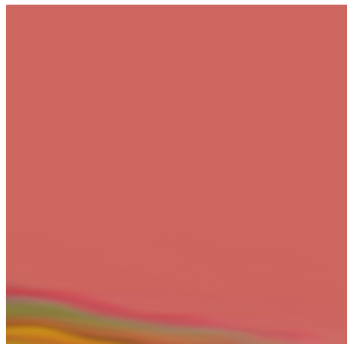
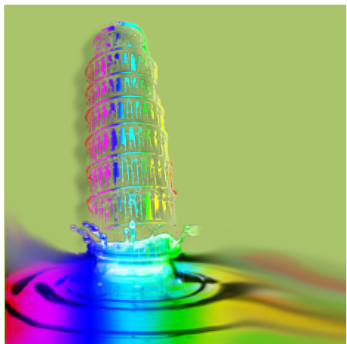
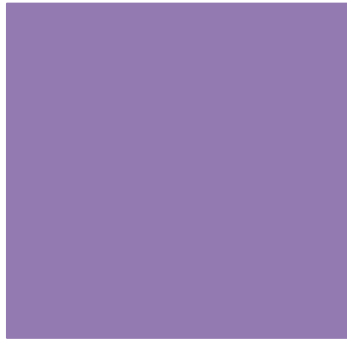




Il rene



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The kidneys - Functions



- Organ for molecular transport and separation, also and endocrine function
- Eliminate substance produced during protein metabolism : urea, creatinine, uric acid (urea $\text{NH}_2\text{-CO-NH}_2$) (always ask what about products of lipid and carbohydrate metabolism)
- Eliminate other substances (sulphates, phenols, drugs)
- Eliminate ions in eccesso (Na^+ , Cl^- , K^+)
- Regulate fluid volume
- Regulate acid-base balance, through elimination of H^+ e HCO_3^- , HPO_4^{2-}
- Production of erythropoietin, a hormone which regulates haemopoiesis
- Production of adrenalin



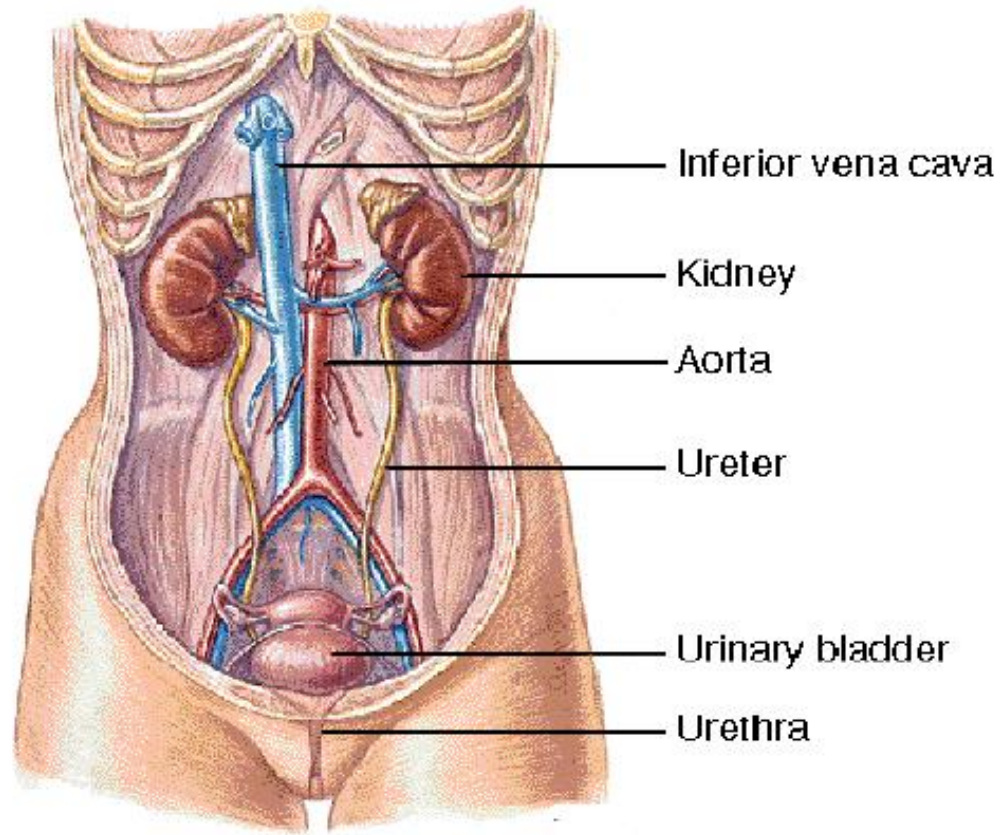
The kidneys - Functions



- Consequences of renal failure (when 90% of nephrons are dysfunctional)
 - Uremia
 - Anemia
 - Low Hematocrit
 - Acidosis
 - Edema
 - Death

