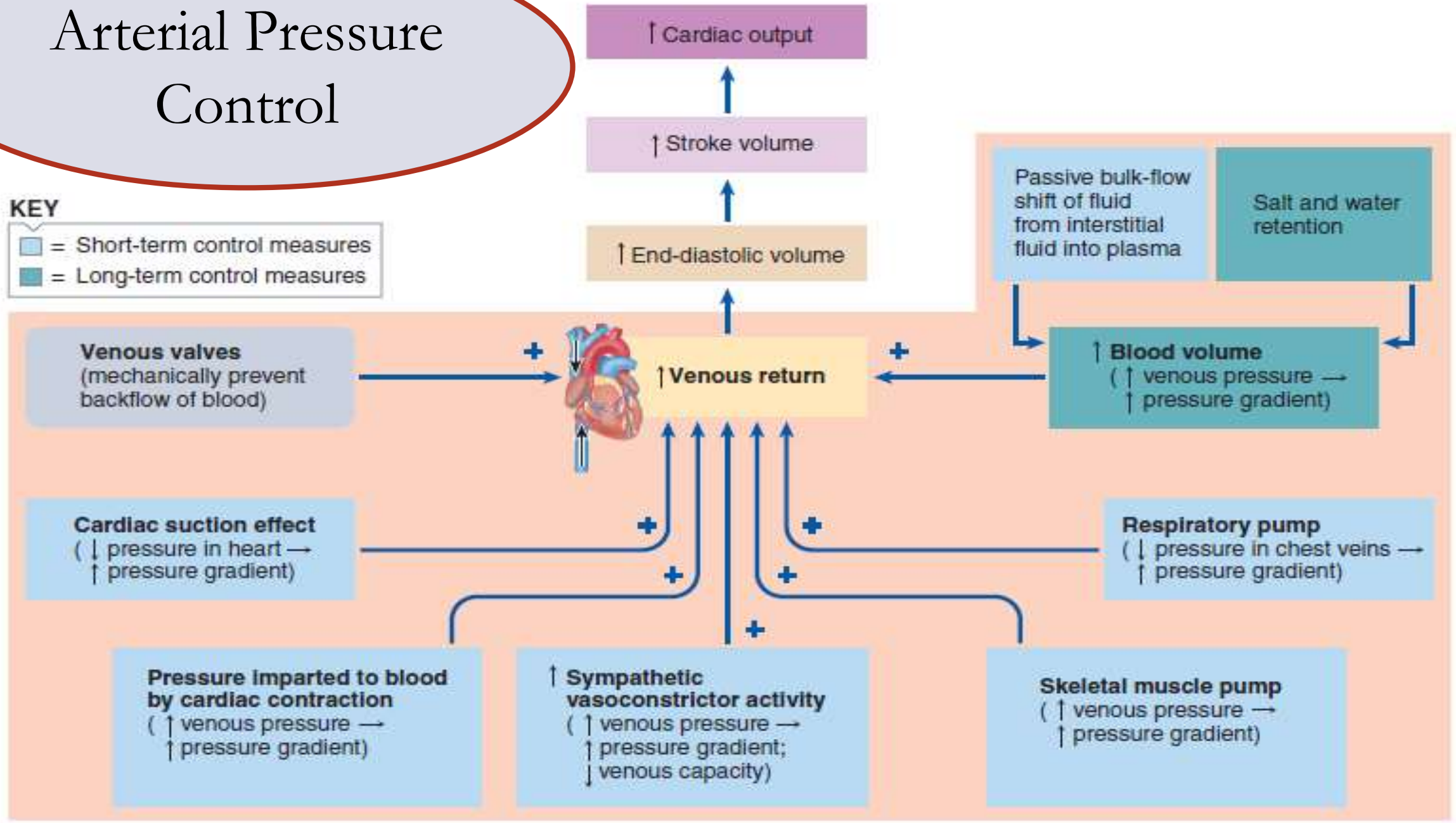
Renal–Body Fluid System for Arterial Pressure Control

- ↑ **Extracellular fluid** → ↑ the blood volume and

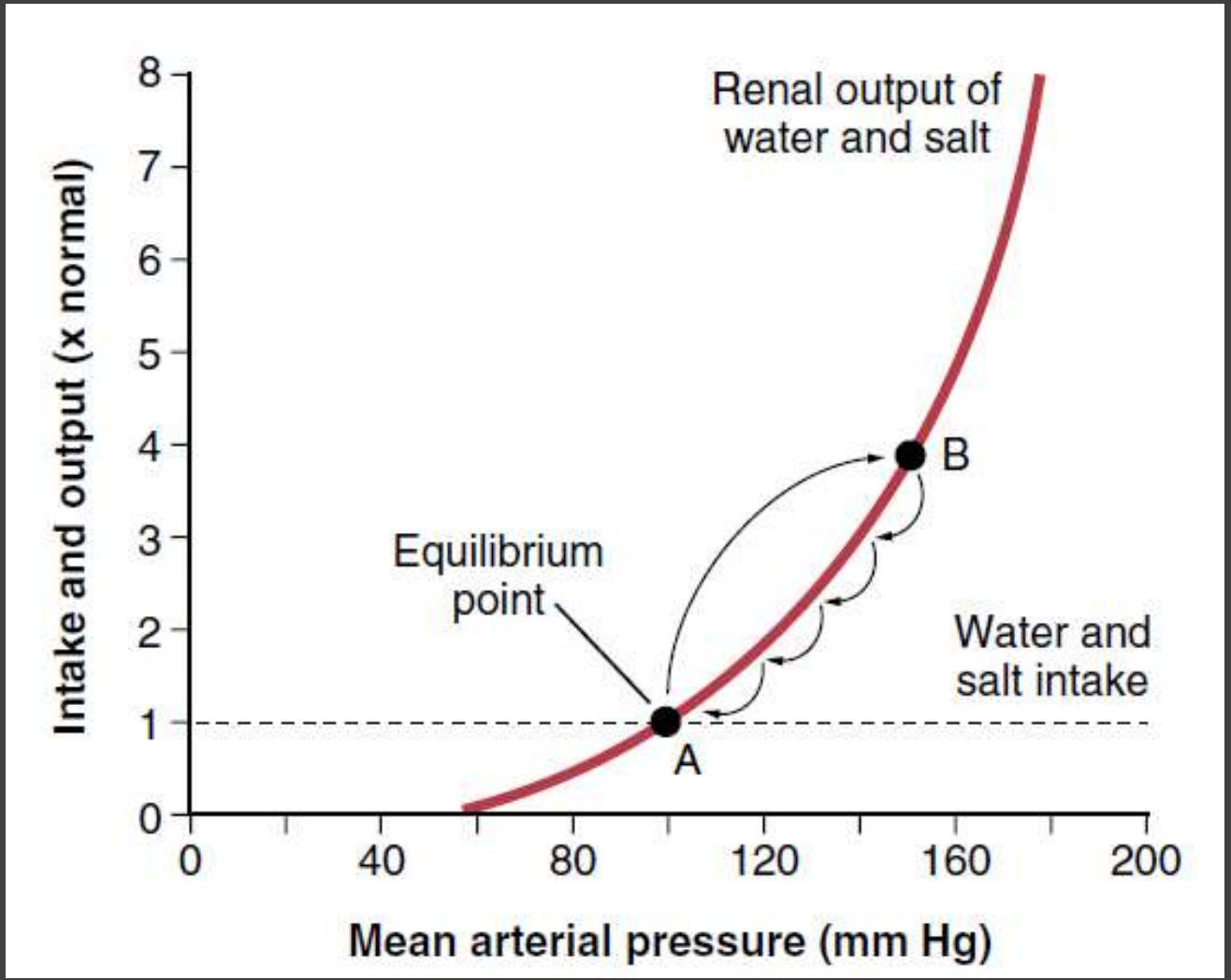
  ↑ Arterial Pressure

- The rising pressure causes the kidneys to excrete the excess extracellular fluid returning the pressure back toward normal

