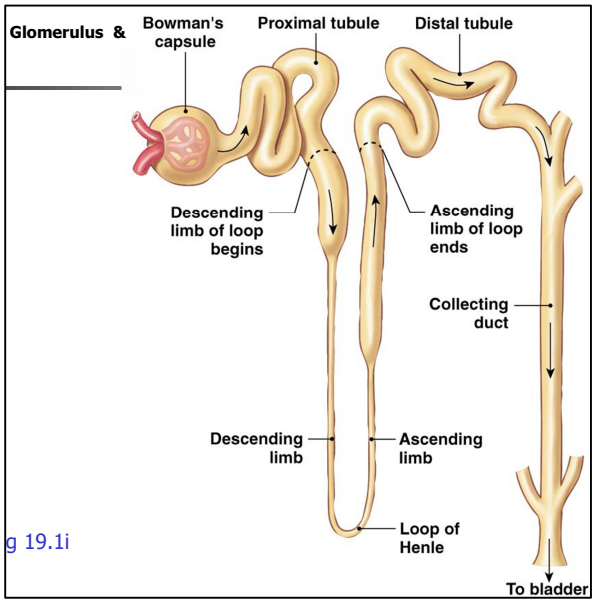
PHYS20008 – Lecture notes – Part 3

Lecture 26 – Tubular function



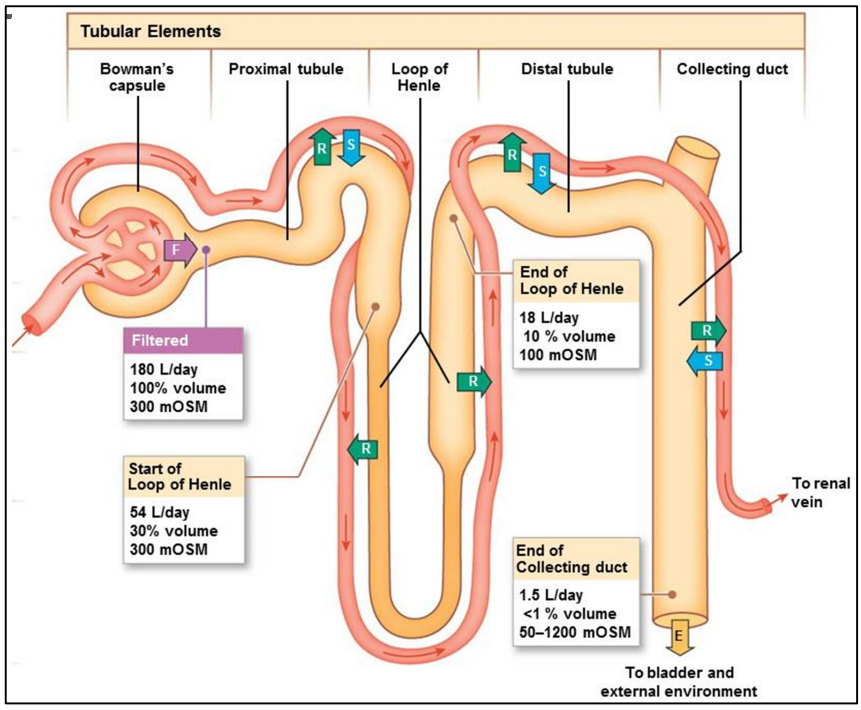
- Depending on what our body needs at the time solutes can be filtrated, reabsorbed, secreted or excreted
- Creatinine is a true waste product

PRS: The plasma is MOST similar in chemical composition to the fluid in the:

A. Proximal tubule
B. Collecting duct
C. Distal tubule
D. Bowman's capsule
E. Ascending limb of the loop of Henle

	Filtration	*Reabsorption*	*Secretion*	*Excretion*
Water	+	+		1%
Na^+	+	+		0.5%
K^+	+	+	+	10%
Ca^{2+}	+	+		2%
Phosphate	+	+		20%
Glucose	+	+		0%
Creatinine	+			100%
Urea	+	+		50%

