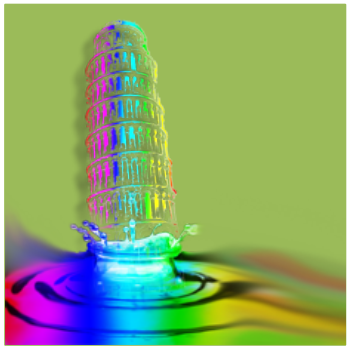

Il rene

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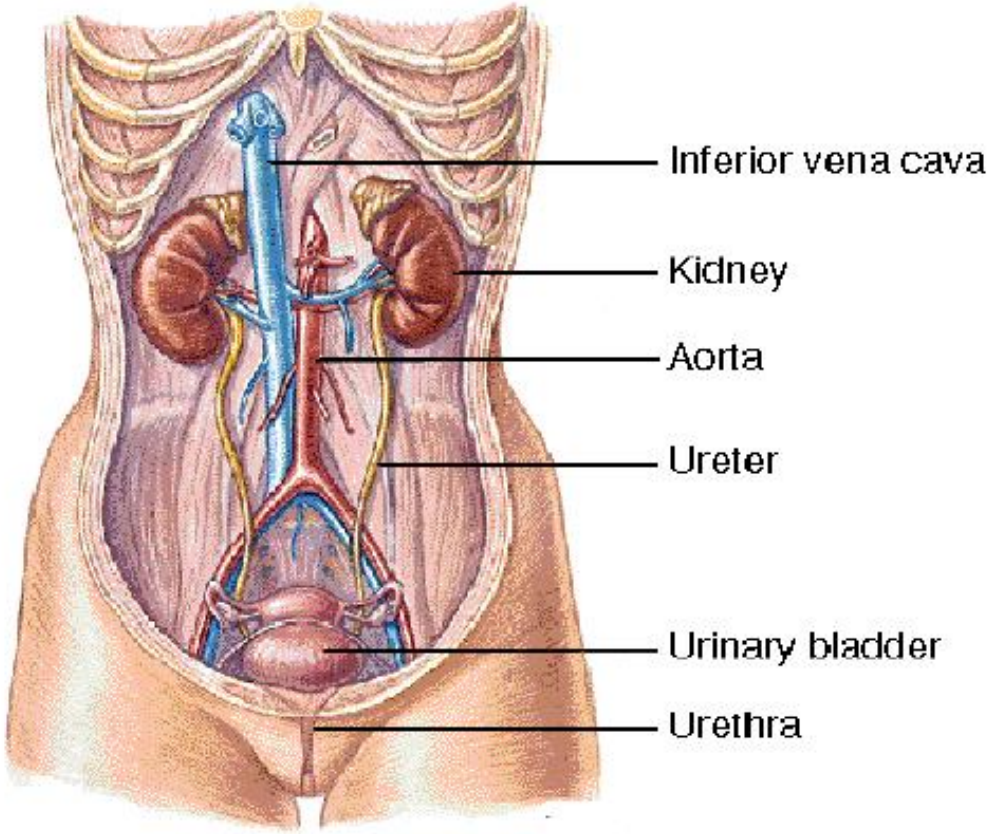
The kidneys - Functions

- Organ for molecular transport and separation, also and endocrine function
- Eliminate substance produced during protein metabolism : urea, creatinine, uric acid (urea NH_2-CO-NH_2) (always ask what about products of lipid and carbohydrate metabolism)
- Eliminate other substances (sulphates, phenols, drugs)
- Eliminate ions in ecesso (Na^+, Cl^-, K^+)
- Regulate fluid volume
- Regulate acid-base balance, through elimination of H^+ e $HCO3^-$, HPO_4^{2-}
- Production of erythropoietin, a hormone which regulates haemopoiesis
- Production of adrenalin

