

# Water & Electrolytes

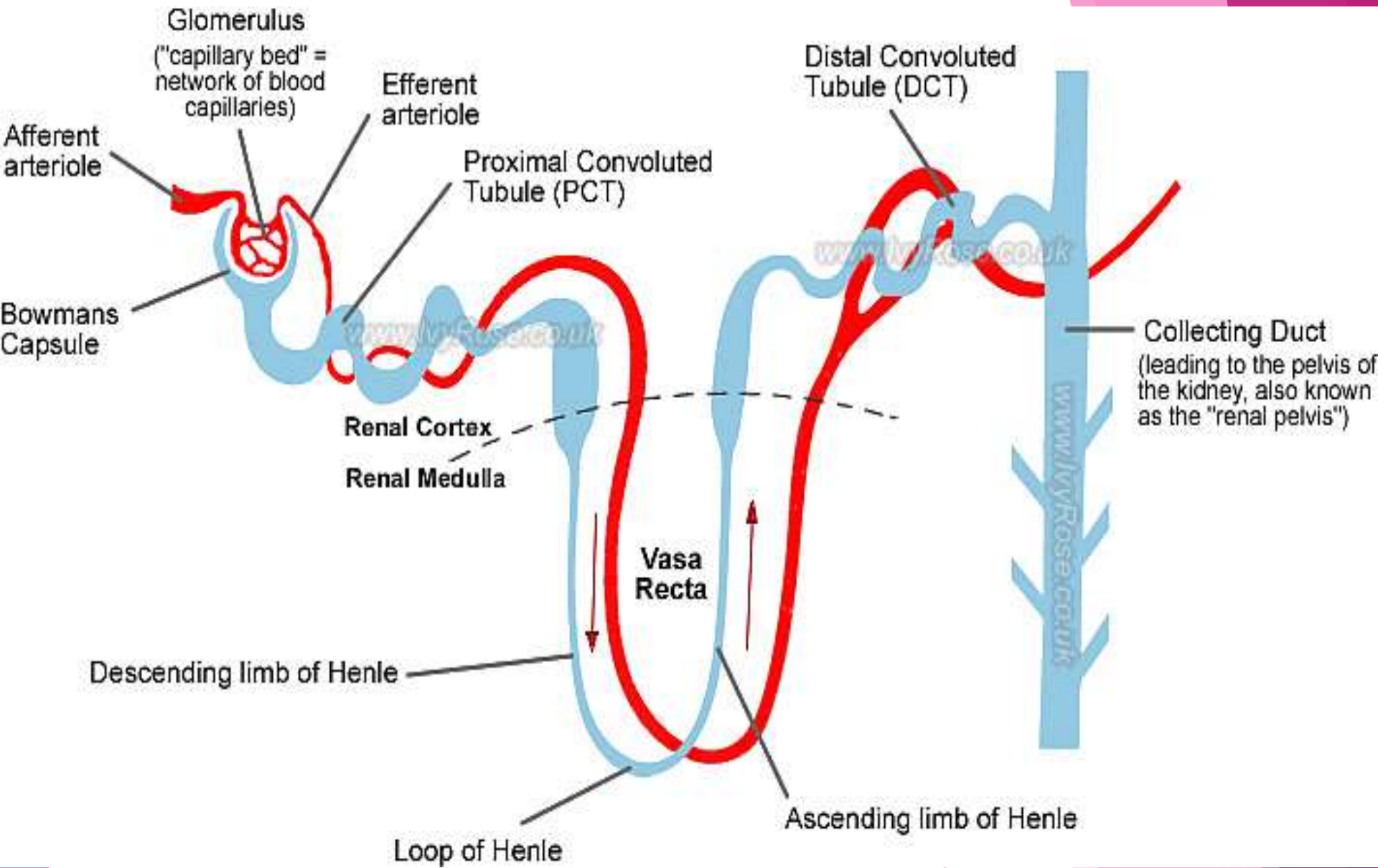
## Potassium & Chloride

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Source: Essentials of Medical  
Biochemistry (Mushtaq Ahmad)  
Chatterjea Textbook of Medical  
Biochemistry  
World Wide Web

# Potassium

- Principal Cation in cell interior
- 80% percent excreted in urine
- < 20% in feces
- Small fraction in sweat



## **Diet / Sources / Excretion**

- Daily allowance 1.5 to 4.5 gms
- Normal level : 3.5 to 5.0 mEq/L  
(milliEquivalents/Liter)
- Citrus fruits, bananas, milk etc.
- 93% reabsorbed in proximal convoluted tubules

# Functions

1. Normal functioning of heart esp. diastole
2. Needed for many enzyme reactions e.g. Glycogenesis
3. Insulin causes fall in plasma  $K^+$ . Deposition of glycogen in hepatocytes is accompanied by deposition of  $K^+$
4. Resting membrane potential
5. Repolarization
6. Compete with H for exchange with Na in renal tubules
7. Required for activity of Na-K ATPase

# Causes of Hypokalemia

1. Decreased intake: Starvation, malnutrition (kwashiorkor)
2. Excessive Renal Loss:
  - i) Diuretics e.g. frusemide and thiazides. More Na ions brought to distal convoluted tubules. Therefore greater exchange of K ions which are lost in urine
  - ii) Metabolic Alkalosis. Deficiency of H ions causes more K ions to undergo exchange with Na ions
  - iii) Renal Disease: renal failure, chronic pyelonephritis etc.
- ▶ 3. Hormones: Increase Aldosterone, Cortisol and ACTH increase loss of K in urine
- ▶ 4. Loss from GIT: Vomiting, Diarrhoea, Ileostomy

# Causes of Hypokalemia

- ▶ 5. Excessive transfer to cells:
- ▶ i) Glycogenesis. Treatment of diabetic acidosis with insulin and glucose
- ▶ ii) Familial periodic paralysis: after intake of carbohydrate meal sudden entry of K into cells

# Hypokalemia - Signs & Symptoms

- Anorexia, nausea, muscle weakness and mental depression. Paralytic ileus.
- Rapid irregular pulse and fall in BP. Pathological lesions seen in heart called myocytolysis
- K less than 1.5mmol/L is fatal



# Causes of Hyperkalemia

- ▶ Less common in clinical practice
- ▶ 1. *Release of cellular K*: Crushed or infected muscles, Intravascular hemolysis, sudden lysis of tumors with chemotherapy
- ▶ 2. *Renal failure*: Hyperkalemia becomes marked with oliguria
- ▶ 3. *Dehydration and shock*: Decreased formation of urine and K retention
- ▶ 4. *Acidosis*: H ions displace K ions from cells
- ▶ 5. *Fever*: excessive breakdown of body proteins liberates cellular K ions
- ▶ 6. *Addison's disease*: less K secreted by distal tubules
- ▶ 7. *Iatrogenic*: I/V K injections

# Hyperkalemia – Signs & symptoms

- ECG changes when serum K above 7mmol/L
- T wave tented and peaked
- QRS complex broad
- Ht. stops in diastole as K ions favor relaxation of myocardial fibers
- Confusion, muscular weakness, numbness and tingling of extremities