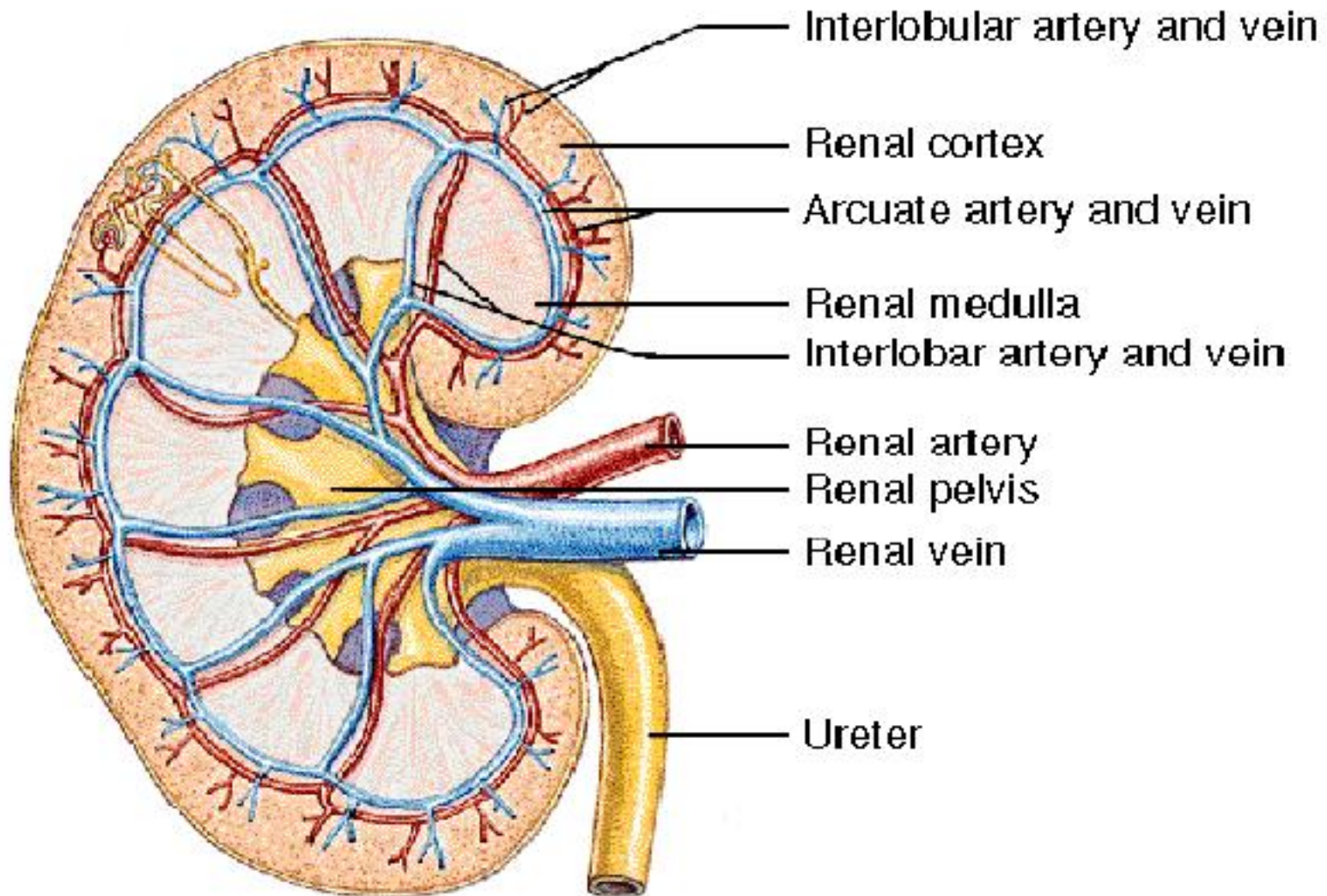


The urinary systems



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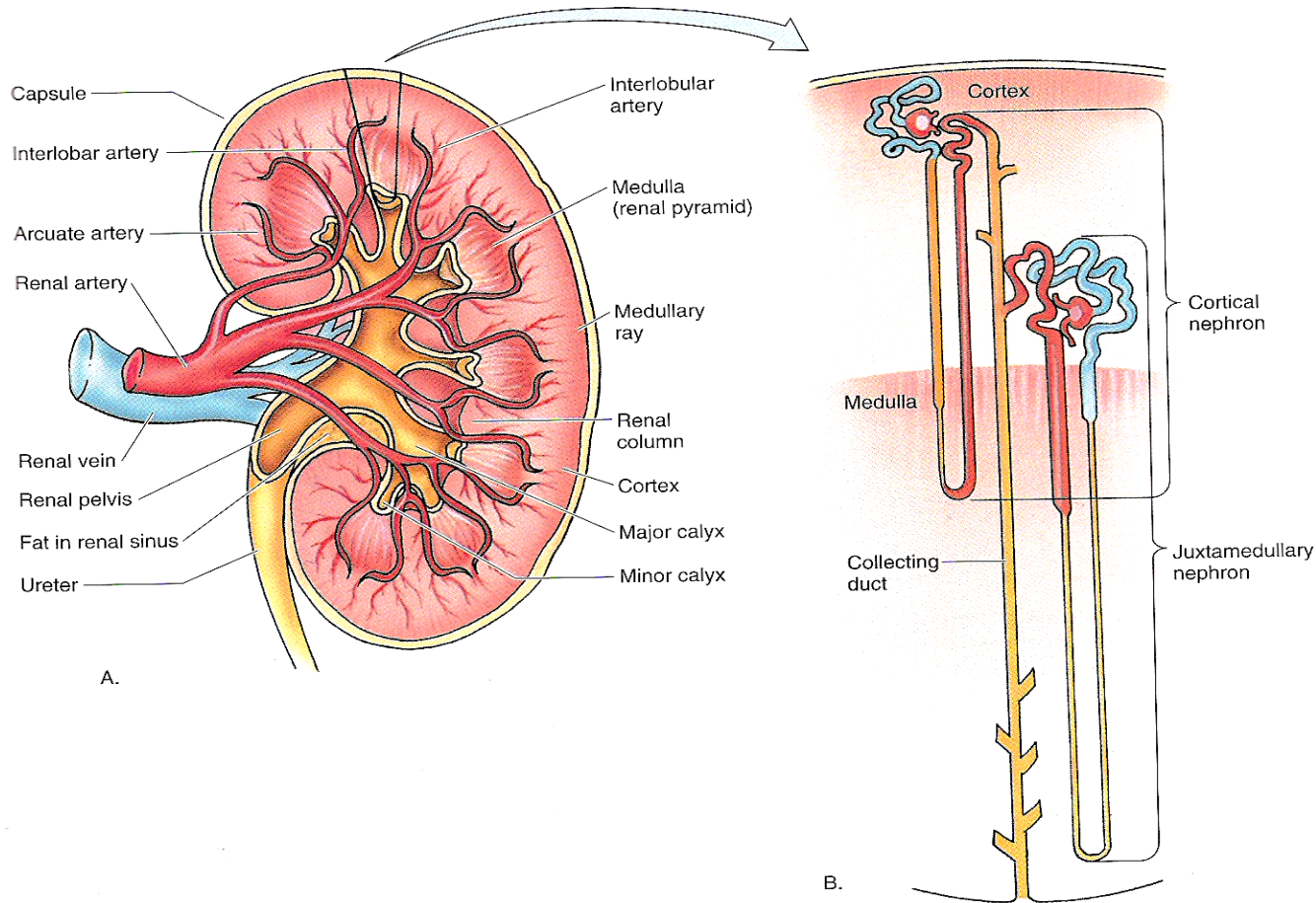
Gross Structure of Kidney