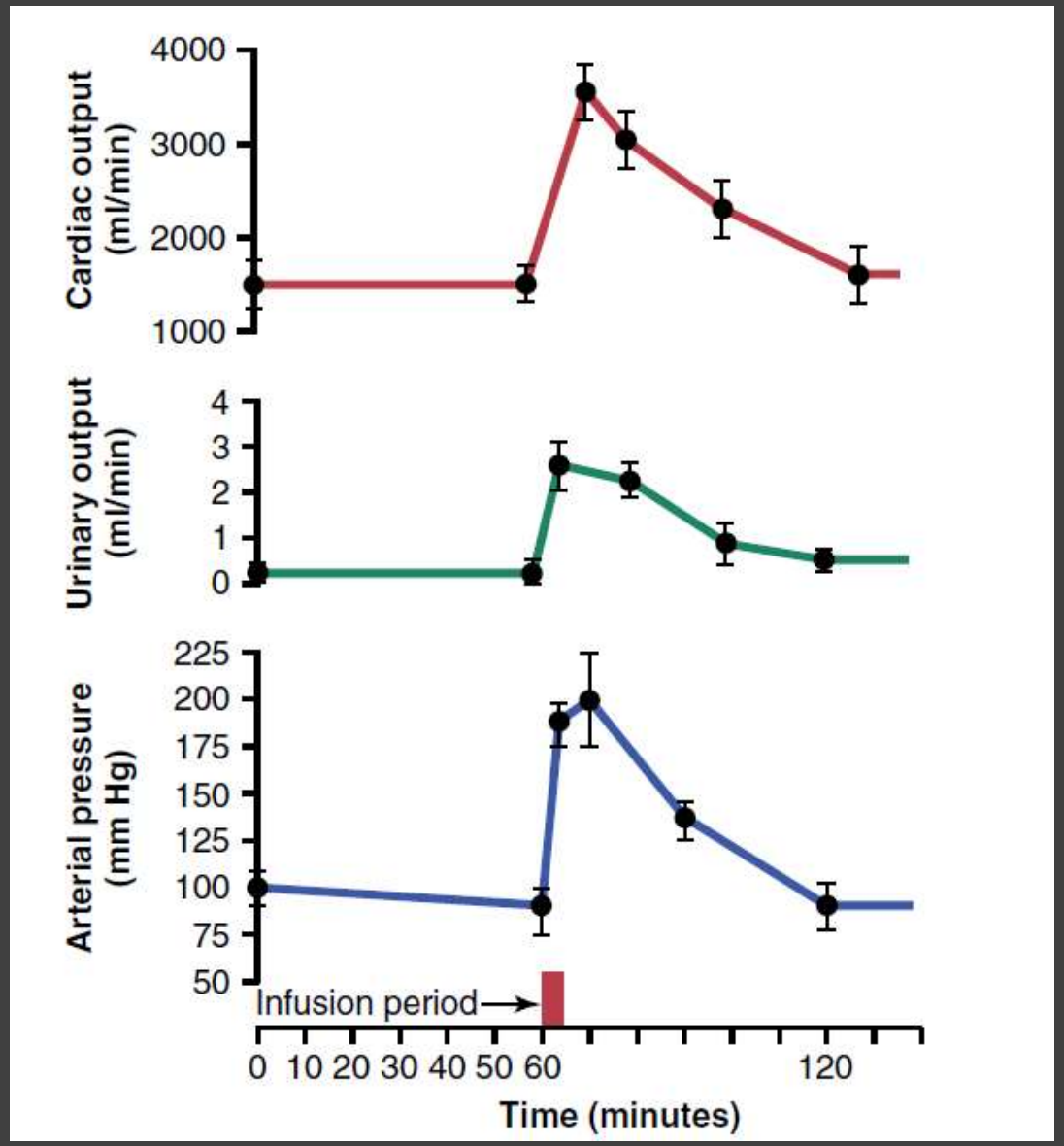
Arterial Pressure Control



A typical arterial pressure–renal urinary output curve measured in a perfused isolated kidney, showing pressure diuresis when the arterial pressure rises above normal



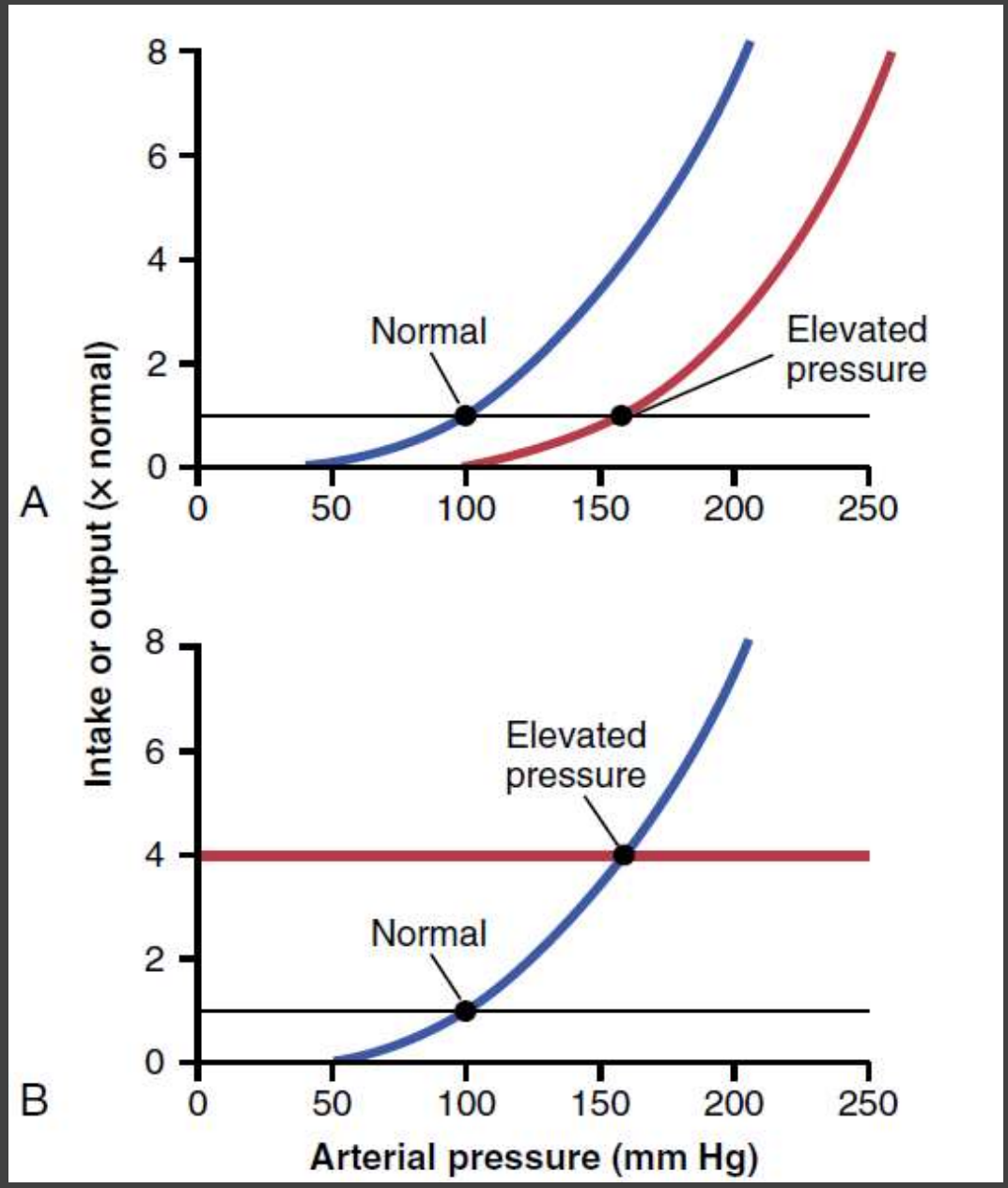
Increases in cardiac output, urinary output, and arterial pressure caused by increased blood volume in dogs who's nervous pressure control mechanisms had been blocked



