Overviews of renal system

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Function

Regulation

- water and electrolytes Na and water ECF
- Arterial blood pressure No Bp= No pee pee , No GFR = No mean arterial blood pressure
- Acid base balance H, HCO3

Excretion

Secretion

Paracrine :Prostaglandin and bradykinin dilatation of blood vessels

Endocrine: EPO, Renin, VD3

Gluconeogenesis

urine formation

- Filtration:
- It is directly proportional to renal blood pressure and renal blood flow. Water and solutes is filtered across glomerular capillaries

- Reabsorption:
- Is the removal of water and solutes from the renal filtrate
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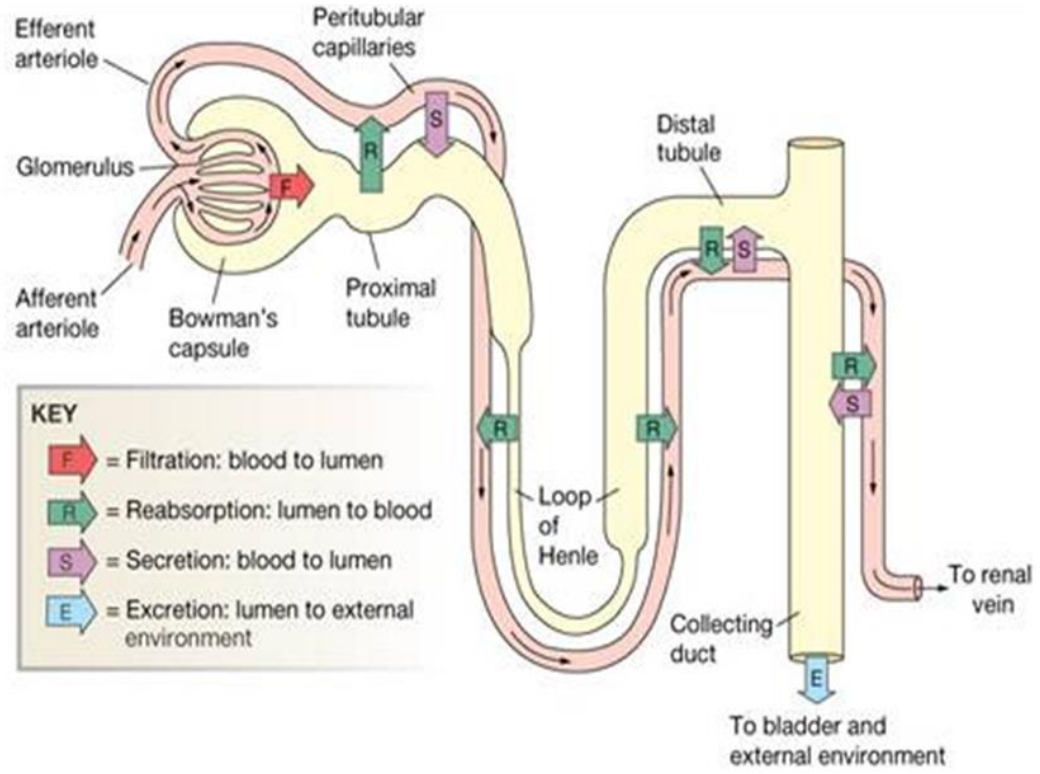
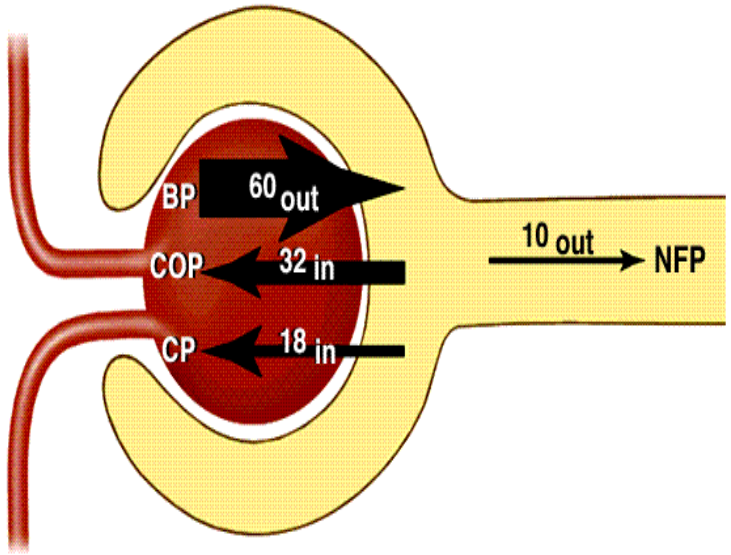
- Secretion:
- Transport of solutes from peritubular fluid into the tubular fluid