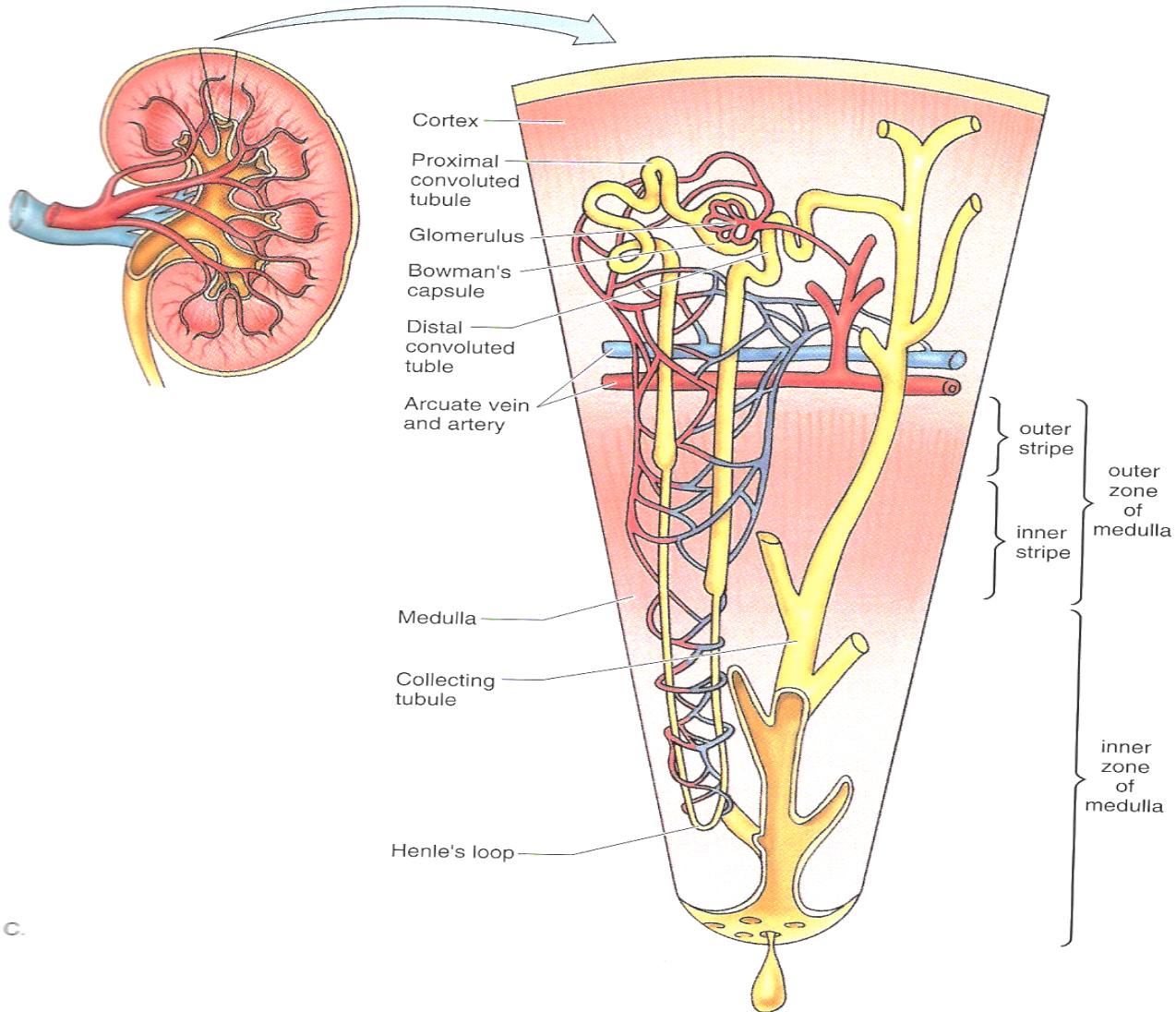
Kidney functional unit

- The functional unit of the kidneys is the nephron. Each kidney has about 1,000,000