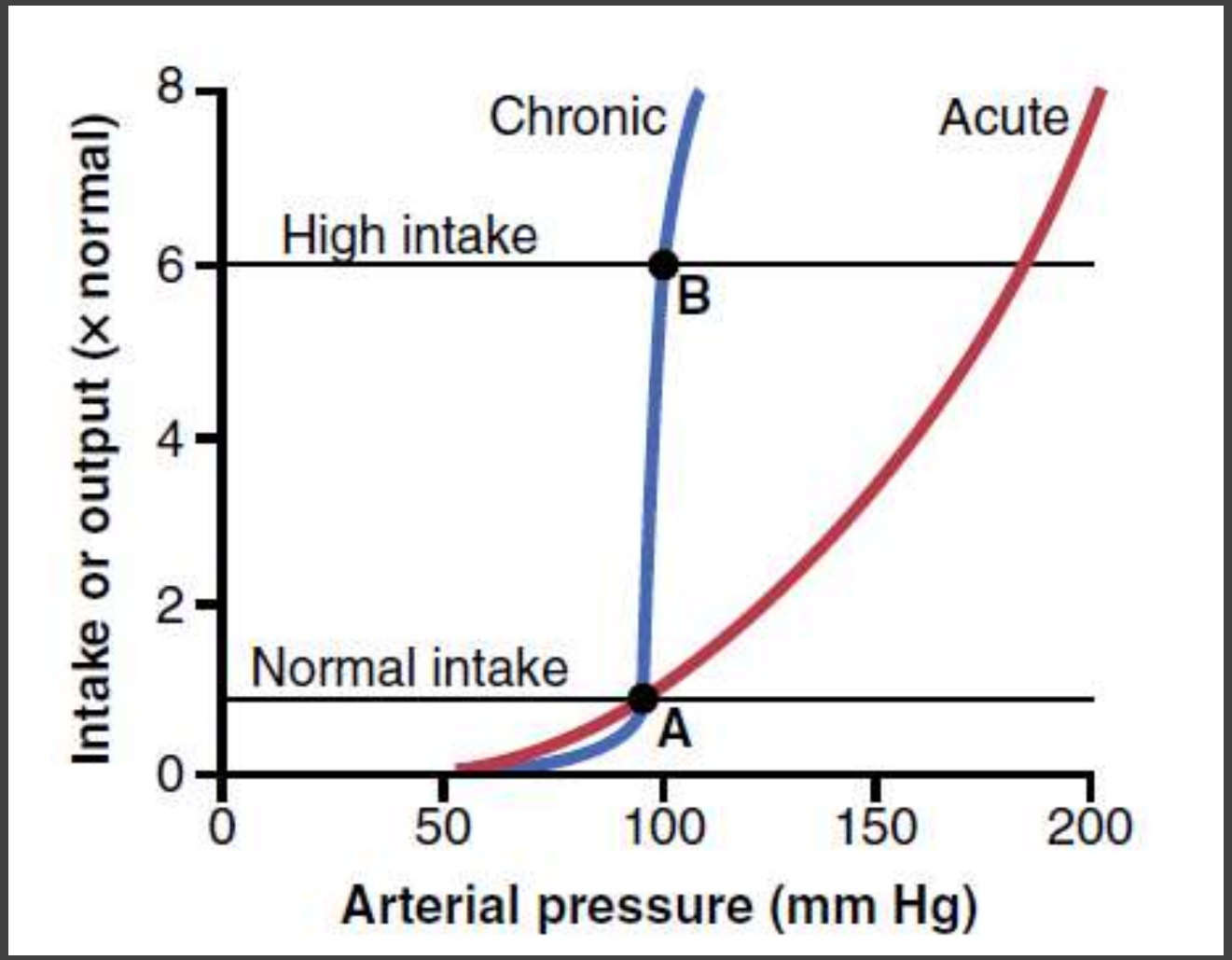
Long term Mean Arterial Pressure can be changed to a new value only when there is a change in

1. Level of salt and water intake or
2. The degree of shift of renal function curve along the pressure axis

Two ways to increase Arterial Pressure



Acute and Chronic Renal Output curves



Salt Insensitive Population

If kidneys, nervous and hormonal systems are functioning normally

- ↑ Salt and Water intake as high as 6 times normal are usually associated with small increases in BP

- Conversely, ↓ in Salt and Water intake to as low as one-sixth normal has little effect on arterial pressure