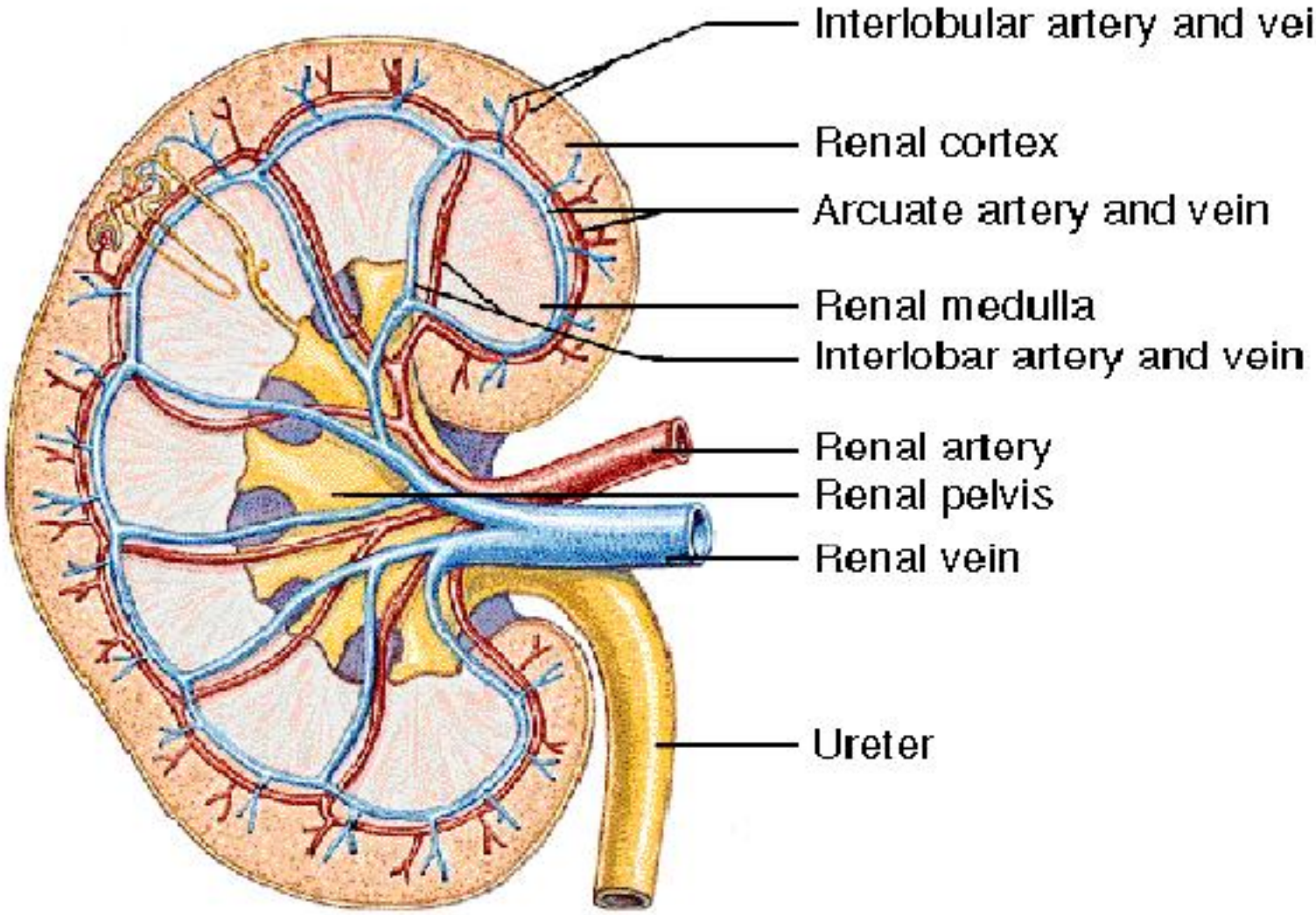
The kidneys - Functions

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

The urinary systems

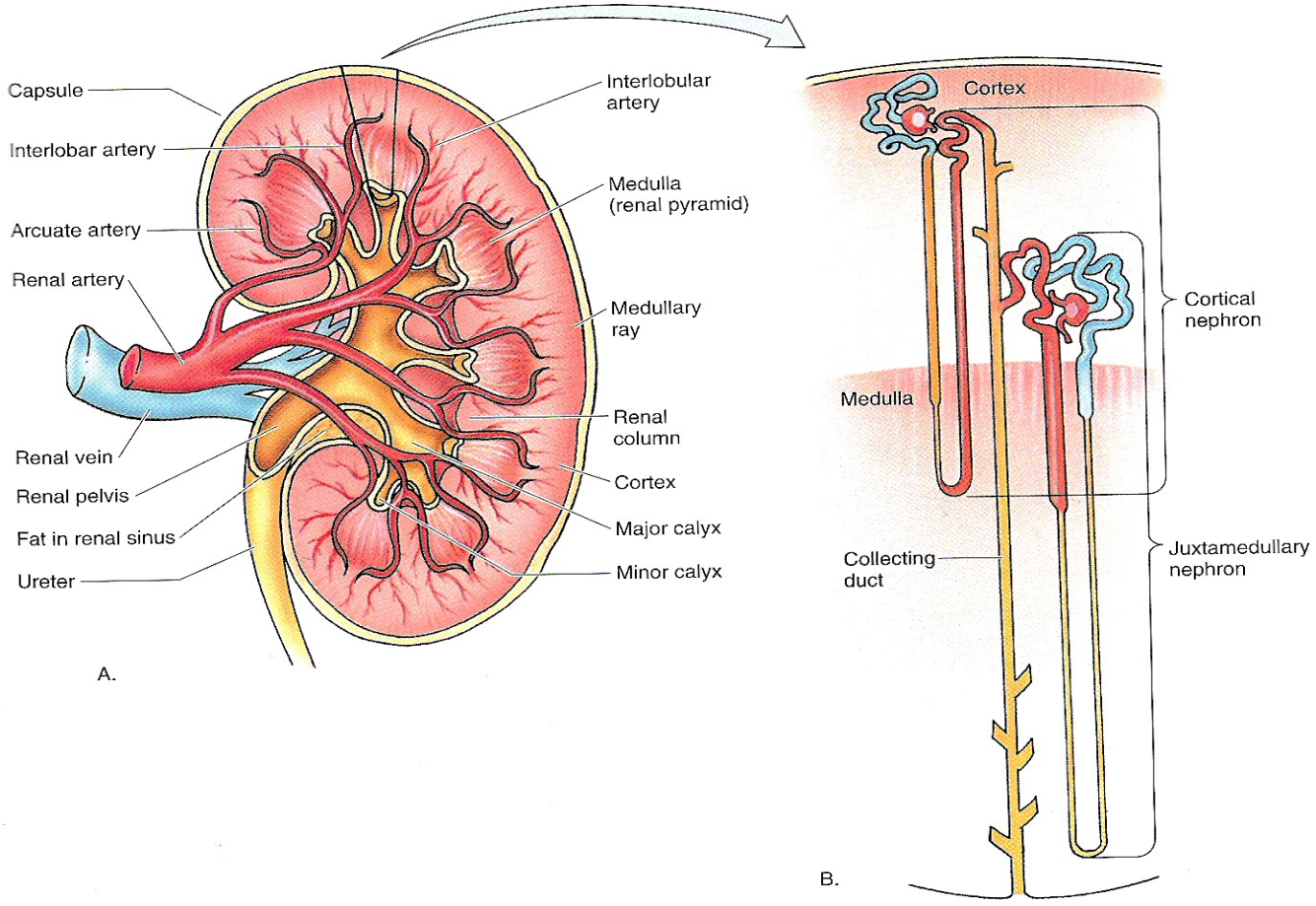


Gross Structure of Kidney