Changes in Filtrate along nephron

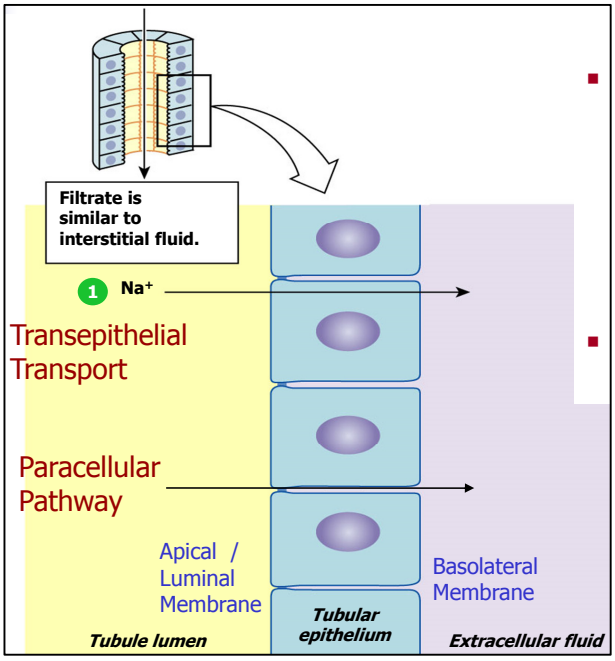


- Only consider the 20% of plasma that is filtered → assume the other 80% doesn't exist so 100% = all the plasma that gets filtered
- 300 mOsm = isosmotic
- Proximal tubule – bulk absorption and isosmotic absorption (reabsorb 70% of our fluid but it stays the same osmolarity) → made possible by the microvilli in the proximal tubule
- Once past the loop of Henle we further reabsorb 20% of the total filtrate but it is only 100 mOsm (hyposmotic → we have reabsorbed a lot more solute than we have fluid) – Controlled by counter current multiplier (discussed later)
- At the end of the collecting duct we reabsorb another 9% (approx.) – hormone controlled
- Wide range of osmolarity for the fluid coming out of the collecting duct and essentially ends up being urine – osmolarity can be from 50-1200 mOsm → can greatly dilute or concentrate our urine
    - This is important depending on our diet (i.e. eaten a lot of salt etc and get rid of without afceting the

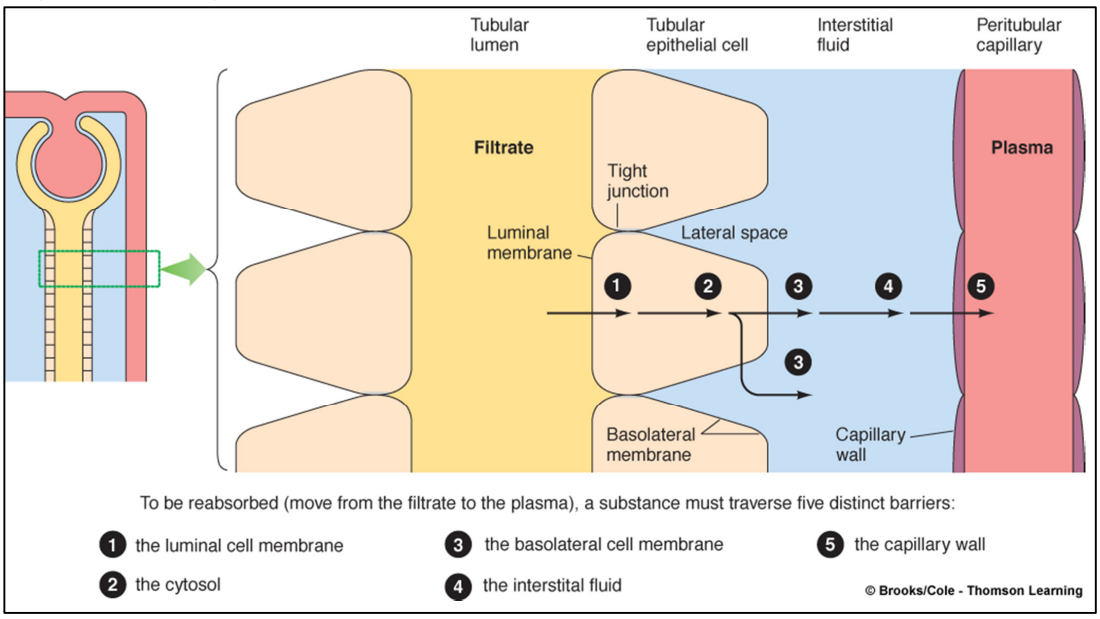
rest of the body much)

Pathways for Tubular Reabsorption

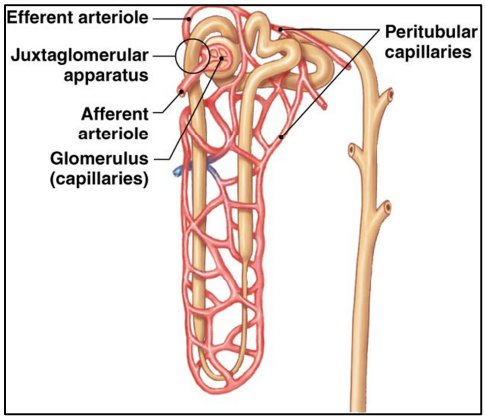
- Transepithelial transport
  - Substances cross both apical and basolateral membrane
  - Has to a cross a cell
  - Usually an active process because we have to create concentration gradients
- Paracellular pathway
  - Substances pass through the junction between two adjacent cells
  - Create tight junctions