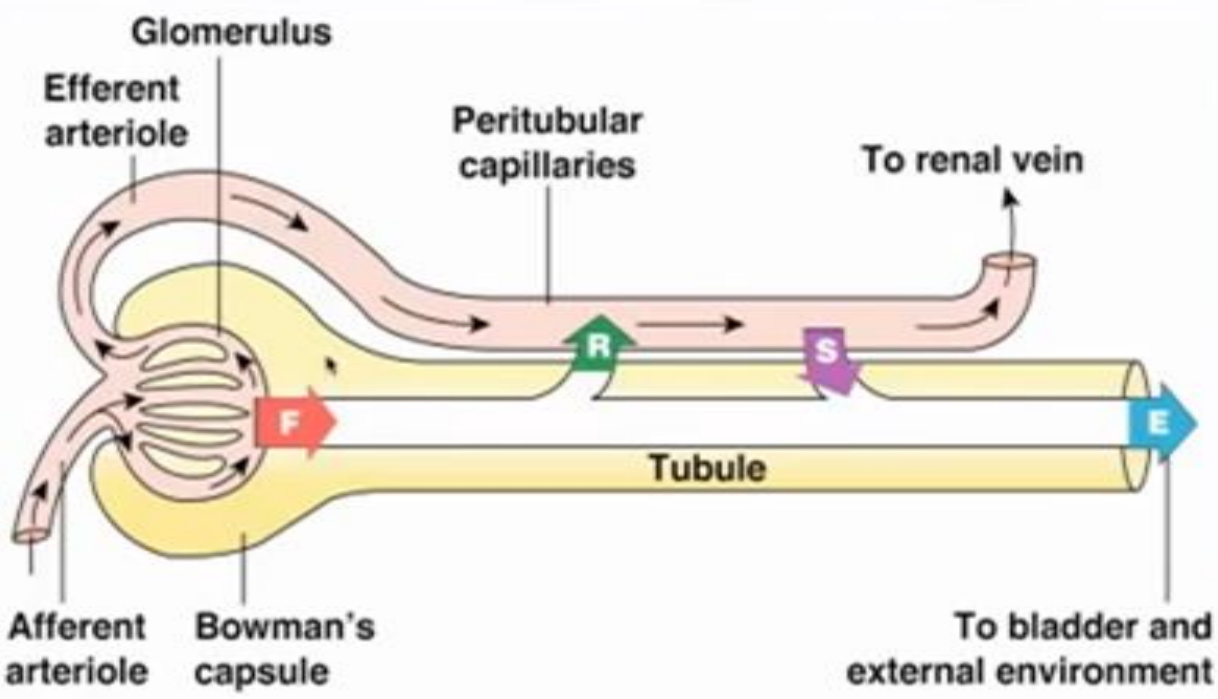
filtration

- 5L Cardiac output
- 25% kidney = 1.25L/min
- 55% blood plasma of 1.25L= 600ml/min
- 20% Renal plasma flow=120ml/min reabsorbed most
- GFR is only 20% the remaining 80% go to efferent arterioles
- 120*60*24=180L/day
- 3L plasma in the blood
- 60 times/day
- Hemodialysis draws your blood at a rate of 200-400ml/min

Starling Forces



Capillary blood pressure (BP)	60 mmHg out
Colloid osmotic pressure (COP)	– 32 mmHg in
Capsular pressure (CP)	– 18 mmHg in
Net filtration pressure (NFP)	10 mmHg out



Amount filtered (F) − amount reabsorbed (R) + amount secreted (S) = Amount of solute excreted (E)

Factors that alter filtration pressure change GFR

These factors include:

- Increased renal blood flow → Increased GFR
- Decreased plasma protein → Increased GFR → edema.(nephrotic syndrome)
- Hemorrhage → Decreased capillary hydrostatic pressure → Decreased GFR

PCT

Reabsorption (Grandmom roles of handling money)