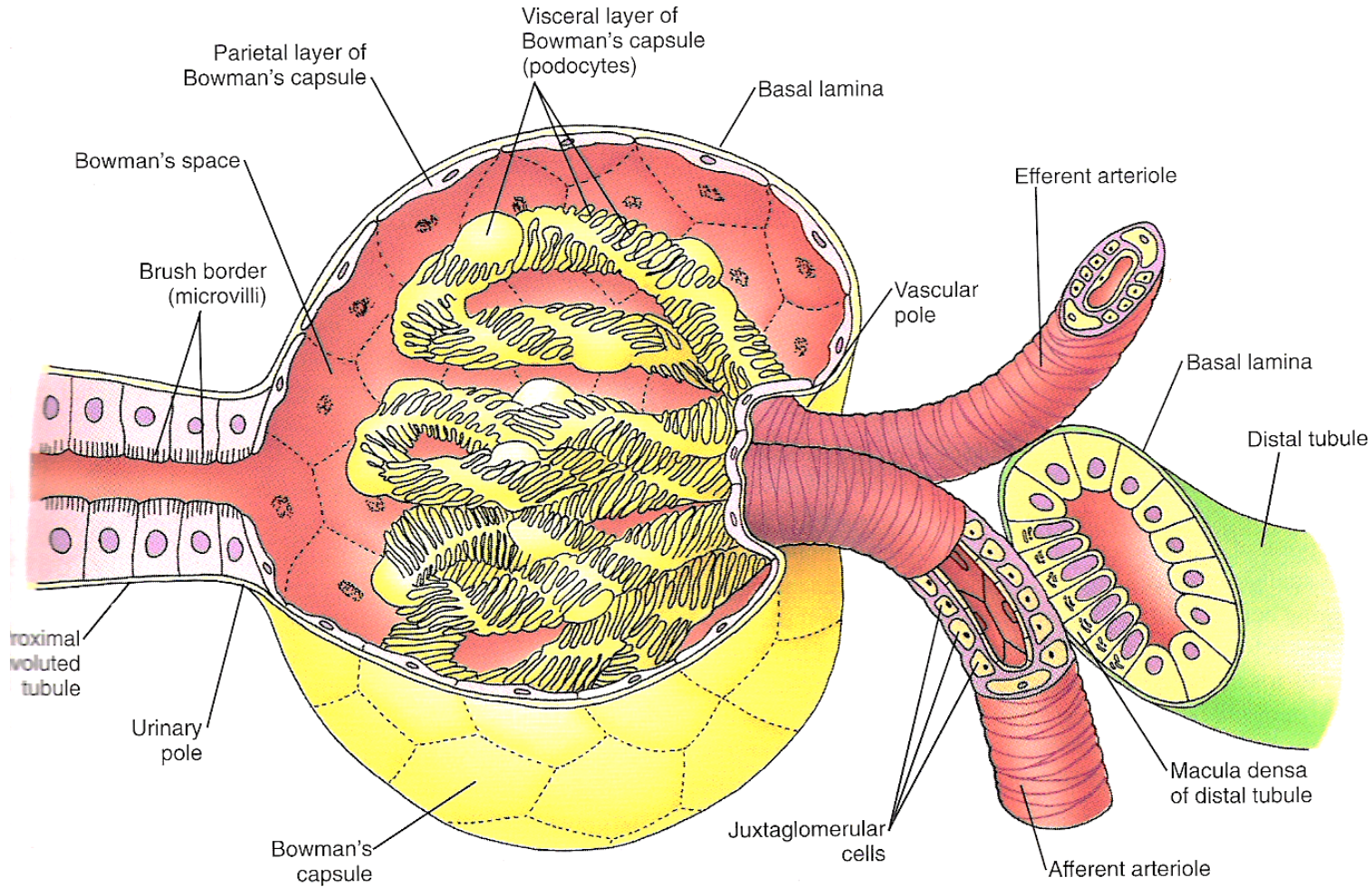


Kidney functional unit



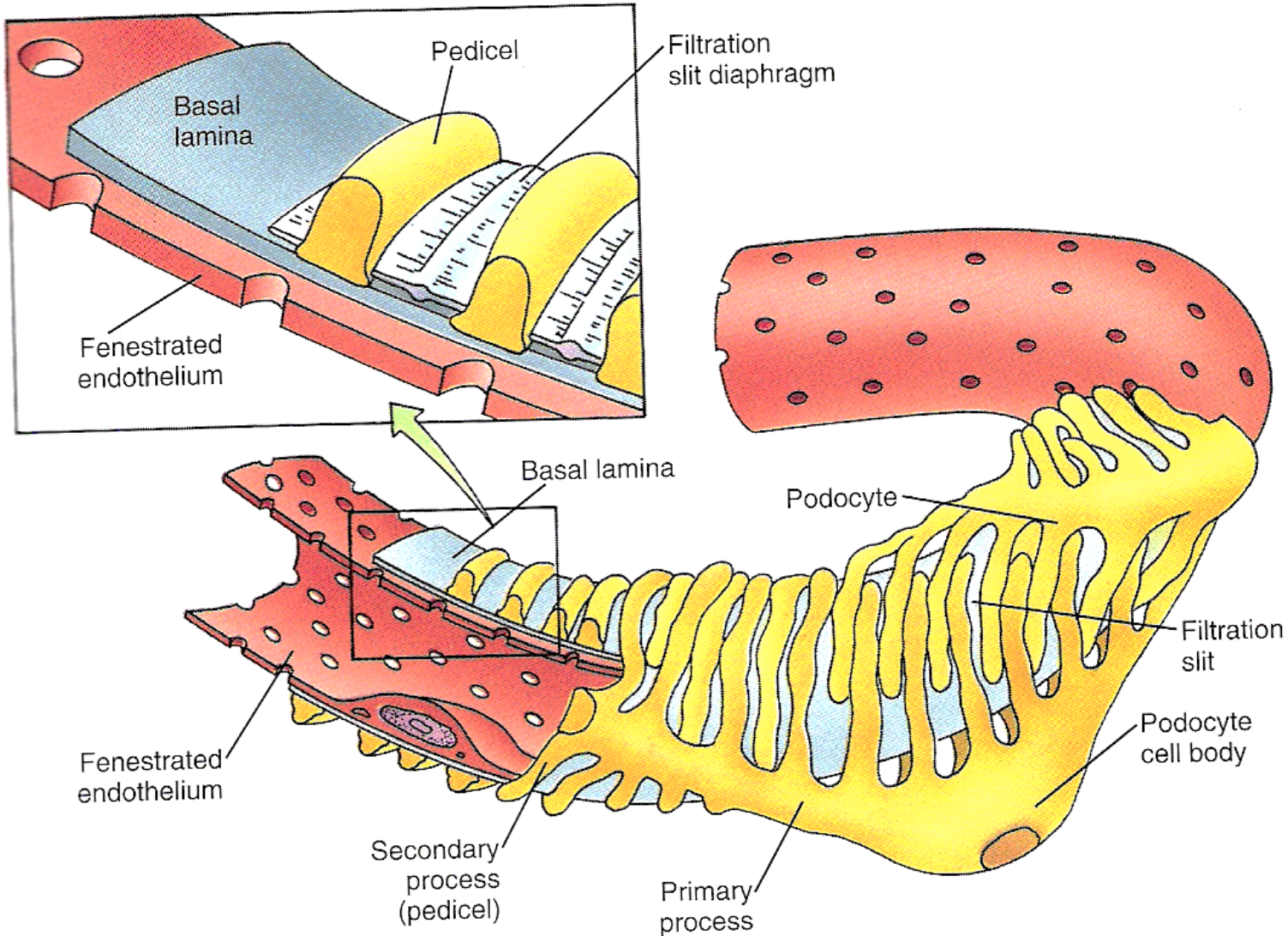


Kidney functional unit



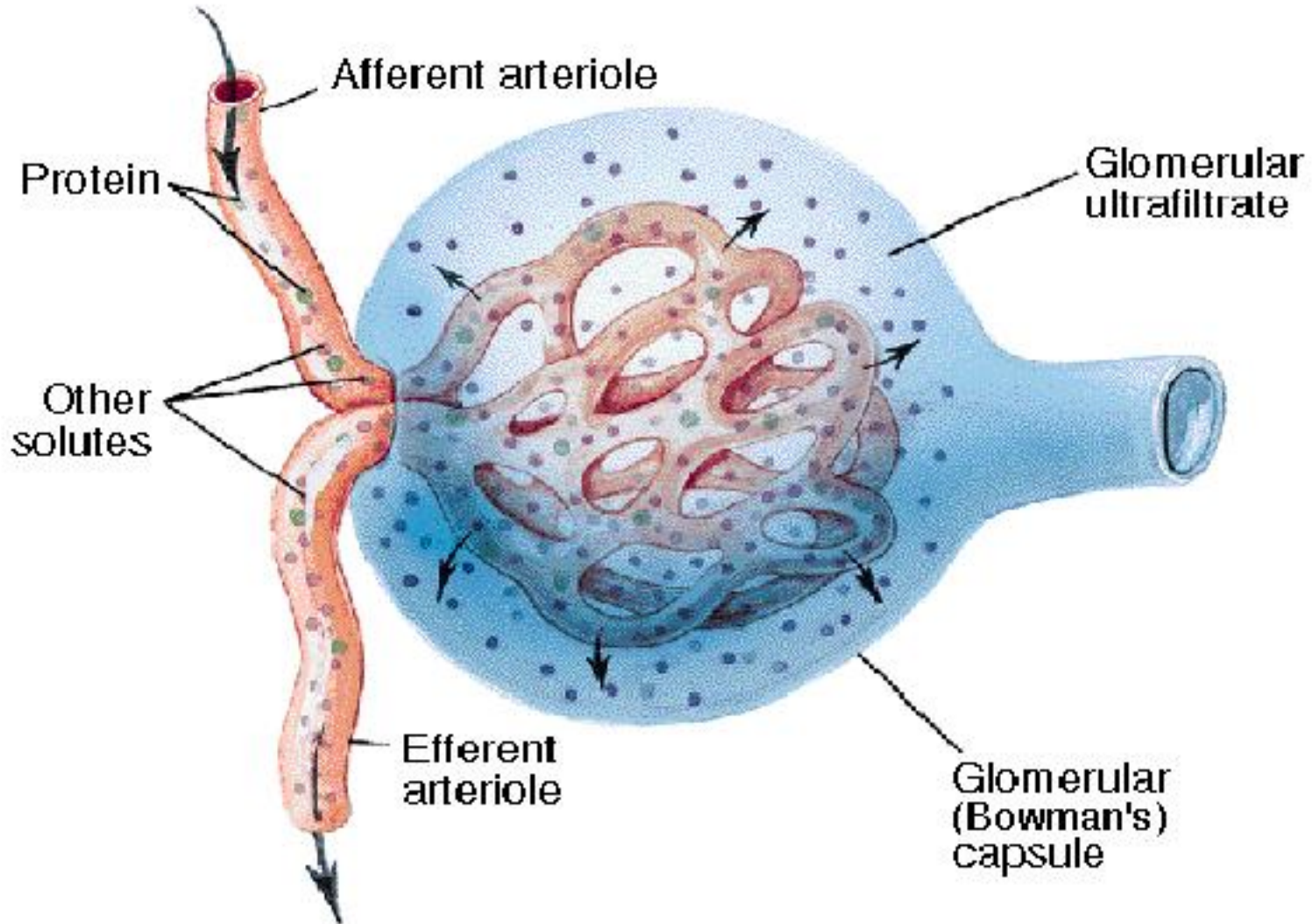


Kidney functional unit



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Glomerular ultrafiltration

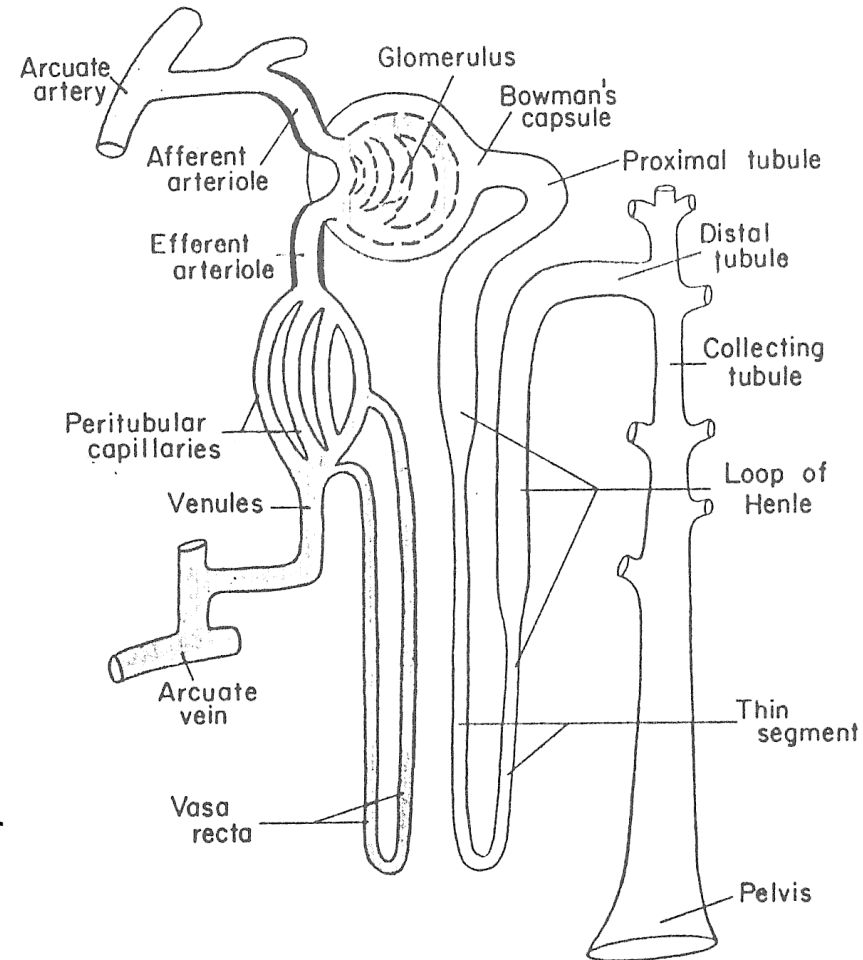




Renal Filtration

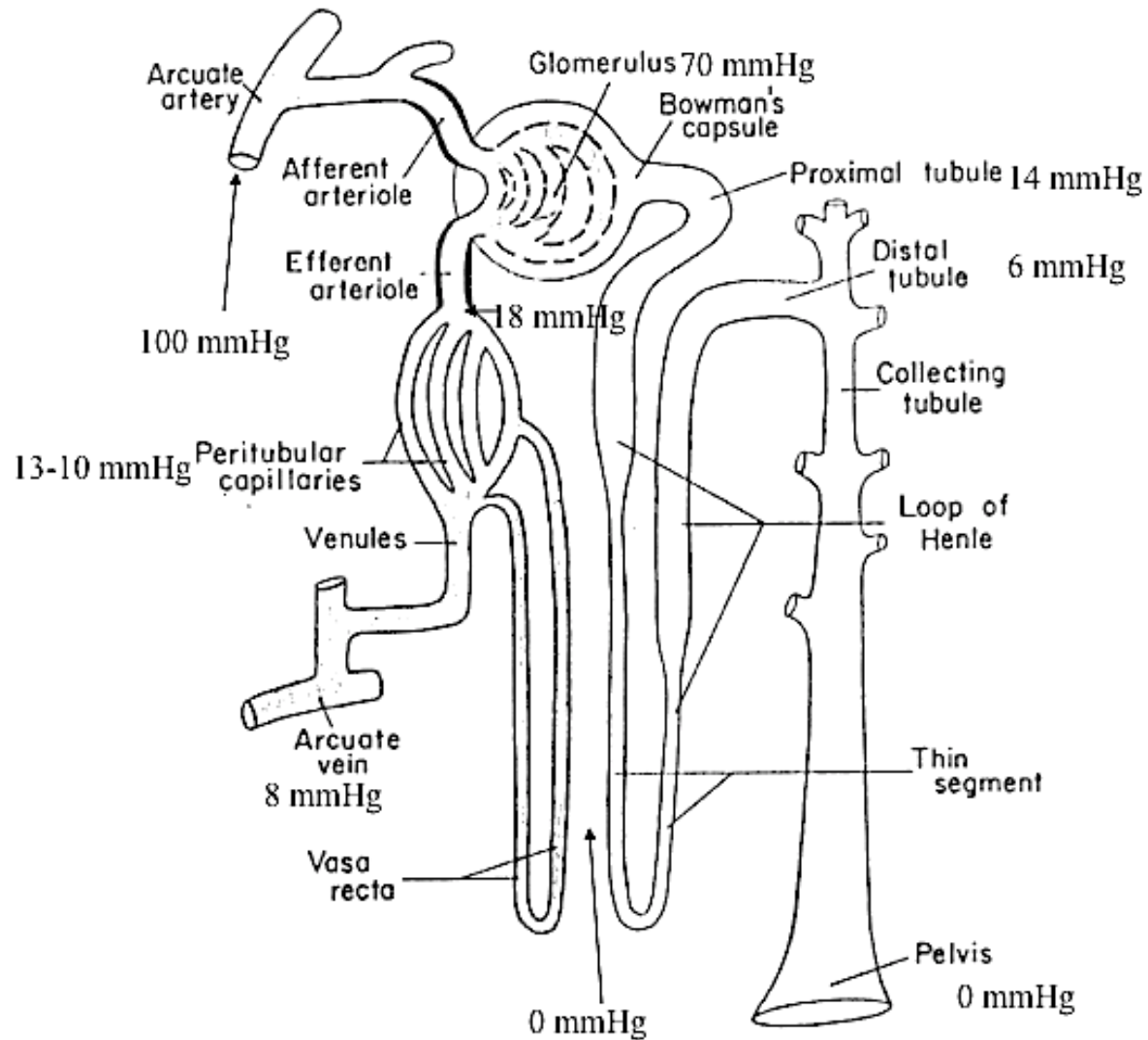