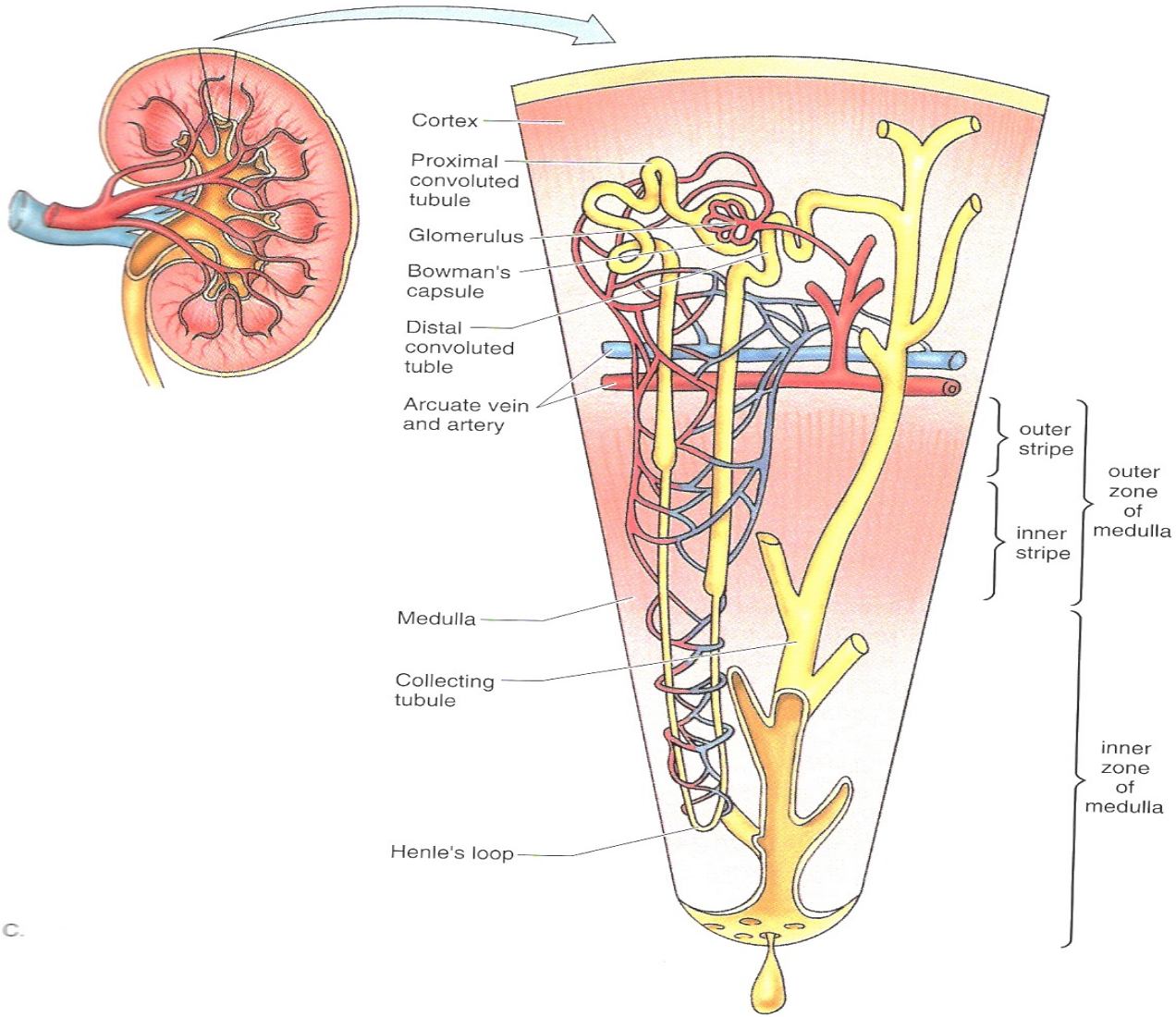


Kidney functional unit

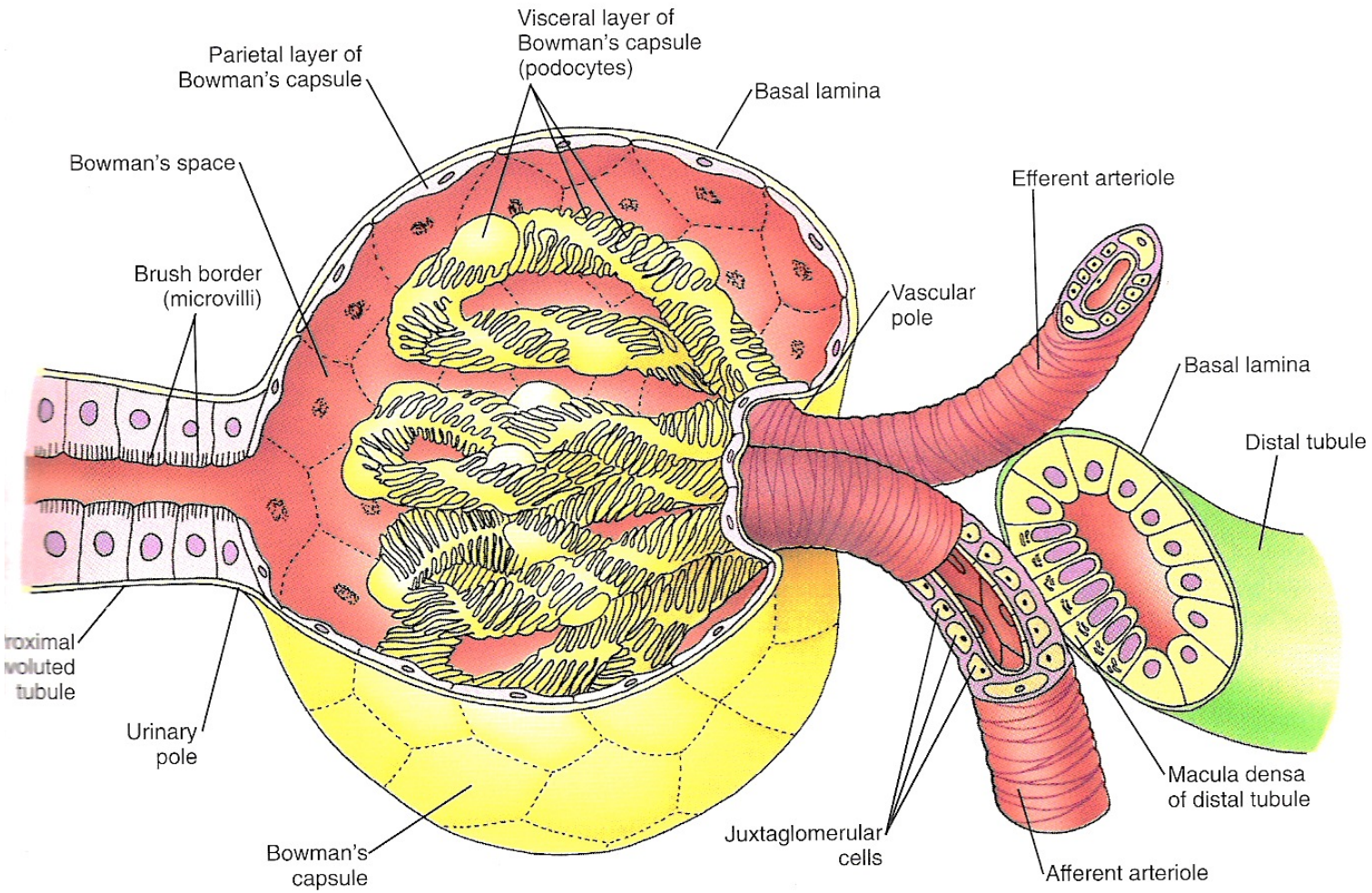
- The functional unit of the kidneys is the nephron. Each kidney has about 1,000,000