Steps of Transepithelial Transport

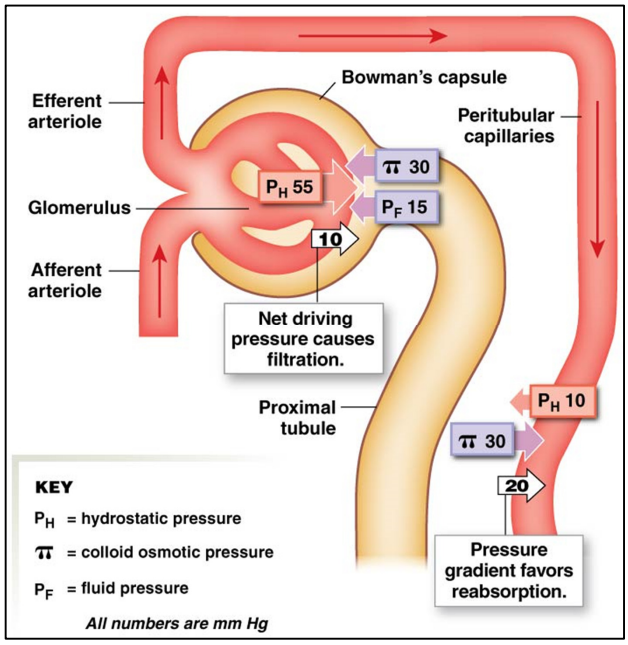


- First need to go through luminal membrane
- Either 4 or 5
  - 4 – stay in interstitial fluid
  - 5 – but if full reabsorption needs to happen cross the interstitial fluid into the plasma



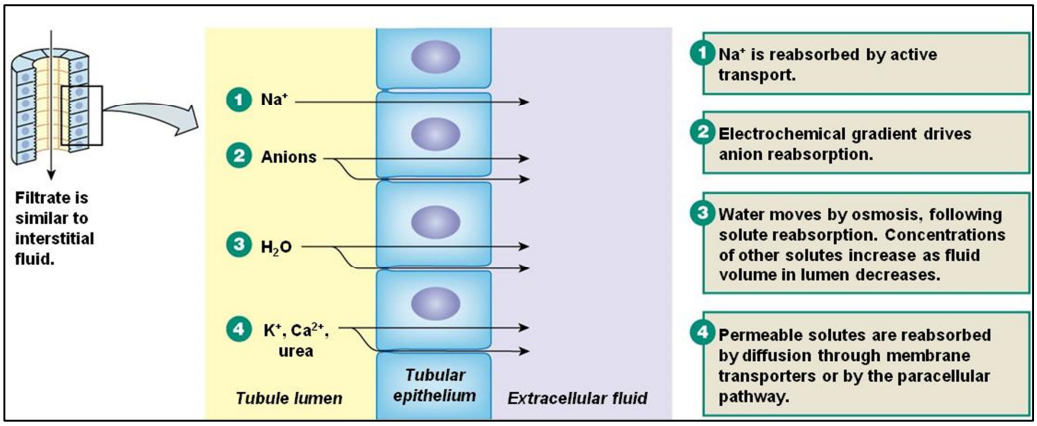
- Position of blood vessels around the nephron
- Efferent arteriole forms a large part of our peritubular capillary – it sits intertwined very close to the tubule which decreases diffusion distance and helps to drive reabsorption

Reabsorption into Peritubular Capillaries



- Hydrostatic pressure is much lower when we go down the efferent tubule than in our bowman's capsule

Principles governing Tubular Reabsorption



- Na is the first thing that moves in and it helps to move all the other stuff
- Na reabsorption = ACTIVE PROCESS
- When Na is reabsorbed, there is a net positive charge in the ECF so anions naturally want to follow → electrochemical gradient
- Now we have an osmolarity gradient as the osmolarity in the ECF has increased due to the reabsorption of the solutes
    - For 3 – i.e. in proximal tubule (however not in all parts of nephron → i.e. in collecting duct which are usually impermeable to water can become permeable to water depending on what hormones are circulating and contacting them)

PRS: Which one/s of these solutes is/are dependent on active transport to be reabsorbed? (active reabsorption)

A. ***Amino acids***
B. ***Glucose***
C. ***Sodium***
D. ***Anions***

Explanation: Active reabsorption

There are 2 types of active transport: primary and secondary

- Na undergoes primary active transport as it is the molecule that is transported by the ATPase but it is the energy created by the Na (i.e. electrochemical and osmotic gradients) that forces the movement of the other solutes