- The immediate constriction of the approximately 50 capillaries that form the glomerulus system induces high pressure. The filtration is therefore more effective ('ultrafiltration').
- The walls of the glomerulus capillaries are 25 times more permeable than normal
- 1200 ml/min of the blood flows in kidneys (1/4 of the total vascular flow)
- The initial filtrate is plasma minus the proteins
- 125 ml/min of filtrate is produced in the Bowman's capsule (180 l/day).
- This passes in tubules and is almost all reabsorbed. In particular, glucose, and all amino acids.
- Urea etc, are not reabsorbed. Ions (Na etc.) are reabsorbed only in part.
- 99,4% of the H₂O is reabsorbed giving 1 liter of urine per day for 180 liters of filtrate



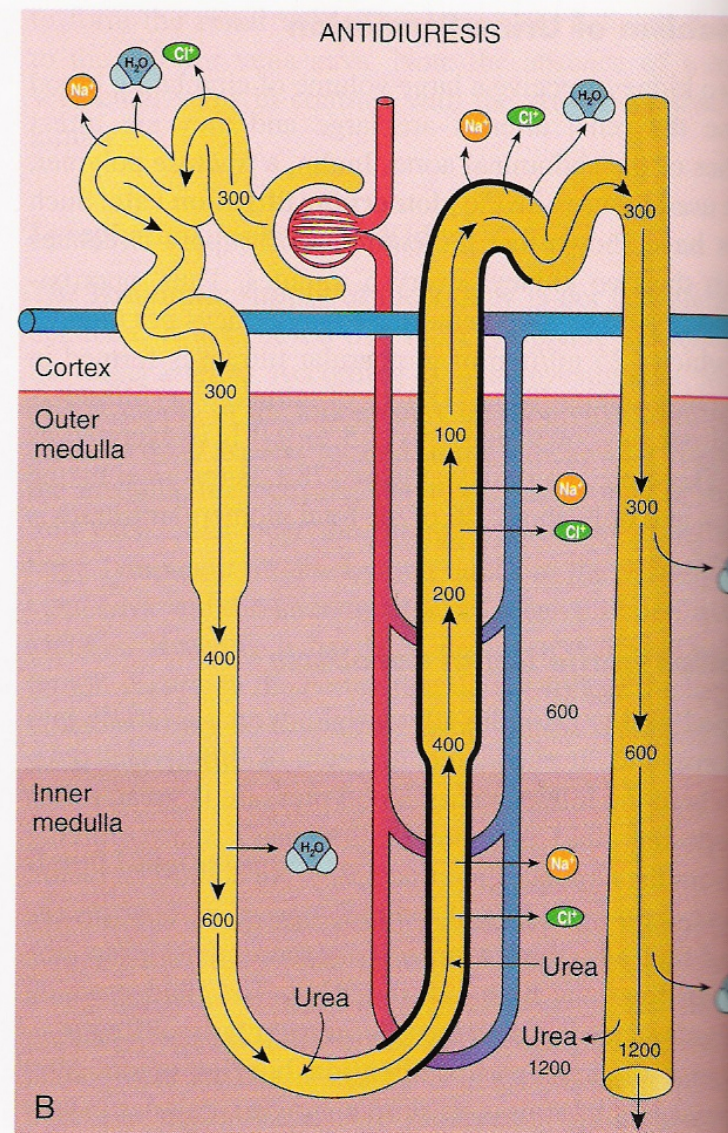
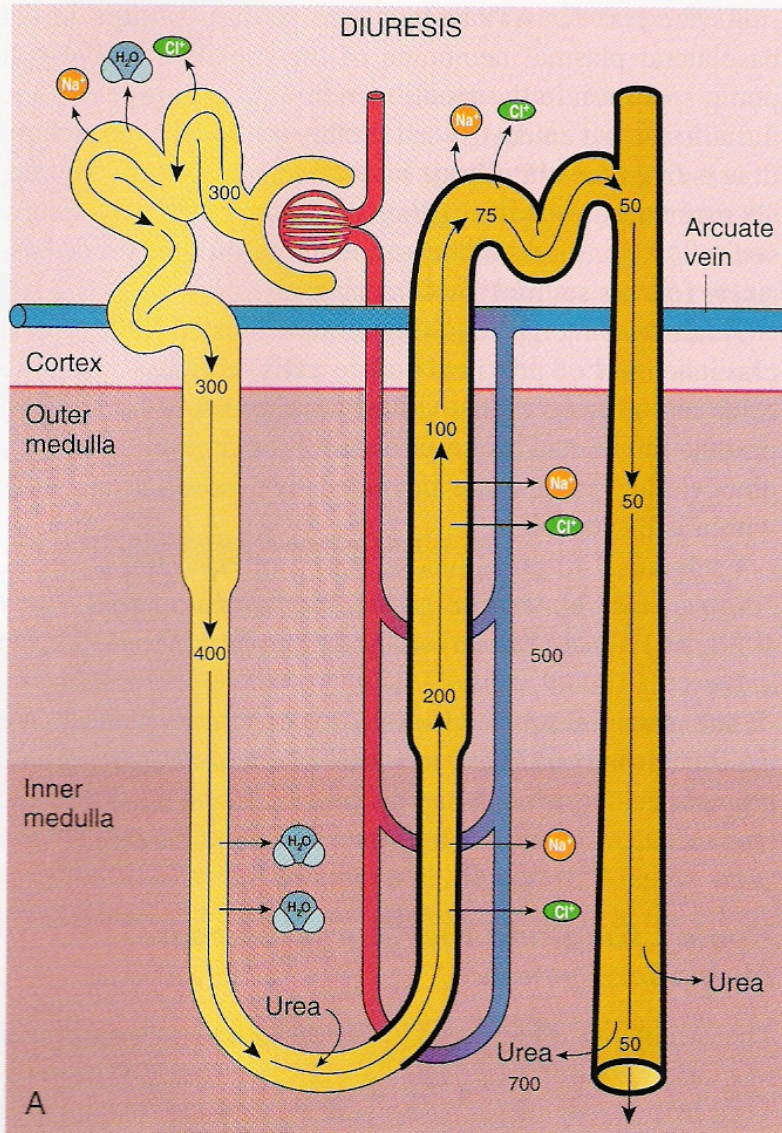