Salt Sensitive Population

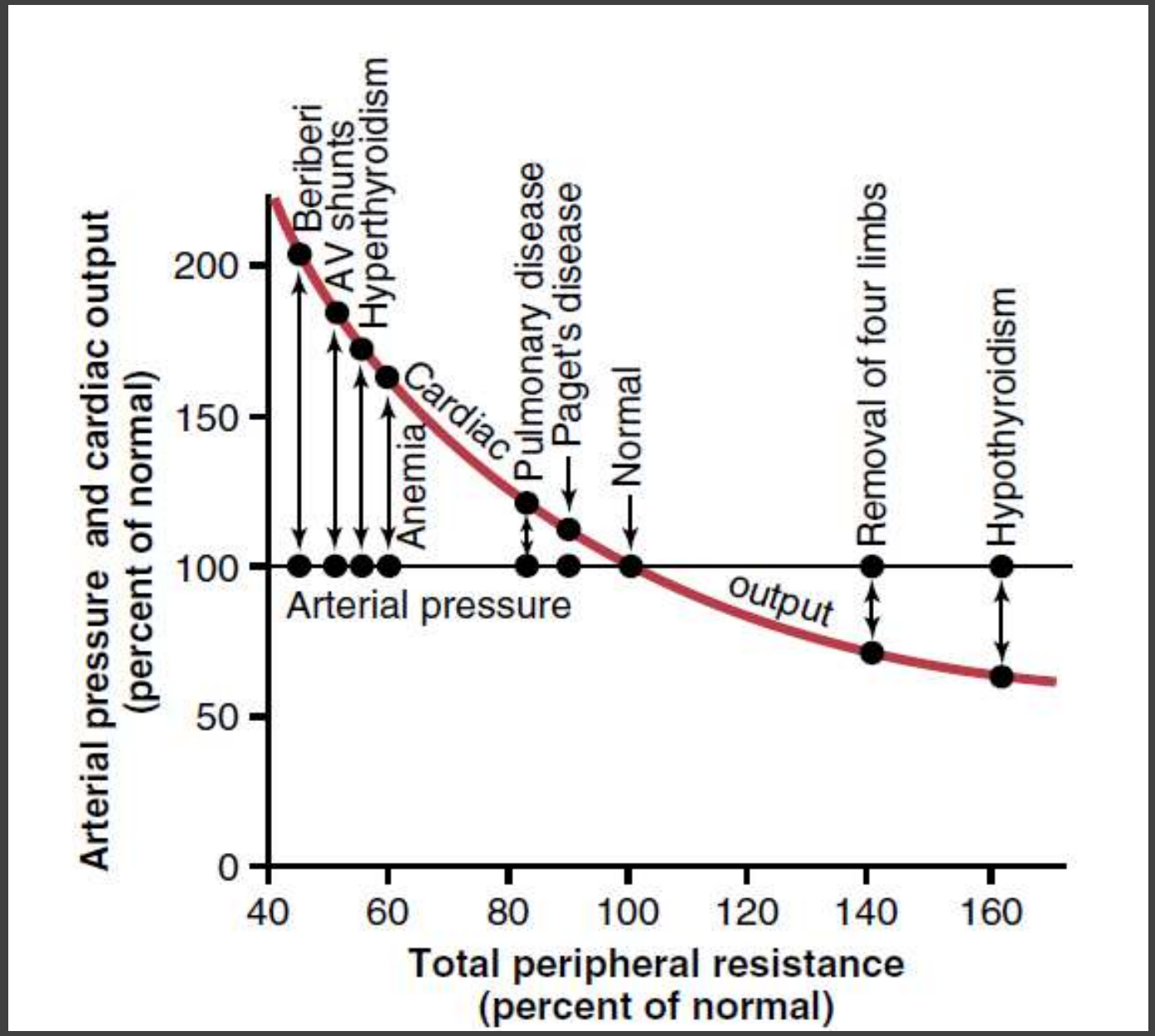
May be due to

- **Loss of functional Nephrons due to kidney injury and**
- **Excessive formation of Angiotensin II or Aldosterone**

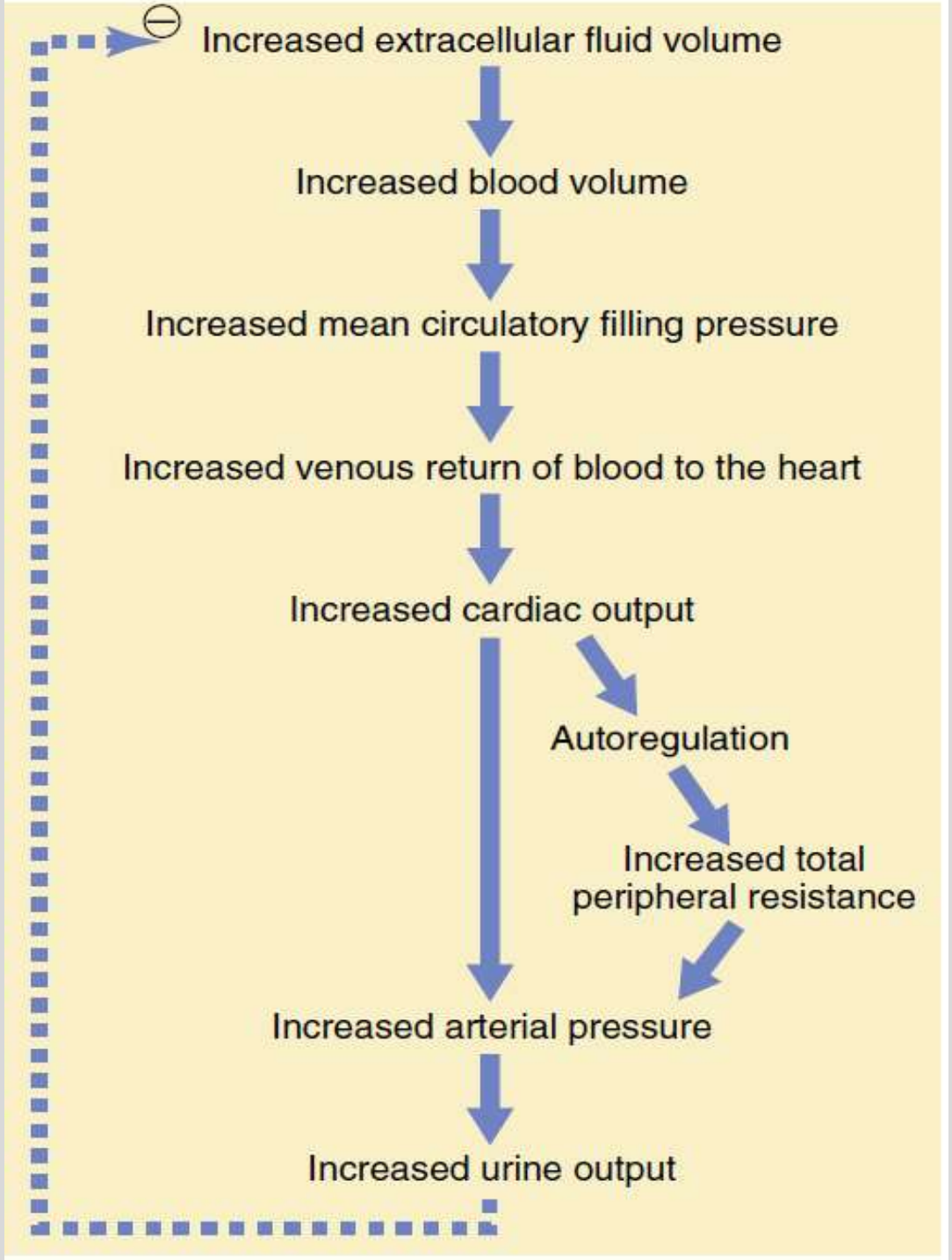
Arterial Pressure = CO x TPR

TPR does not increase BP unless it increases the intrarenal vascular resistance

Relation of Total Peripheral Resistance to the Long-term Levels of Arterial Pressure and Cardiac Output