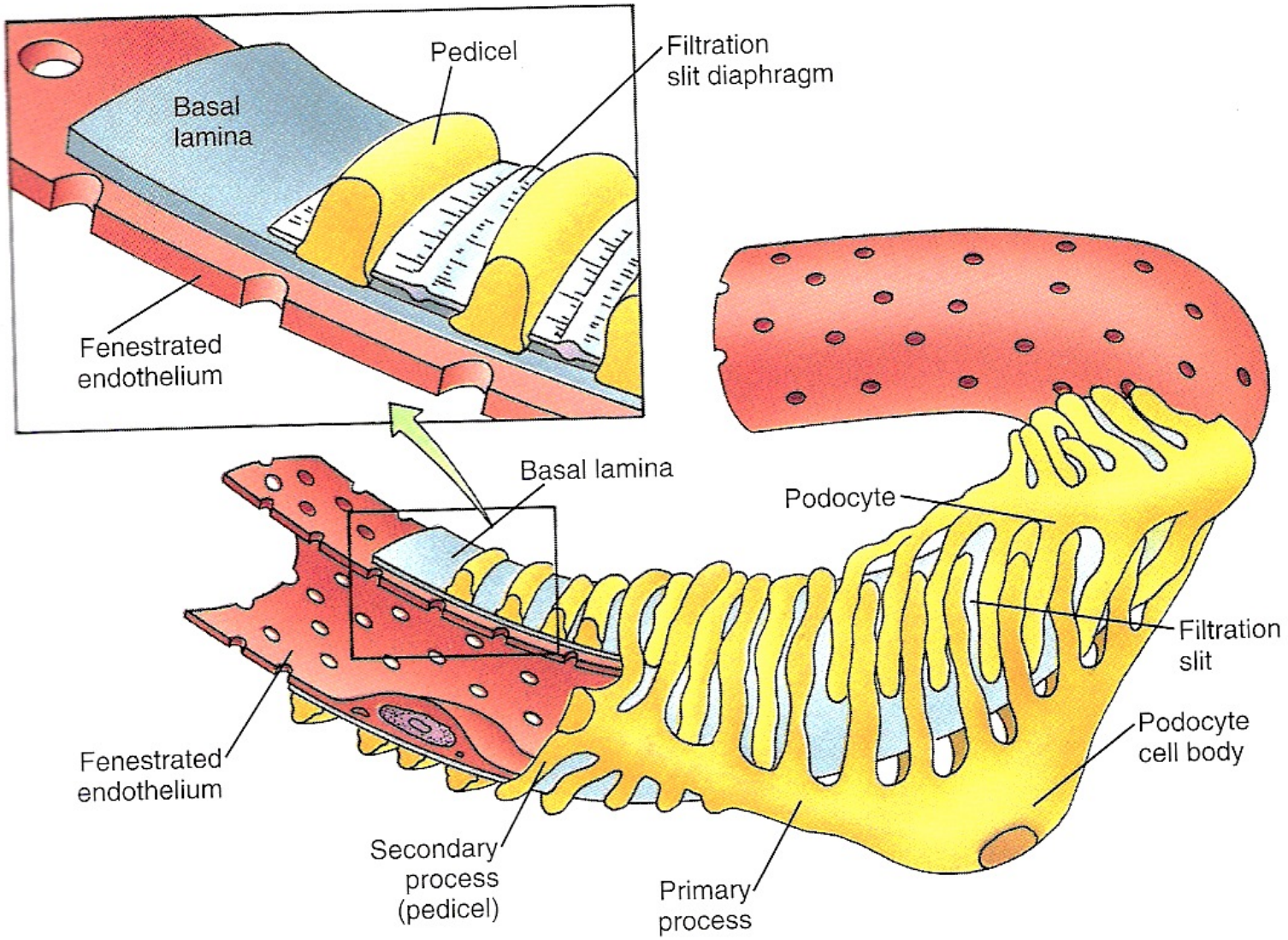
Kidney functional unit



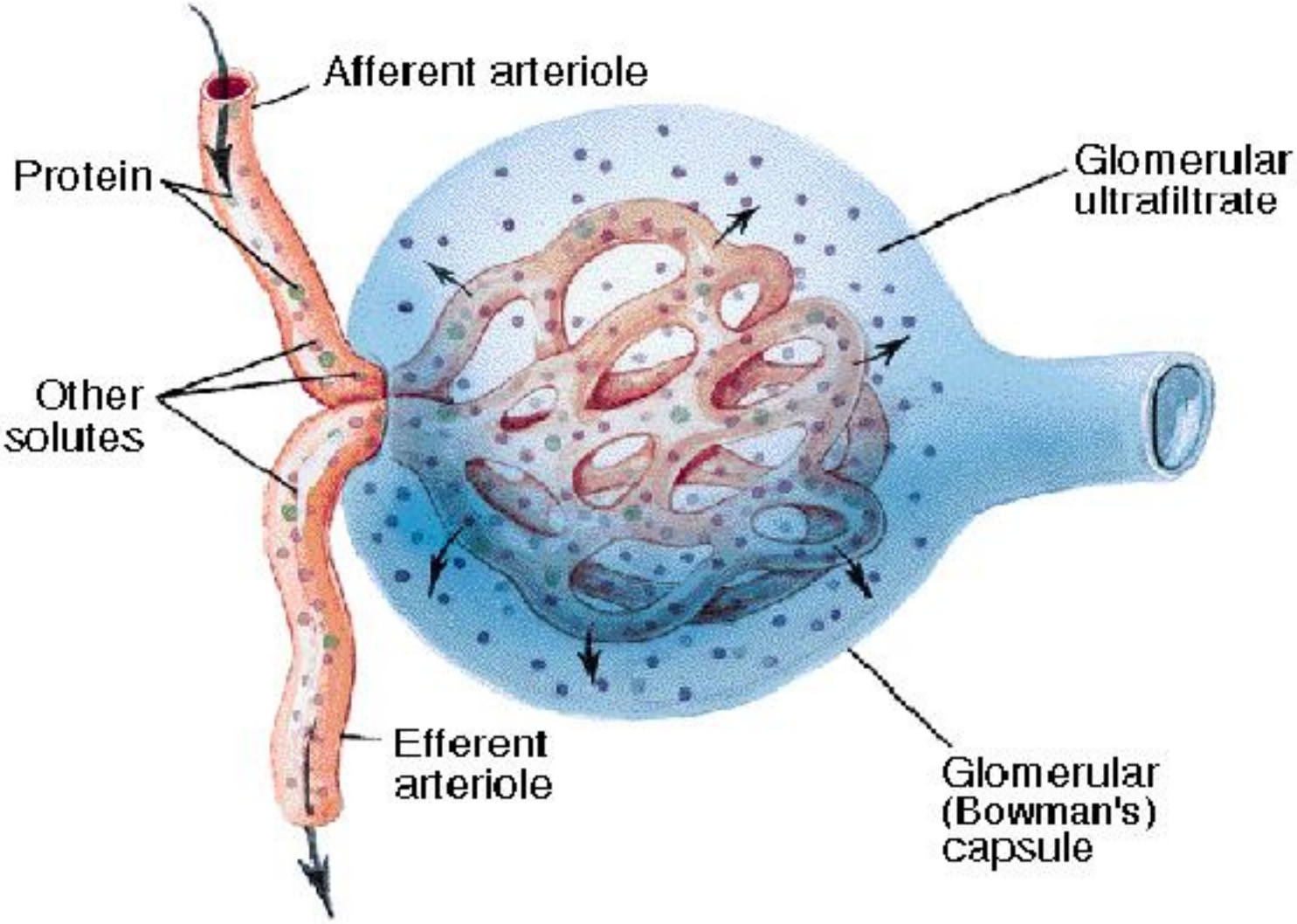
Kidney functional unit



Kidney functional unit

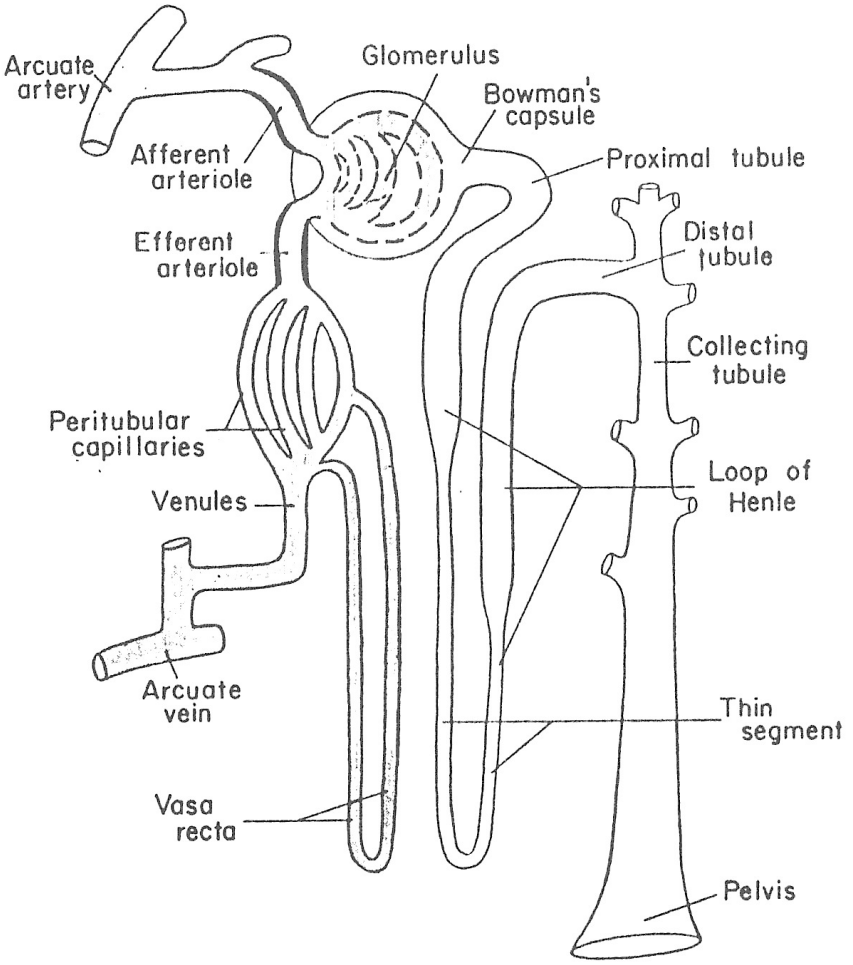


Glomerular ultrafiltration

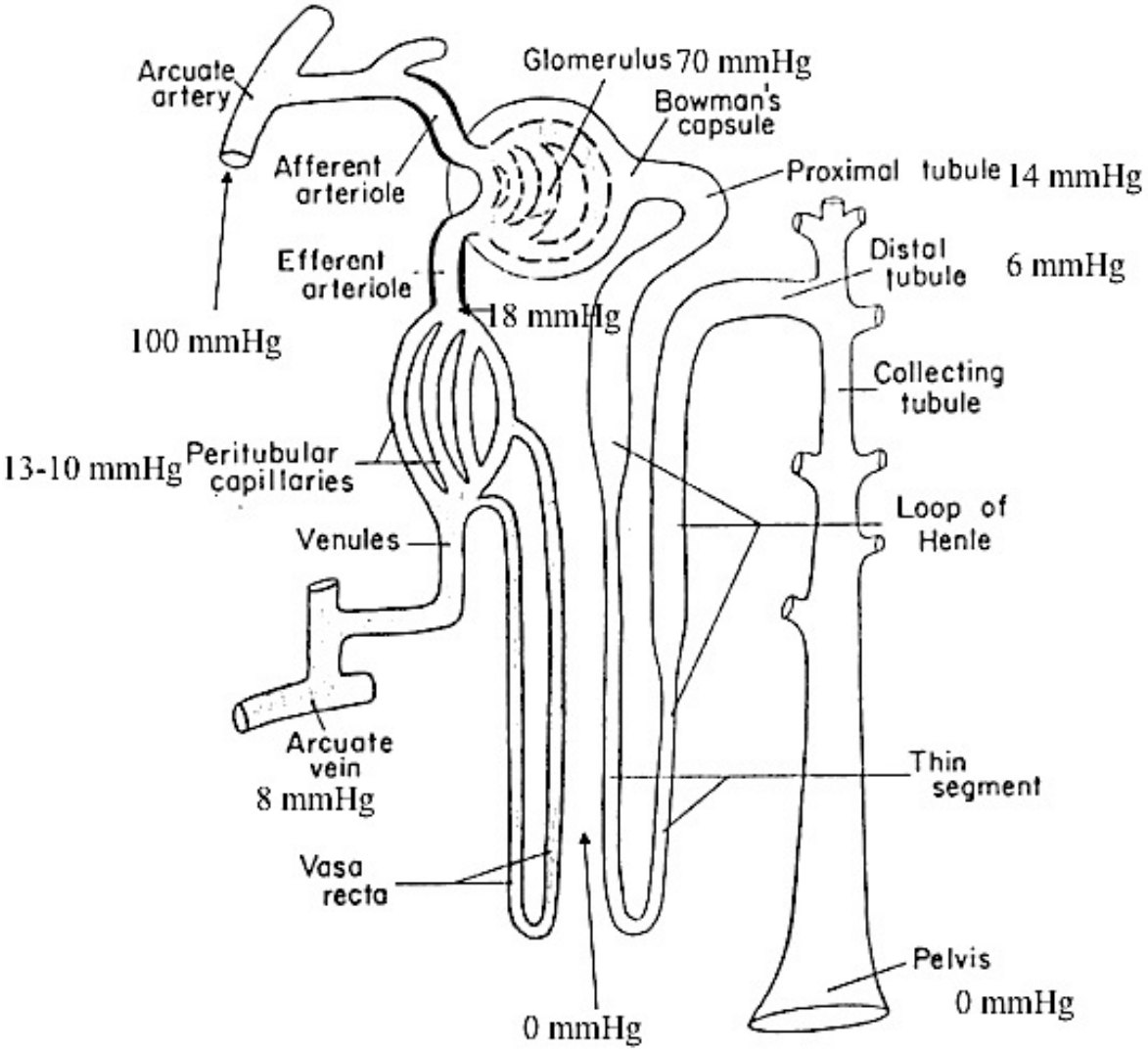


Renal Filtration

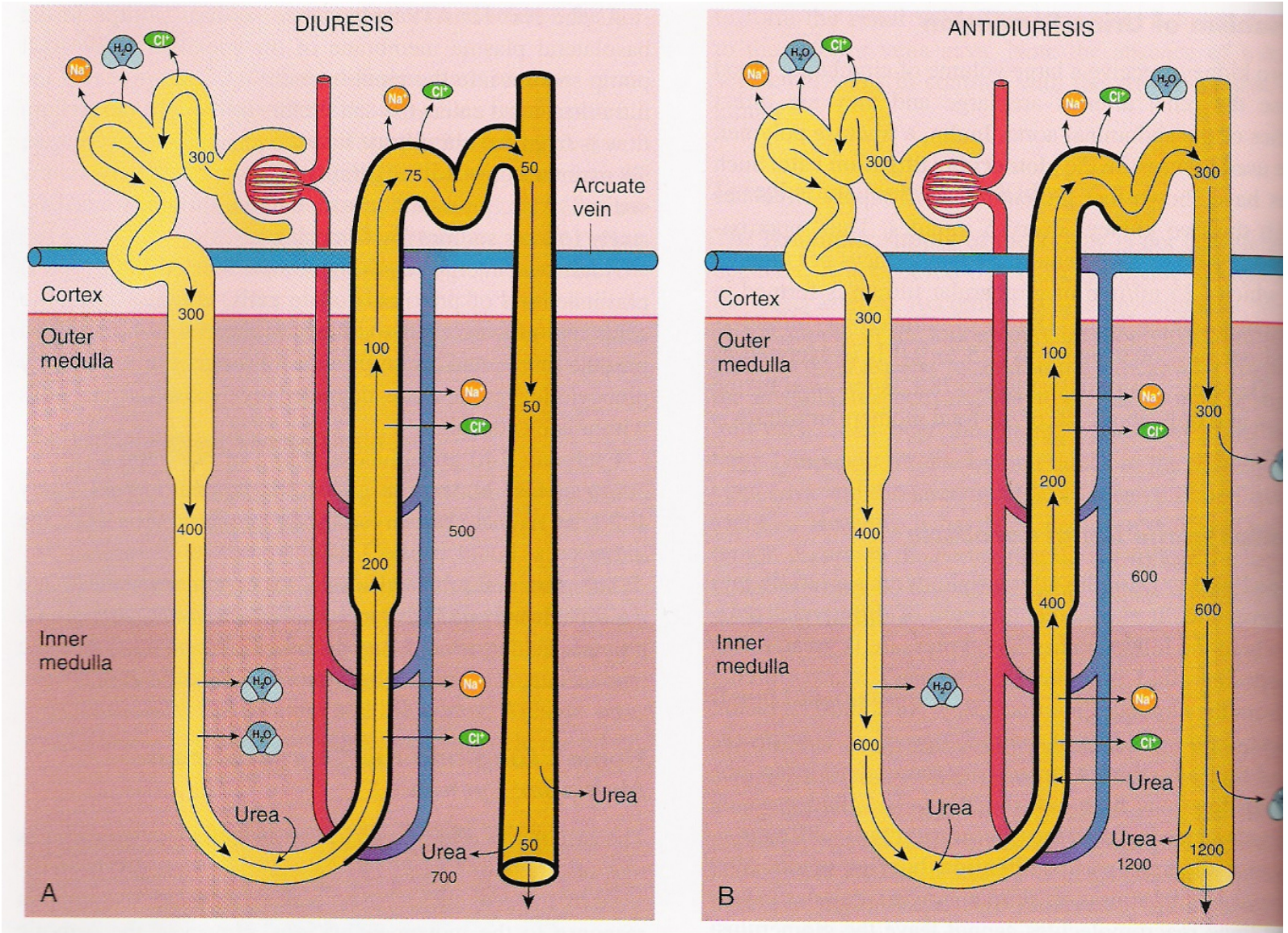
- The immediate constriction of the approximately 50 capillaries that form the glomerulus system induces high pressure. The filtration is therefore more effective (‘ultrafiltration ').
- The walls of the glomerulus capillaries are 25 times more permeable than normal
- 1200 ml/min of the blood flows in 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 H_20 is reabsorbed giving 2 liters of urine per day for 180 liters of filtrate