Basolateral membrane

Na+ and K+ pump once time energy

Apical Border

Na+ facilitated diffusion

SGLT2 Na+ and Glucose active transport

Amino acid

Ca++

HCO3-

Basolateral membrane

GLUT2 Na+ and glucose facilitated diffusion

Secretion urine

Uric acid

Oxalic acid

Bile salts

Para aminoheppuric acid

Acid base balance

HCO3 reabsorption basolateral membrane

H+ secretion urine

Apical membrane

Na+ and H+ exchanger secondary active transport

Loop of Henle

- Thin descending limb is only permeable to water concentrated segment

300mosm

1200mosm

- Thick Ascending limb is permeable to salt and water

Diluting segment 100mosm

Basolateral membrane

Na+ K+ pump Once energy

Apical surface

Thick segment Na+ K+ 2Cl- secondary symport co-transporter

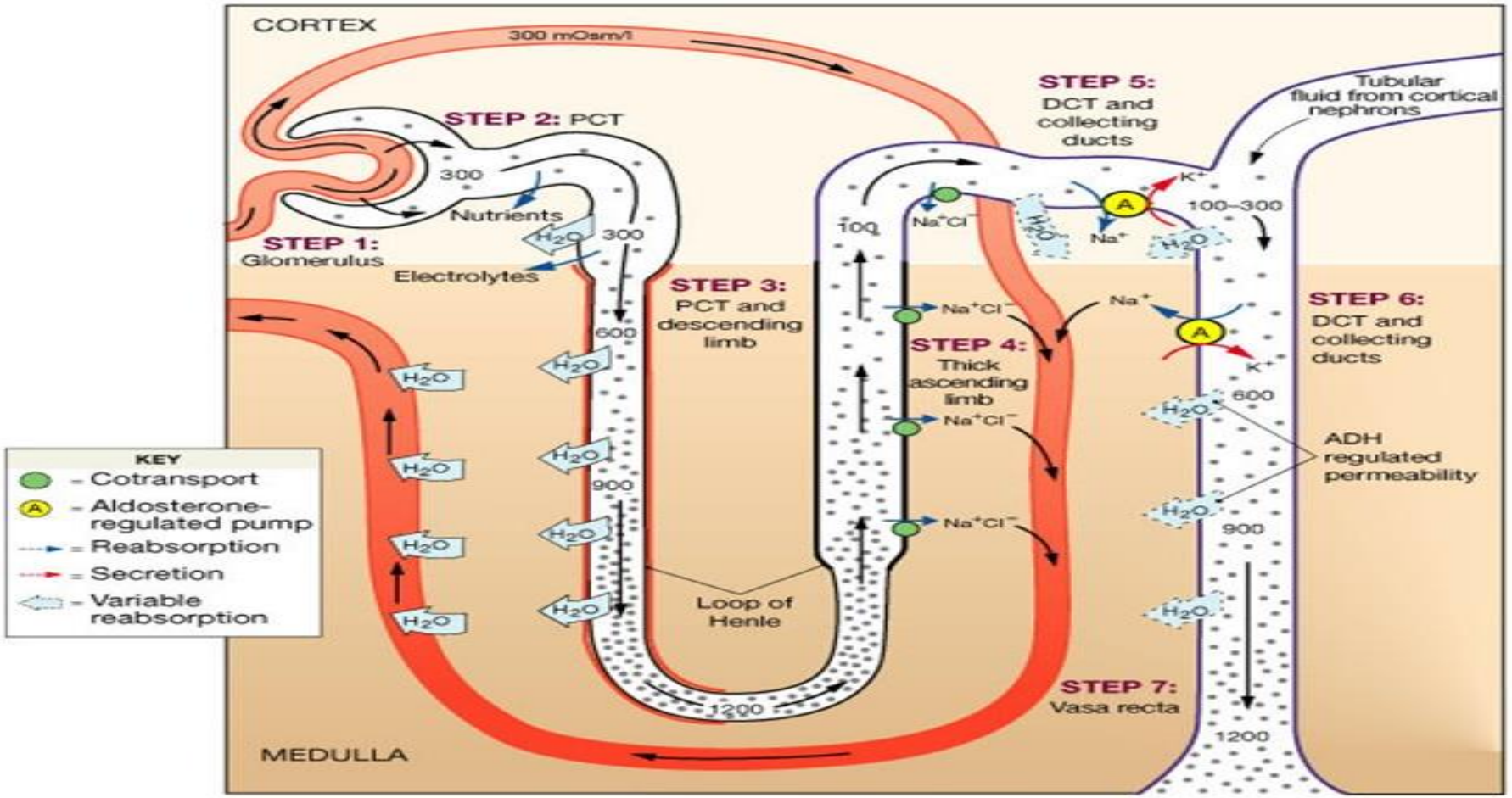
Ca+ Mg+ HCO3+ paracellular

Loop diuretics (the most powerful)