Effect of Increased Blood Volume on B.P

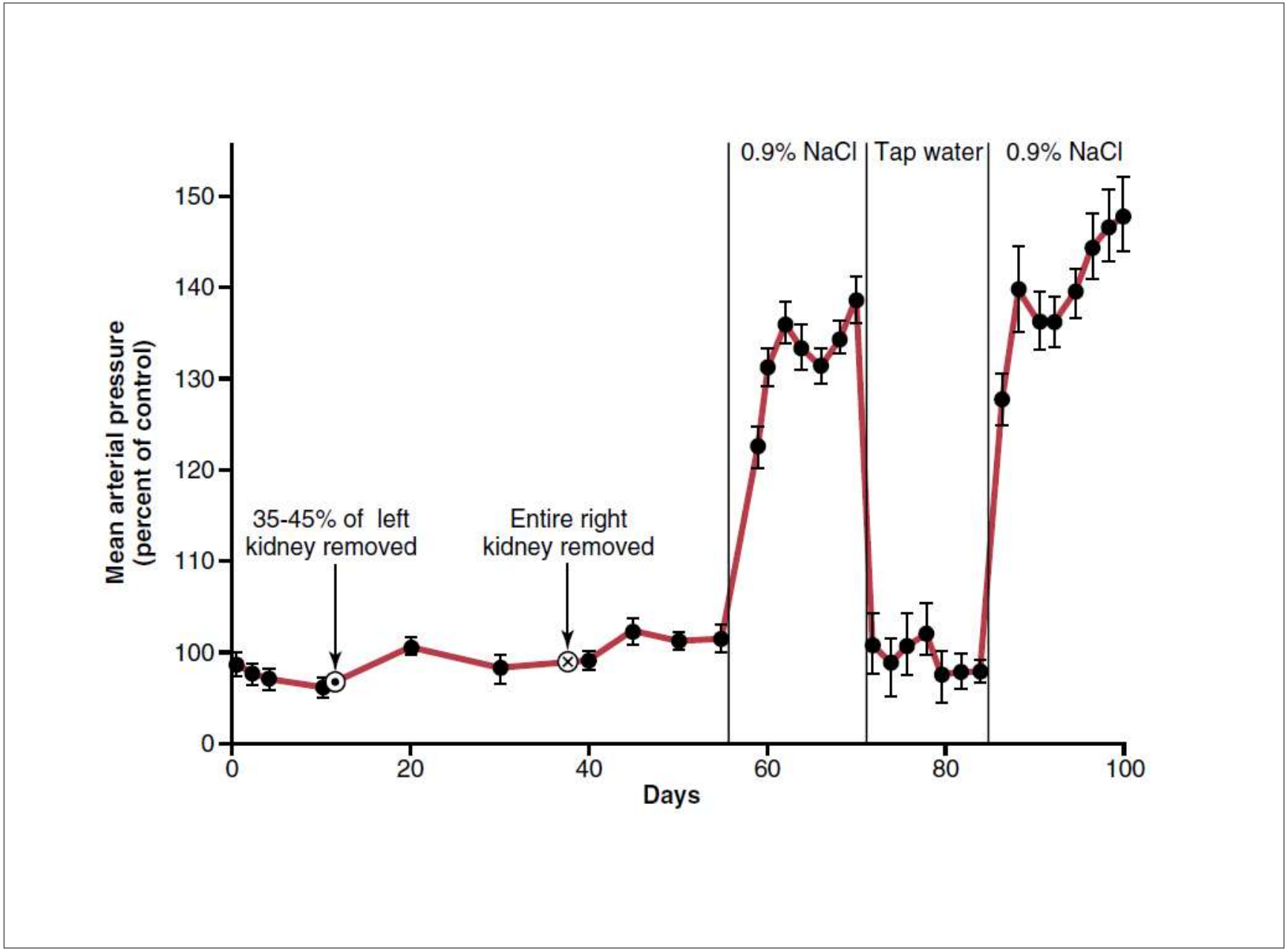


Importance of Salt (NaCl) in the Renal–Body Fluid Schema for Arterial Pressure Regulation

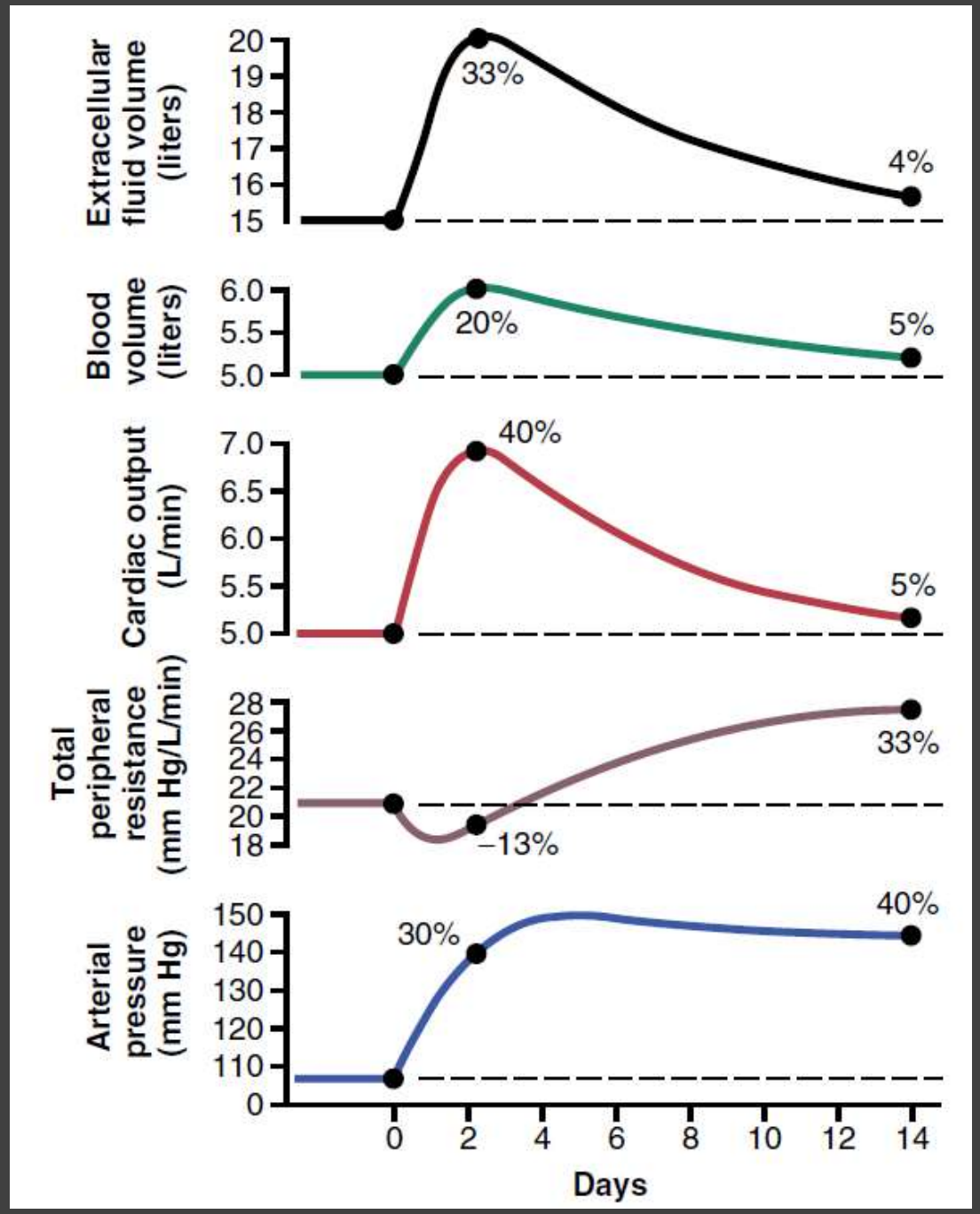
↑ salt intake → ↑ BP (salt-sensitive individuals)

- ↑ **osmolarity** stimulates **thirst center** → drinking more water to return the extracellular salt concentration to normal and ↑ the ECF volume
- ↑ osmolality due to ↑ salt in the ECF stimulates the hypothalamic–posterior pituitary gland to secrete **↑ ADH**