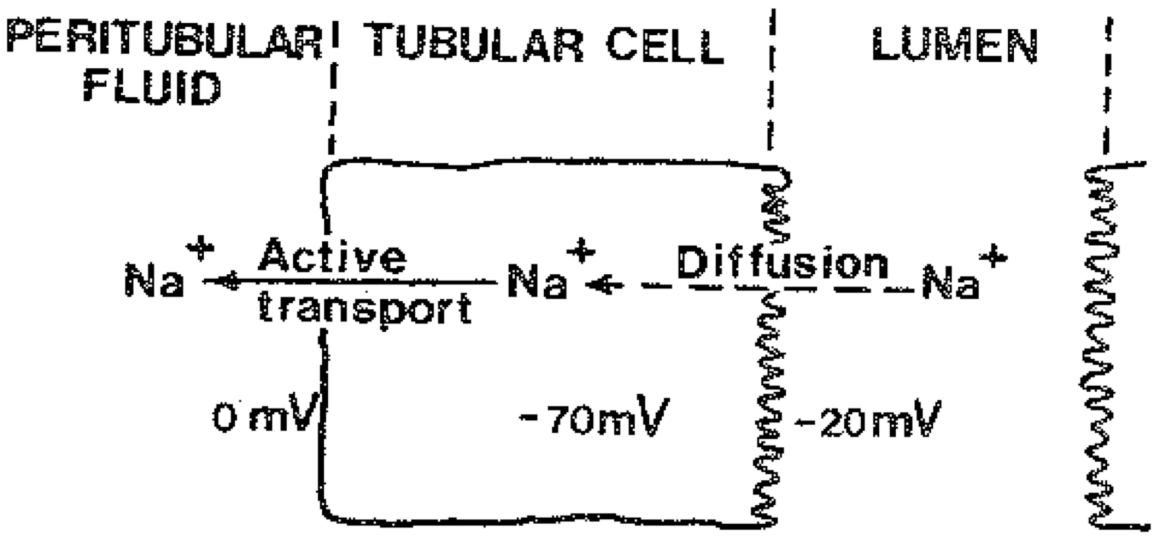
Renal Filtration



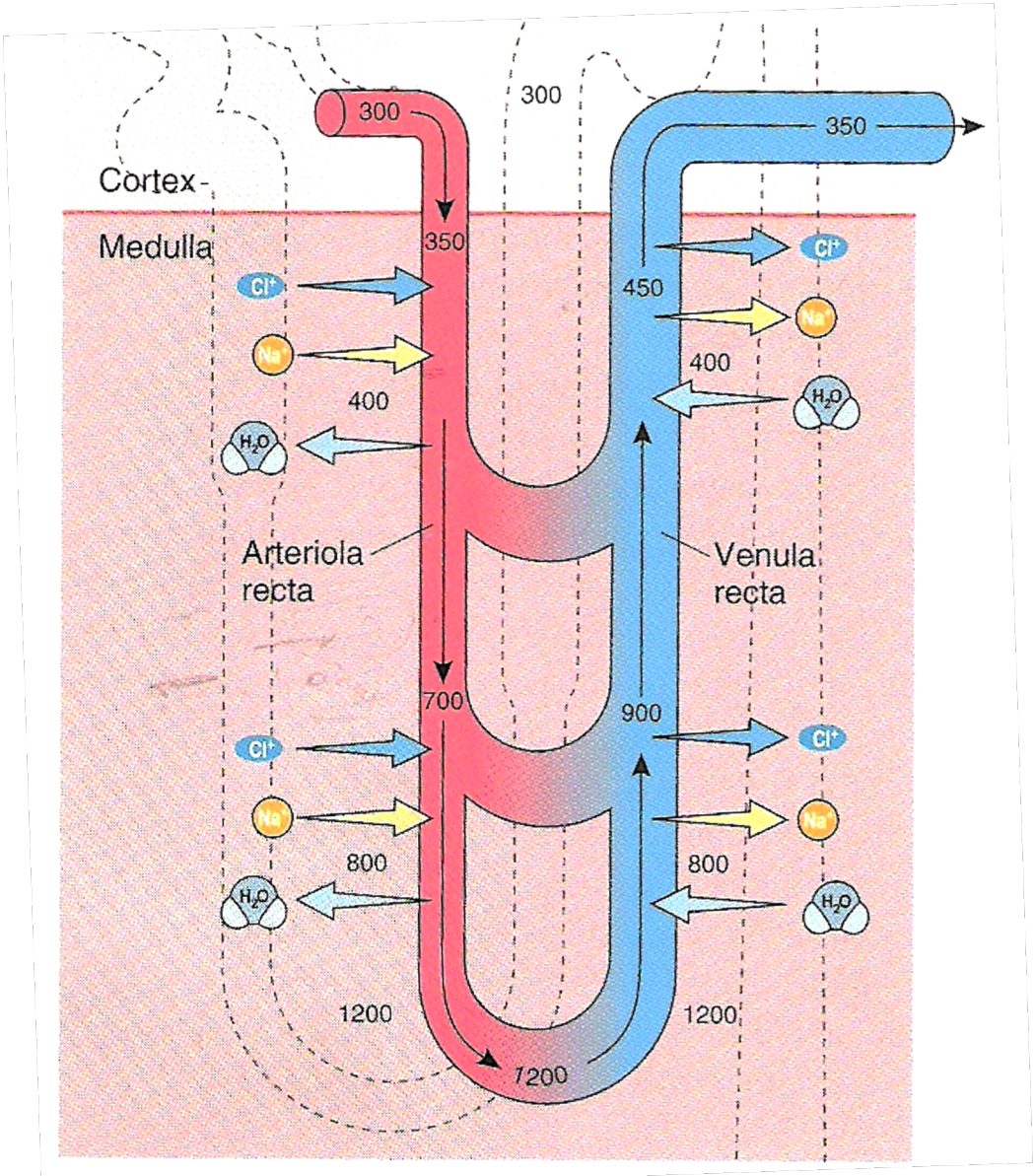
Renal function



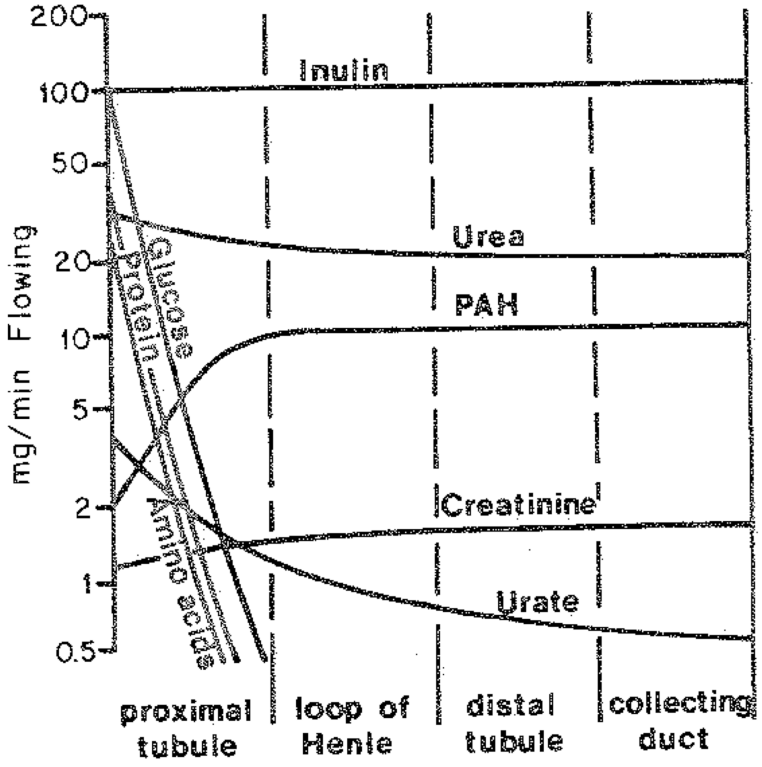
TRASPORTO DELLO IONE Na^+

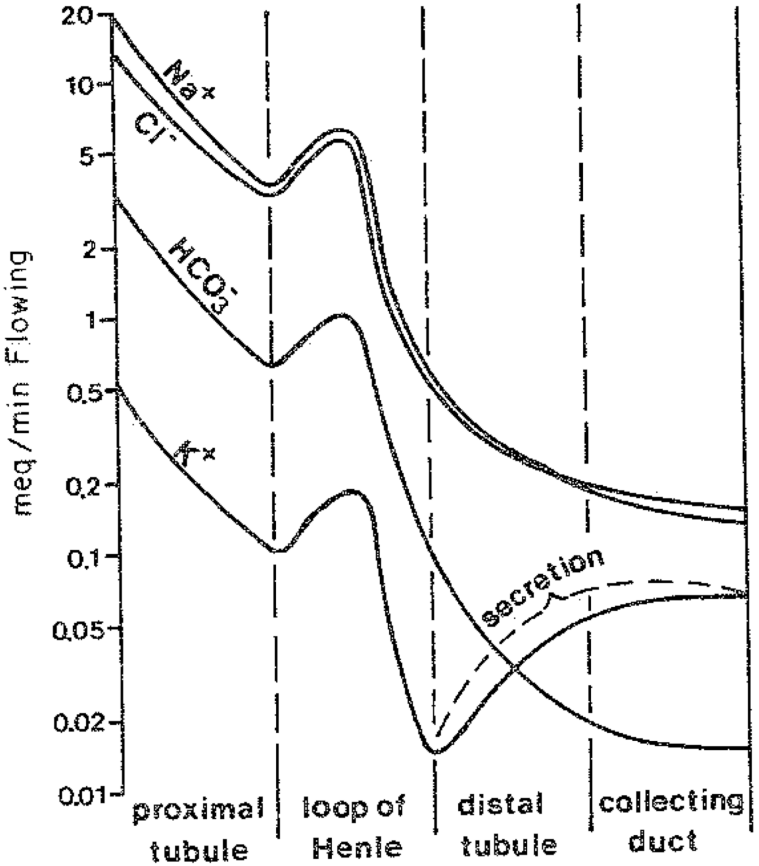


Renal Function

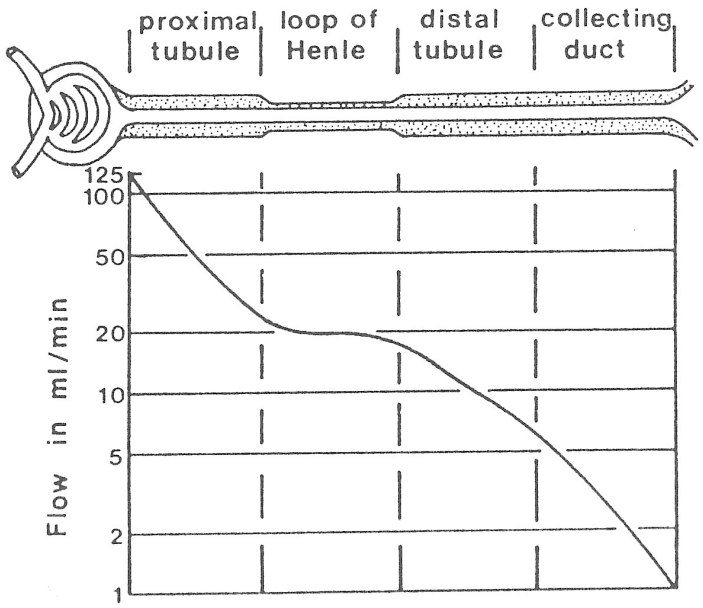


RIASSORBIMENTO RENALE

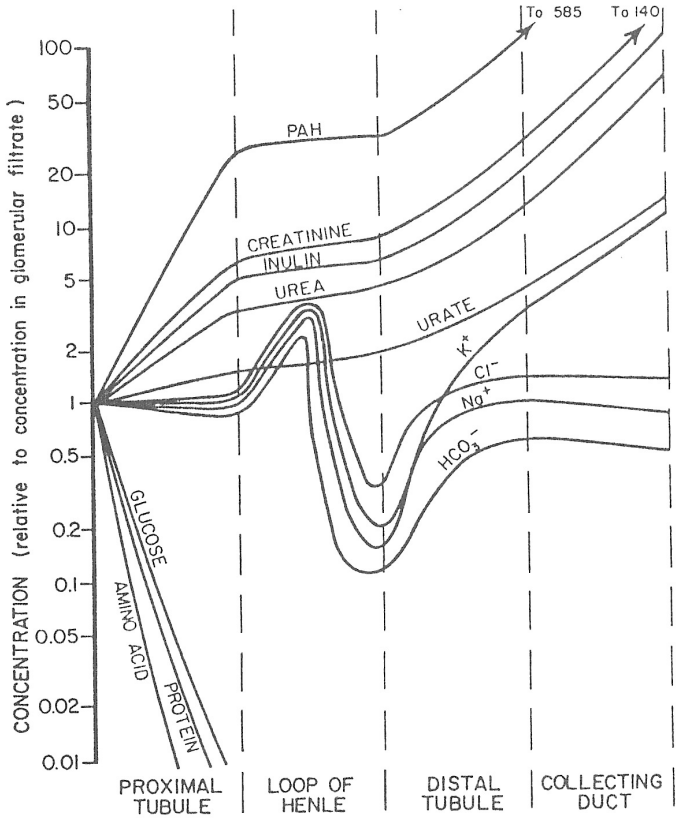




Renal function



Water flow in the tubule

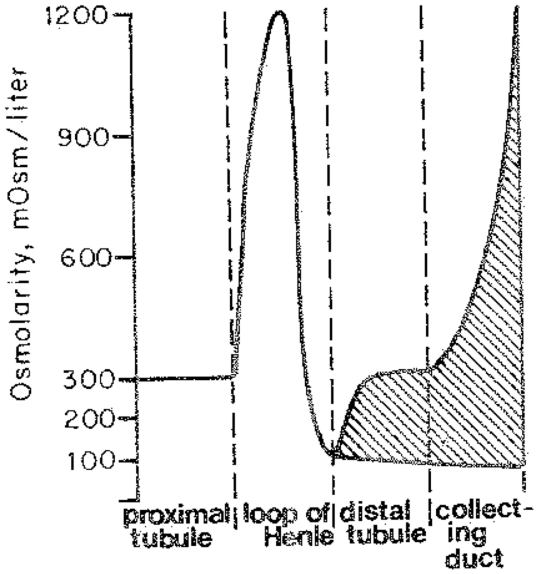