25% of Na+

Na+ K+ 2cl-

The Counter-Current Mechanism



Late Distal convoluted duct and collecting duct

Principle cells

Larger in number

Taller

Collecting duct

Aldosterone

Na and H2O reabsorption

H2O reabsorption (ADH) vasopressin

alpha intercalated cells

- Fewer in number
- Shorter
- Collecting and DCT

Acid base balance

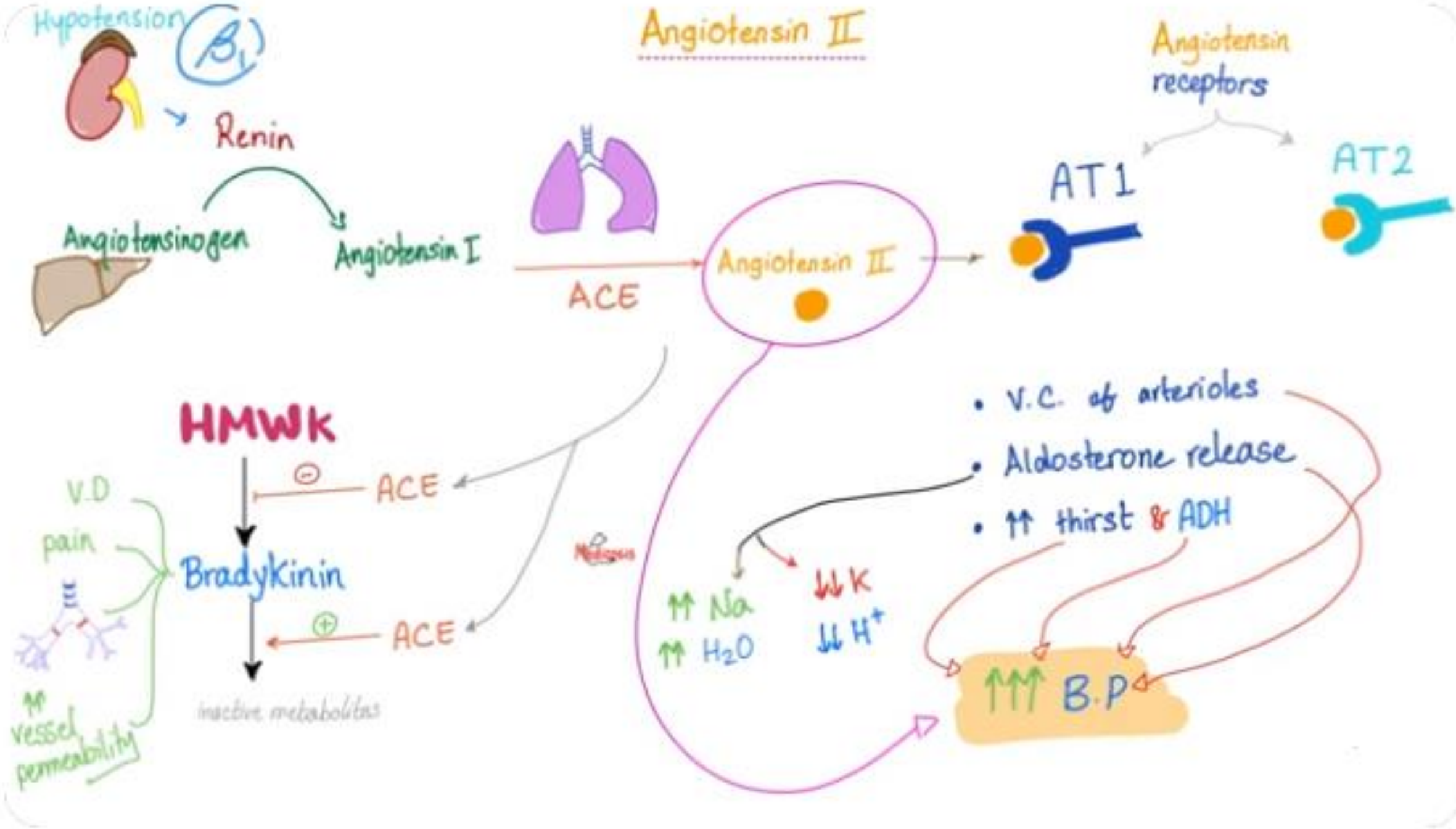
aldo

H and K secretion Apical NH3 NH4

HCO3 reabsorption and Cl- dump basolateral membrane NH4Cl

- Ammonium chloride (titratable acid)

NH4CL


Hypotension
β_1
Renin
Angiotensinogen
Angiotensin I
ACE
Angiotensin II
Angiotensin II
Angiotensin receptors
AT1
AT2
HMWK
ACE
V.D
pain
Bradykinin
ACE
inactive metabolites
vessel permeability
Medulla
↑↑ Na
↑↑ H_2O
↓↓ K
↓↓ H^+
• V.C. of arterioles
• Aldosterone release
• ↑↑ thirst & ADH
↑↑↑ B.P