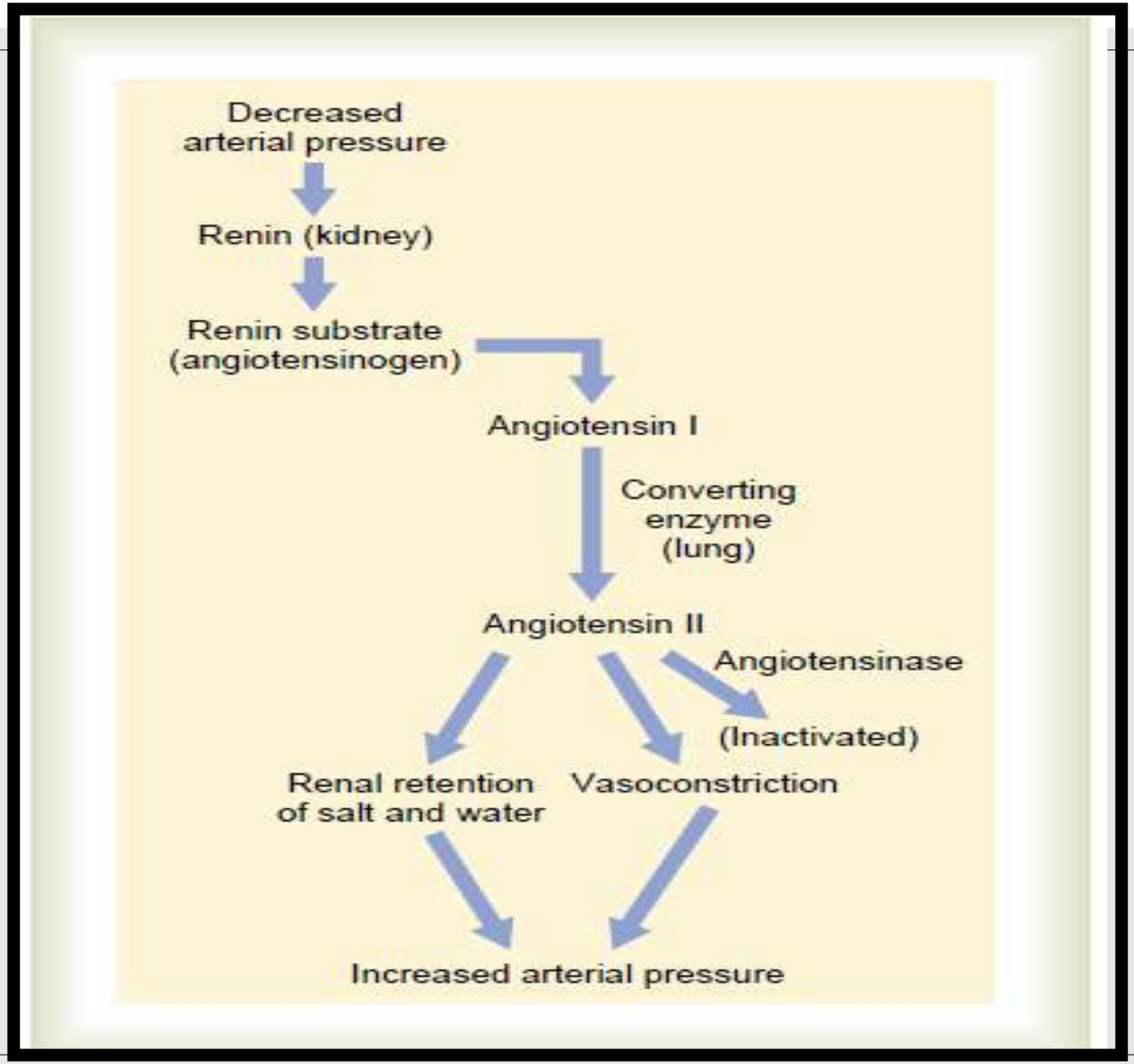
The effect on arterial pressure of drinking 0.9% NaCl instead of water in dogs with 70% of their renal tissue removed



Progressive changes in important circulatory system variables during the first few weeks of volume-loading hypertension



The Renin-Angiotensin System



Angiotensin II

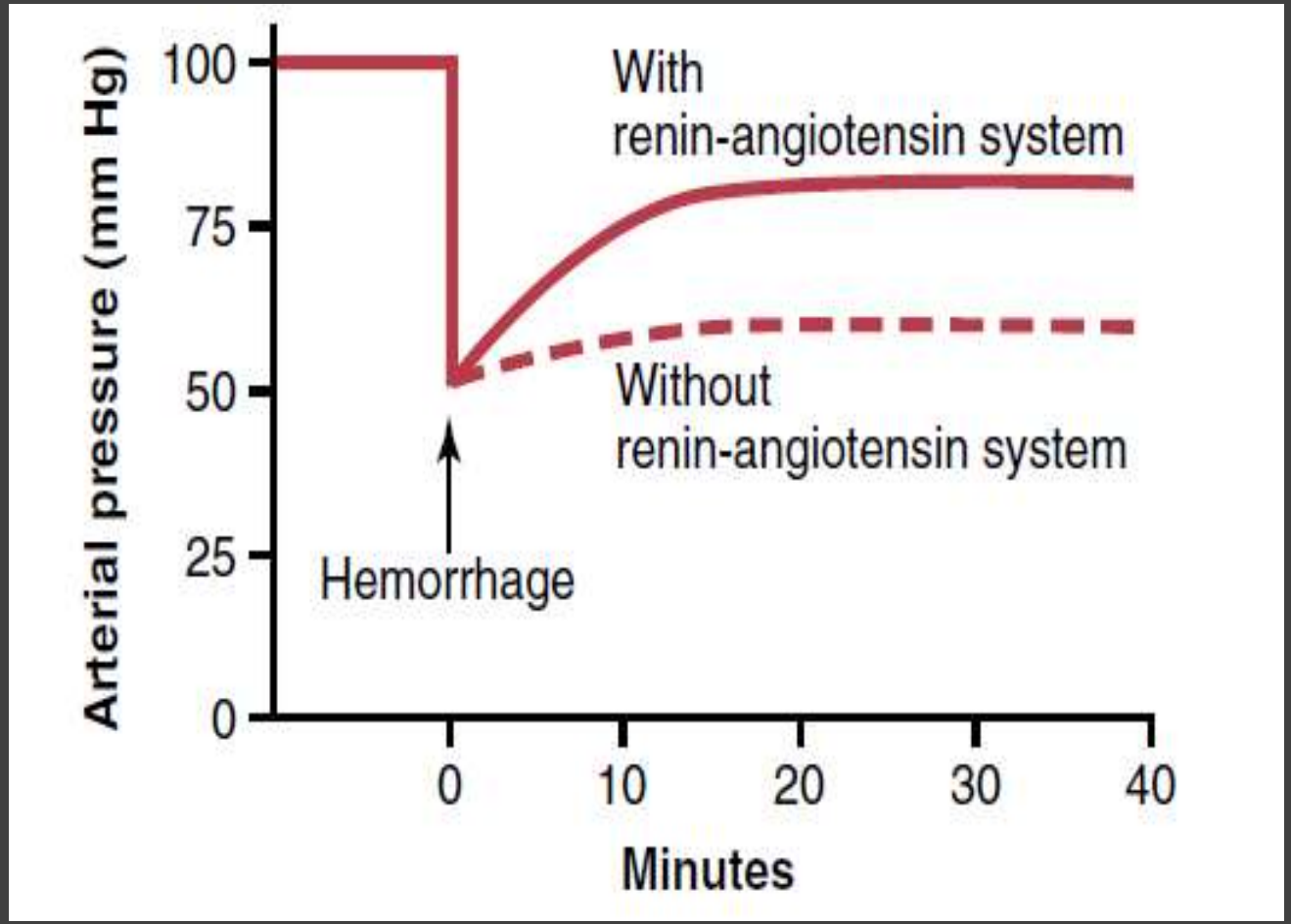
Causes **Vasoconstriction** in 2 ways

- **Direct effect** acts directly on kidneys to cause salt and water retention and decreased excretion