Change in concentration of filtrate with respect to t=0 (when the filtraton process begins)

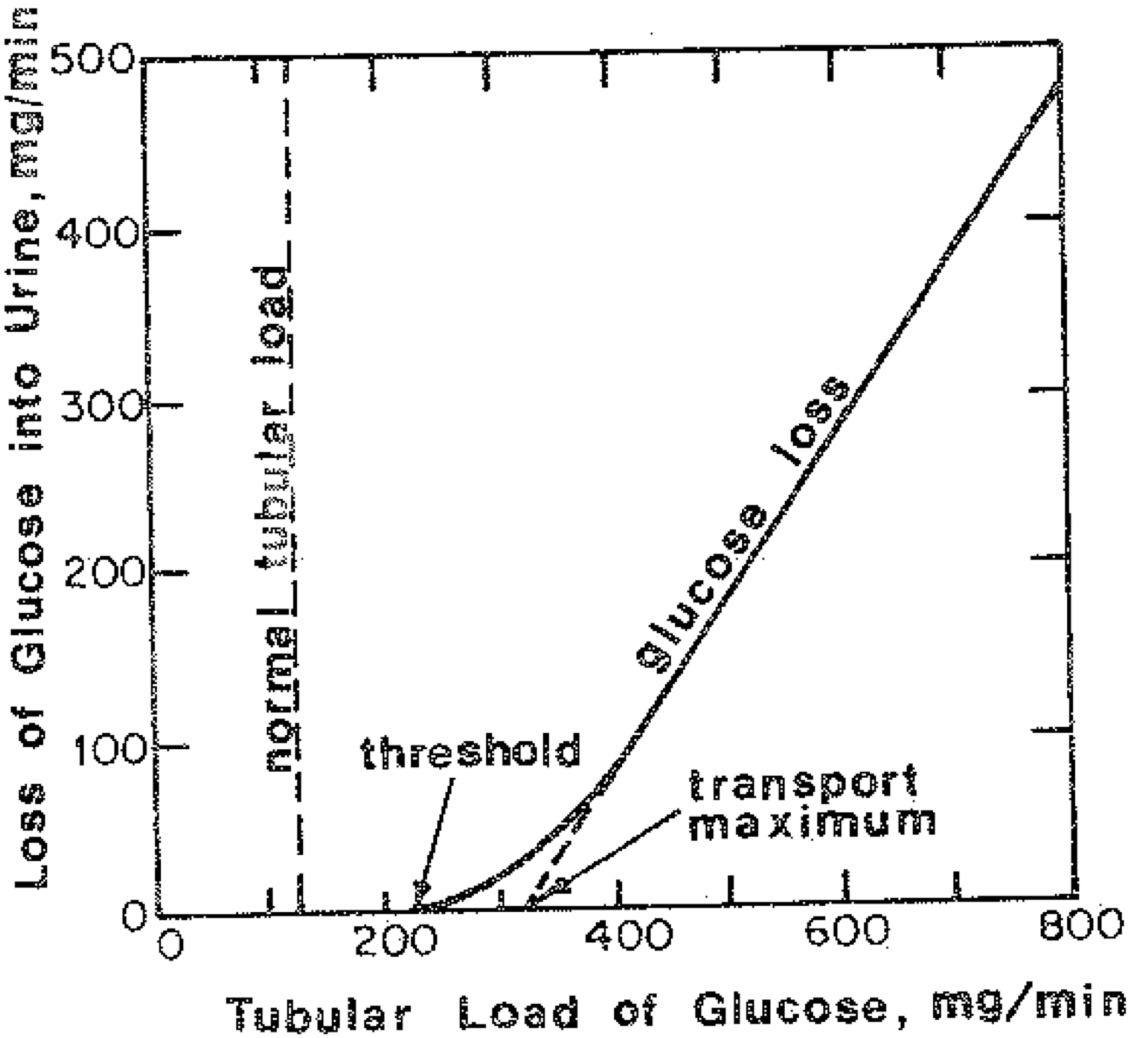
Reabsorption is guided by active and passive transport and osmosis. Glucose and amino acids are reabsorbed in the proximal tubule by active means, whereas +ve ions are reabsorbed throughout H_20 is reabsorbed through osmosis everywhere except in the loop of Henle. K e H are secreted in the distal zones, and negative ions follow the positive passively.