Renal Filtration



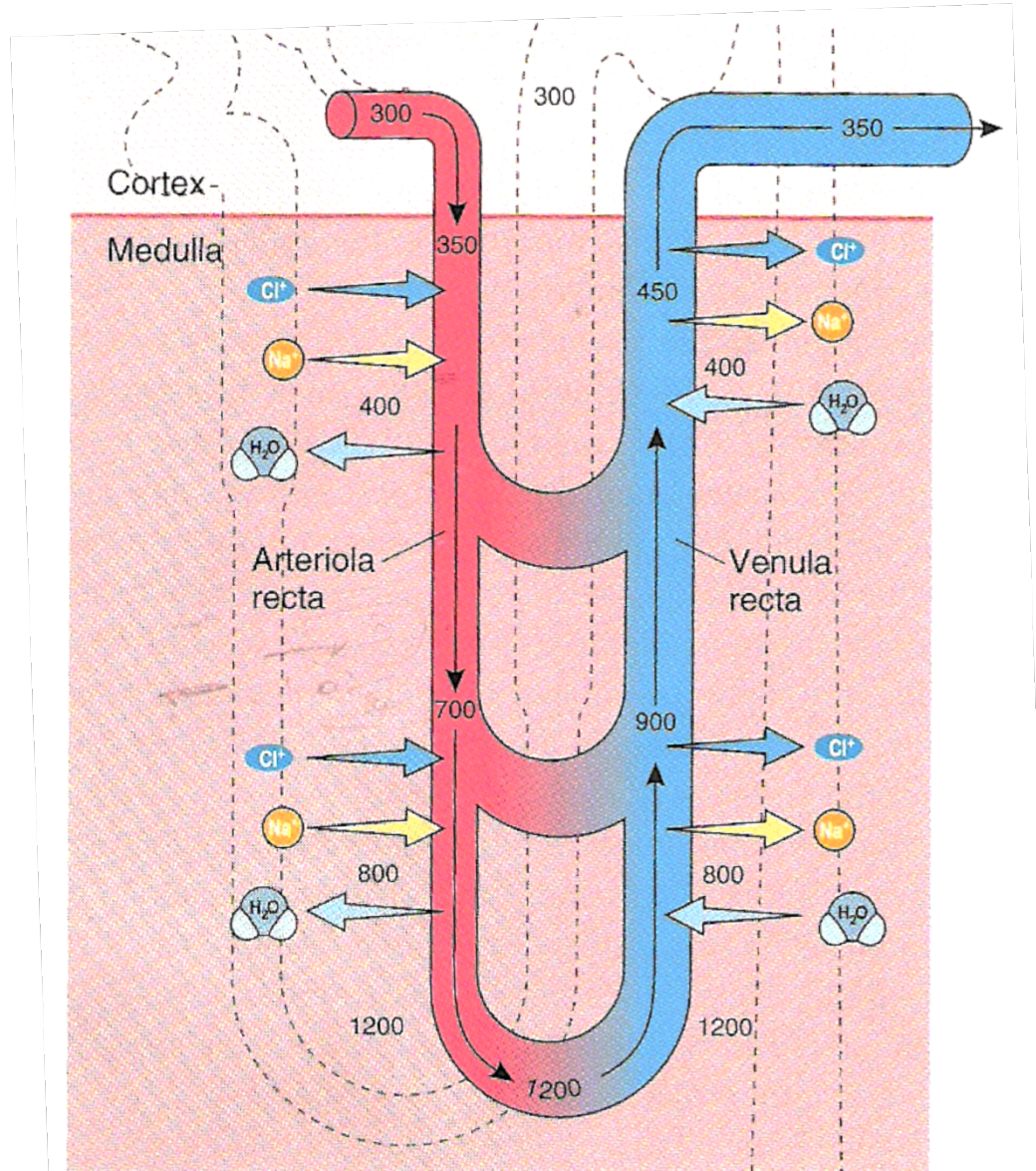


Renal function



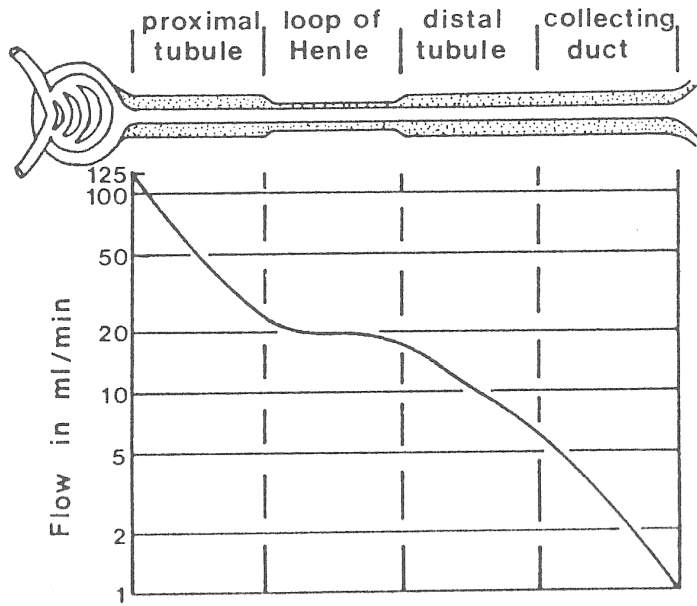


Renal Function

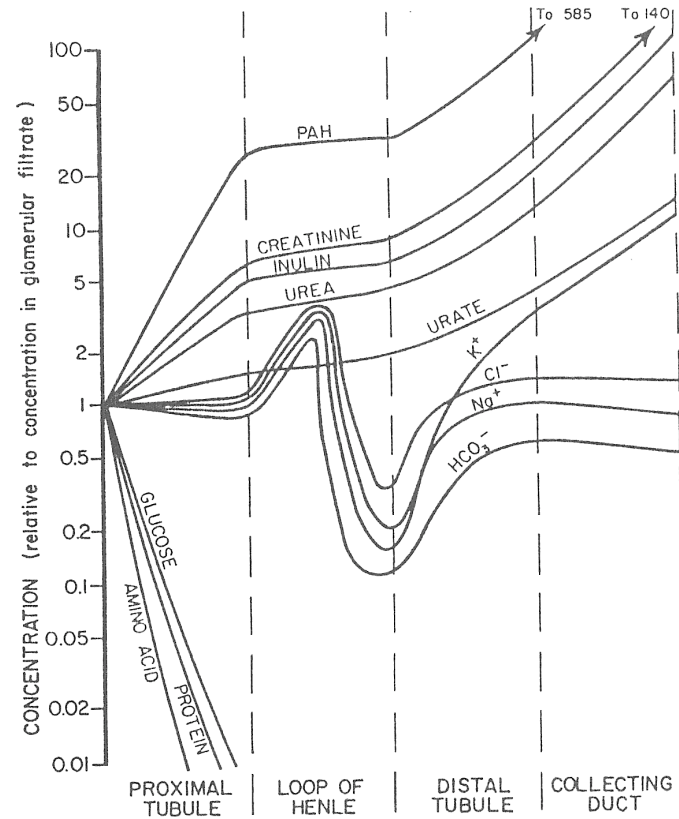




Renal function



Water flow in the tubule



Change in concentration of filtrate with respect to t=0
(when the filtration process begins)

Reabsorption is guided by active and passive transport and osmosis. Glucose and amino acids are reabsorbed in the proximal tubule by active means, whereas +ve ions are reabsorbed throughout H₂O is reabsorbed through osmosis everywhere except in the loop of Henle. K e H are secreted in the distal zones, and negative ions follow the positive passively.