- **Indirectly** → causes Adrenal glands to secrete Aldosterone

  → salt and water reabsorption by kidneys tubules

Effect of Renin-Angiotensin Vasoconstrictor System after Severe Hemorrhage



Role of Salt in Renal Regulation of B.P

THIRST (thirst center)

Excess salt in the ECF →

↑ fluid osmolality

→ **drinking** extra amounts of water to return ECF salt

→ concentration to normal → thus ↑ ECF

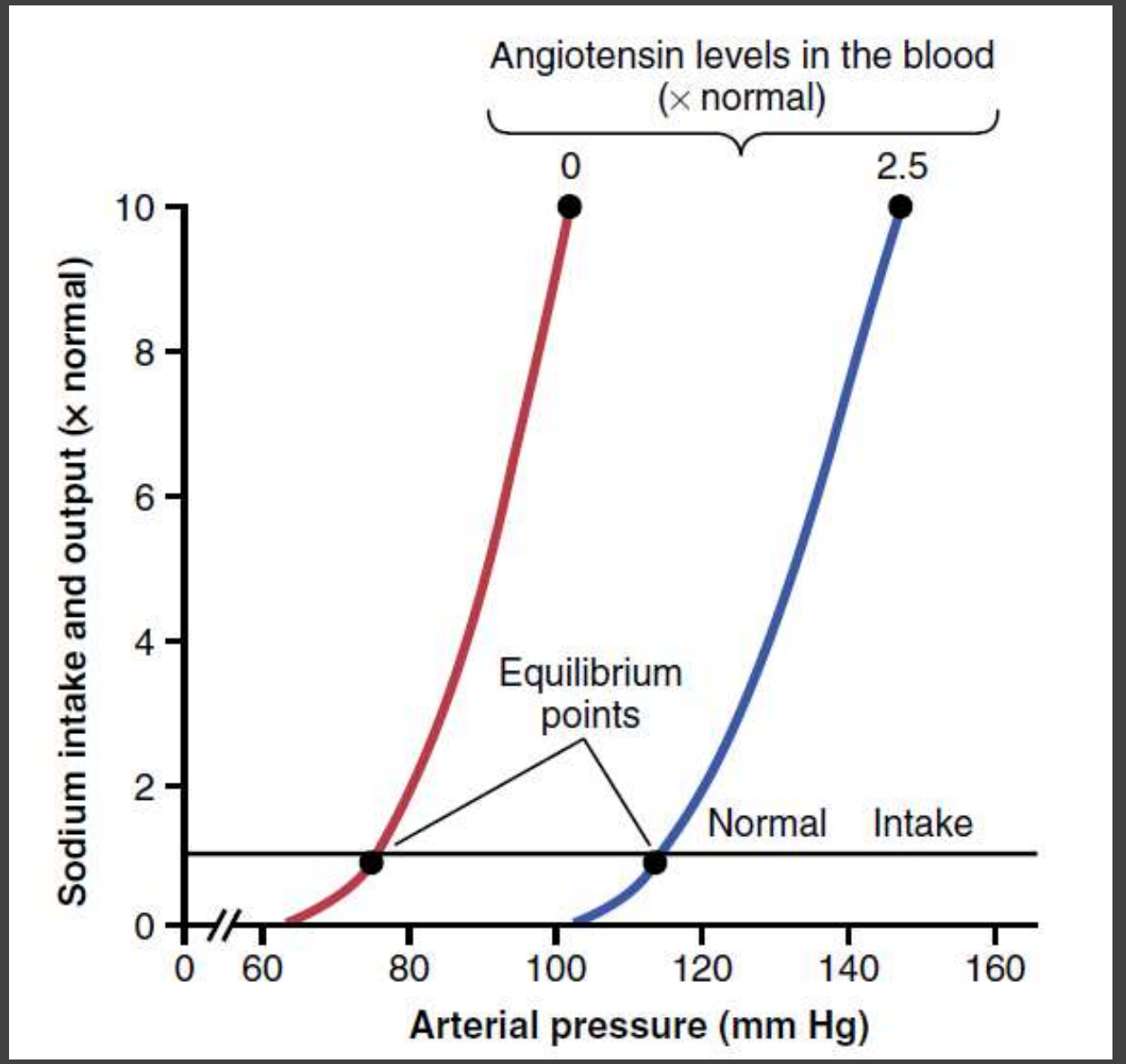
Antidiuretic Hormone

Excess salt in the ECF →

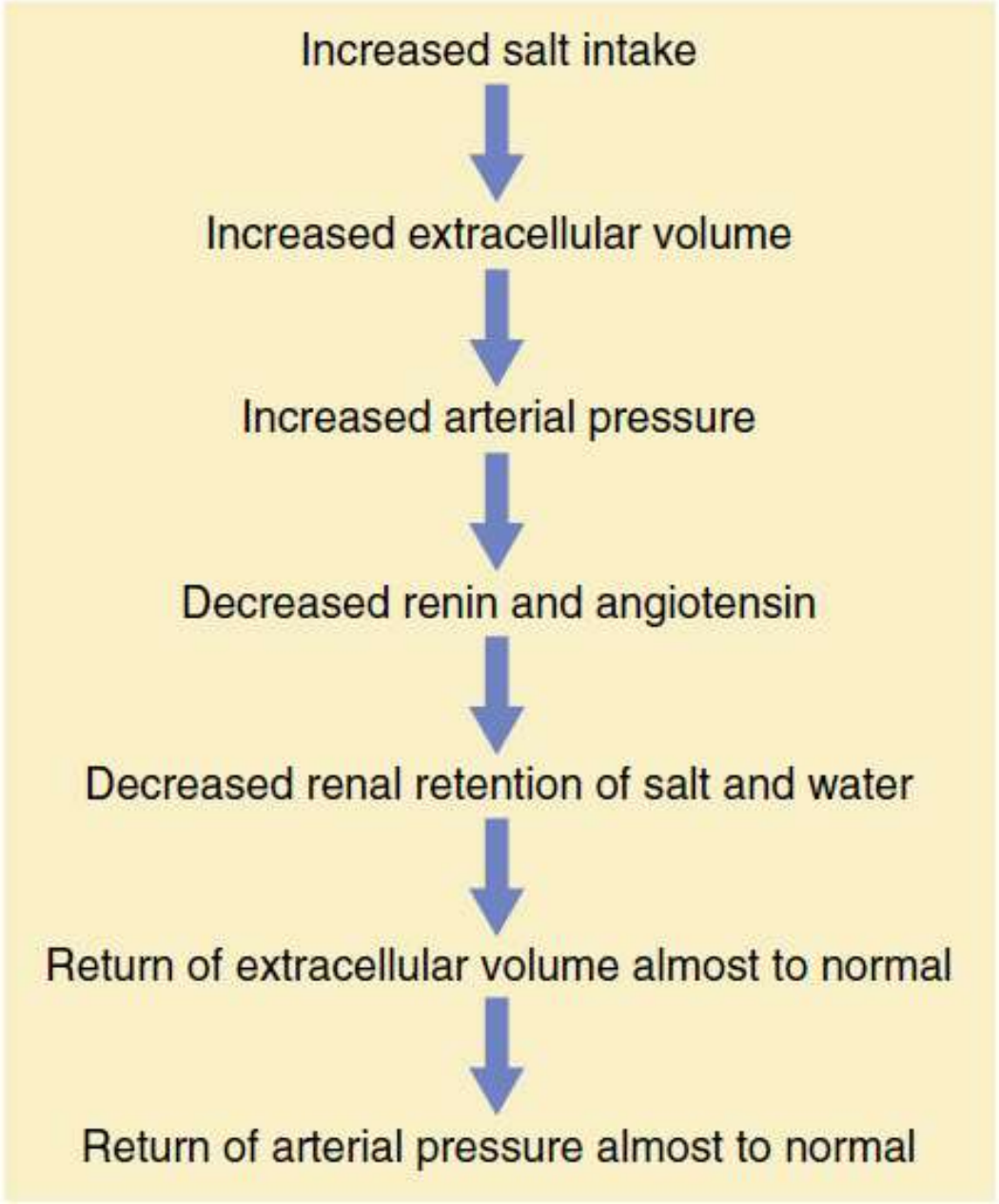
↑ fluid osmolality by stimulating **hypothalamic-posterior pituitary gland**