Osmolarità renale

L'osmolarità è la pressione osmotica generata dai soluti presenti in 1 L di soluzione. Spesso viene confusa con **l'osmolalità**.
L'osmolalità è una misura della concentrazione di una soluzione; rappresenta il numero di osmoli di soluto per chilogrammo di solvente.
Si distingue dall' osmolarità che è definita invece come il numero di osmoli di soluto per litro di soluzione.
L'osmolarità è una grandezza fisica che misura la concentrazione delle soluzioni usata in chimica, e in particolare è il numero totale di molecole e ioni presenti in un litro di solvente.



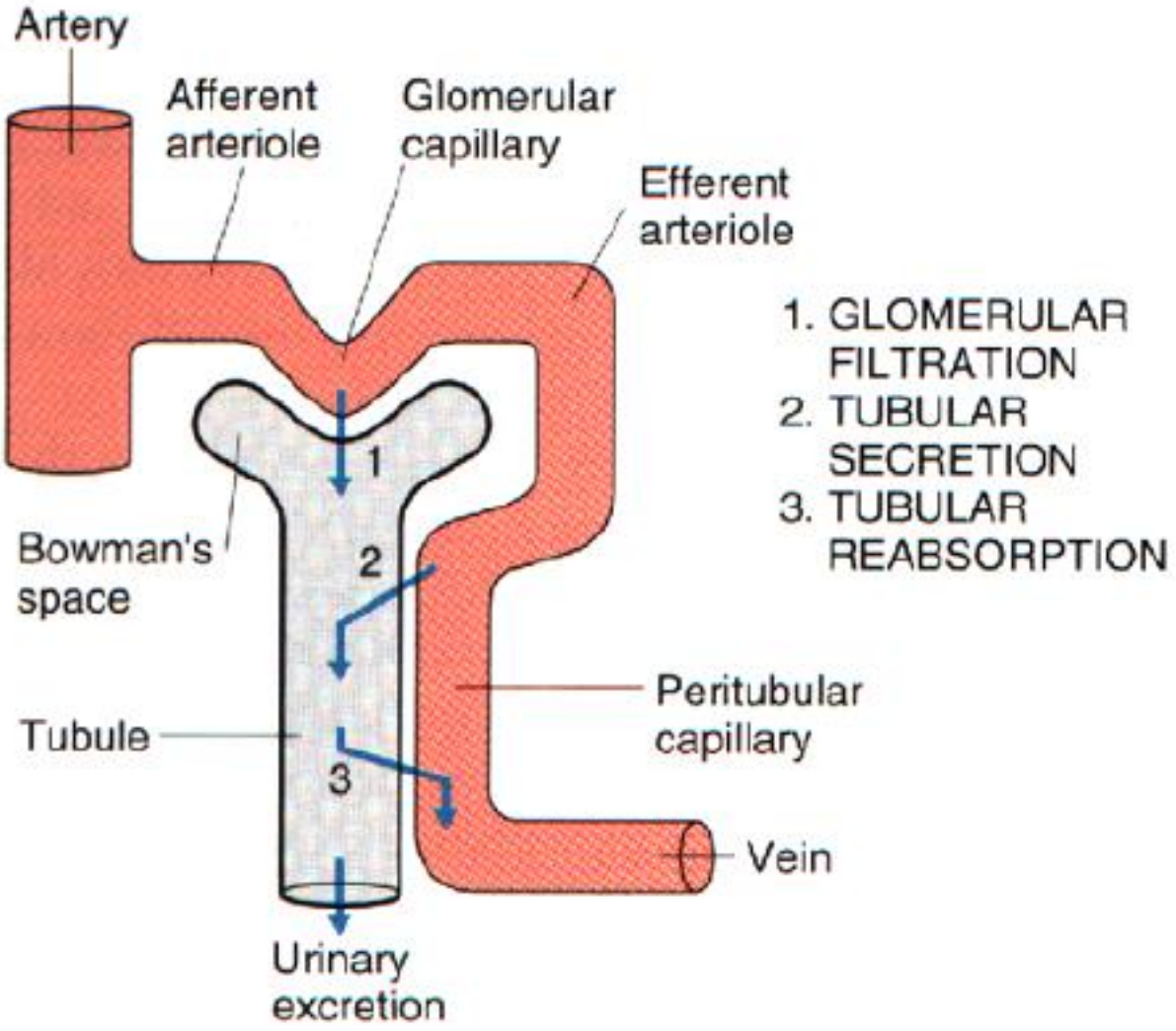
Perdita di glucosio nelle urine



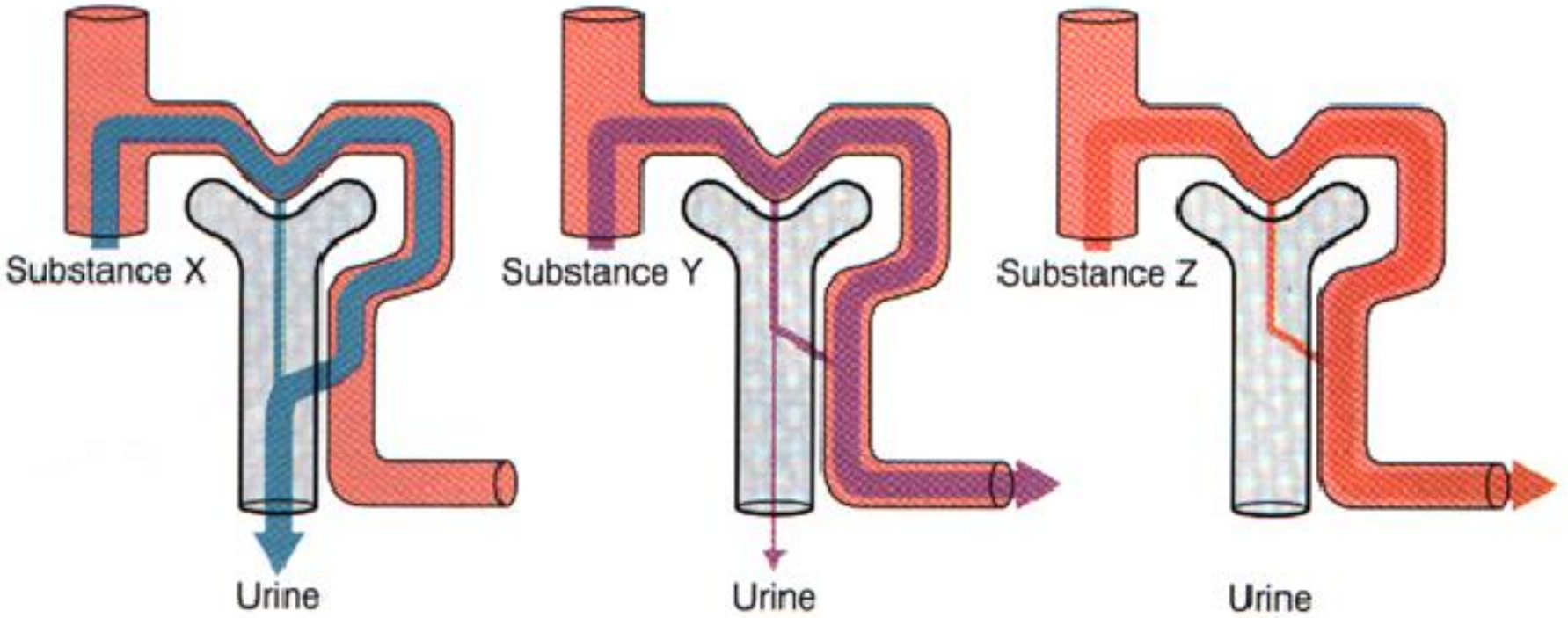
Renal function

- The threshold for glucose reabsorbtion is 18 mM. All molecules have a maximum reabsorbtion 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)

Summary: three renal processes



Three fates of a molecule



Filtration partial reabsorption total reabsorption