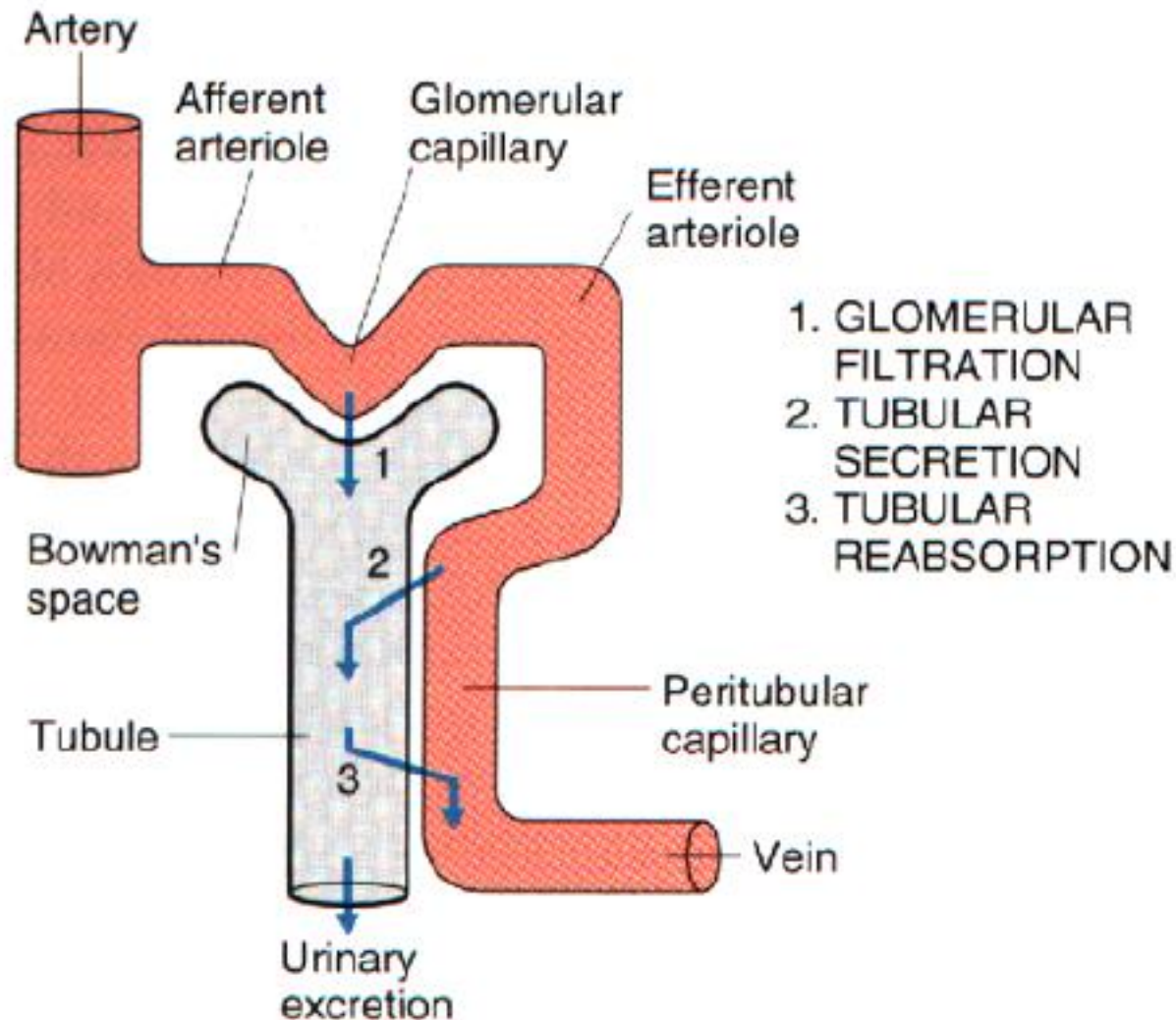
Renal function



- The threshold for glucose reabsorption is 18 mM. All molecules have a maximum reabsorption threshold except Na. (Drink to eliminate)
- Glomerular filtration rate $GFR=125$ ml/min.
- Blood flow= 1200 ml/min
- % blood filtered and processed = 10
- % plasma blood filtered and processed = 20 (because the other half is cells)

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Summary: three renal processes



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Three fates of a molecule