→ **decreased excretion** by kidneys → and thus ↑ ECF

Quantitative Analysis of Arterial Pressure changes caused by Angiotensin II

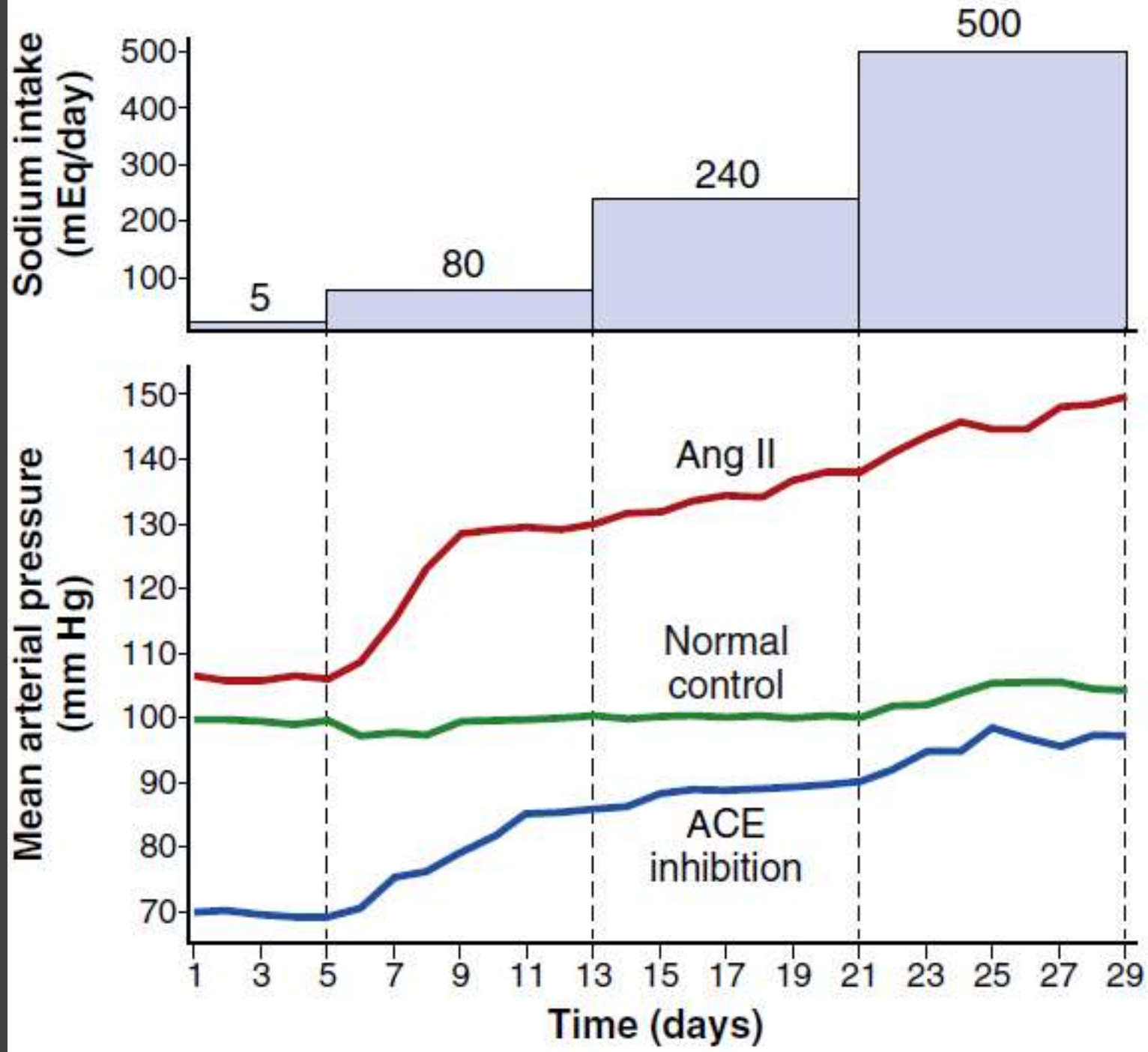



eat less
SALT!



Effect of Increased Salt Intake and Role of Renin Angiotensin System

Changes in mean arterial pressure during chronic changes in sodium intake in dogs



Renin-Angiotensin system is perhaps the body's most **powerful** system for accommodating wide variations in salt intake with minimal changes in arterial pressure

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Seconds to Minutes	**Act after many minutes**	**After a Few Hours**
Autonomic Nervous system **Reflex Mechanisms** Baroreceptor Feedback Mechanism Chemoreceptor Mechanism Volume, Atrial and Bainbridge Reflexes **CNS Ischemic Response**	1. Renin angiotensin Vasoconstrictor Mechanism 2. Stress Relaxation of Vasculature 3. Capillary Fluid Shift	**Renin Angiotensin Aldosterone System**

Intermediate Arterial Pressure Control Mechanisms

Act after many minutes

1. **Renin angiotensin Vasoconstrictor Mechanism**

2. **Stress Relaxation of Vasculature**

3. **Capillary Fluid Shift**

What is the mechanism by which the vessel wall can accommodate large volume of fluids without significant increase in B.P?

Stress Relaxation

High pressure in the blood vessels

↓

Stretching of vessels for minutes or hours

↓

fall in pressure toward normal

intermediate-term pressure “buffer”

The Capillary Fluid Shift Mechanism

Capillary Pressure Falls

Fluid is absorbed from tissues through capillary membranes into circulation

→

building up blood volume

→ ↑ **pressure in the circulation**

Capillary Pressure Rises

Fluid is lost from circulation into tissues →

↓ **the blood volume & all the pressures throughout the circulation**

Reference Books

- Guyton and Hall
- Sherwood Physiology
- Ganong’s Review of Medical Physiology

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Thank
you