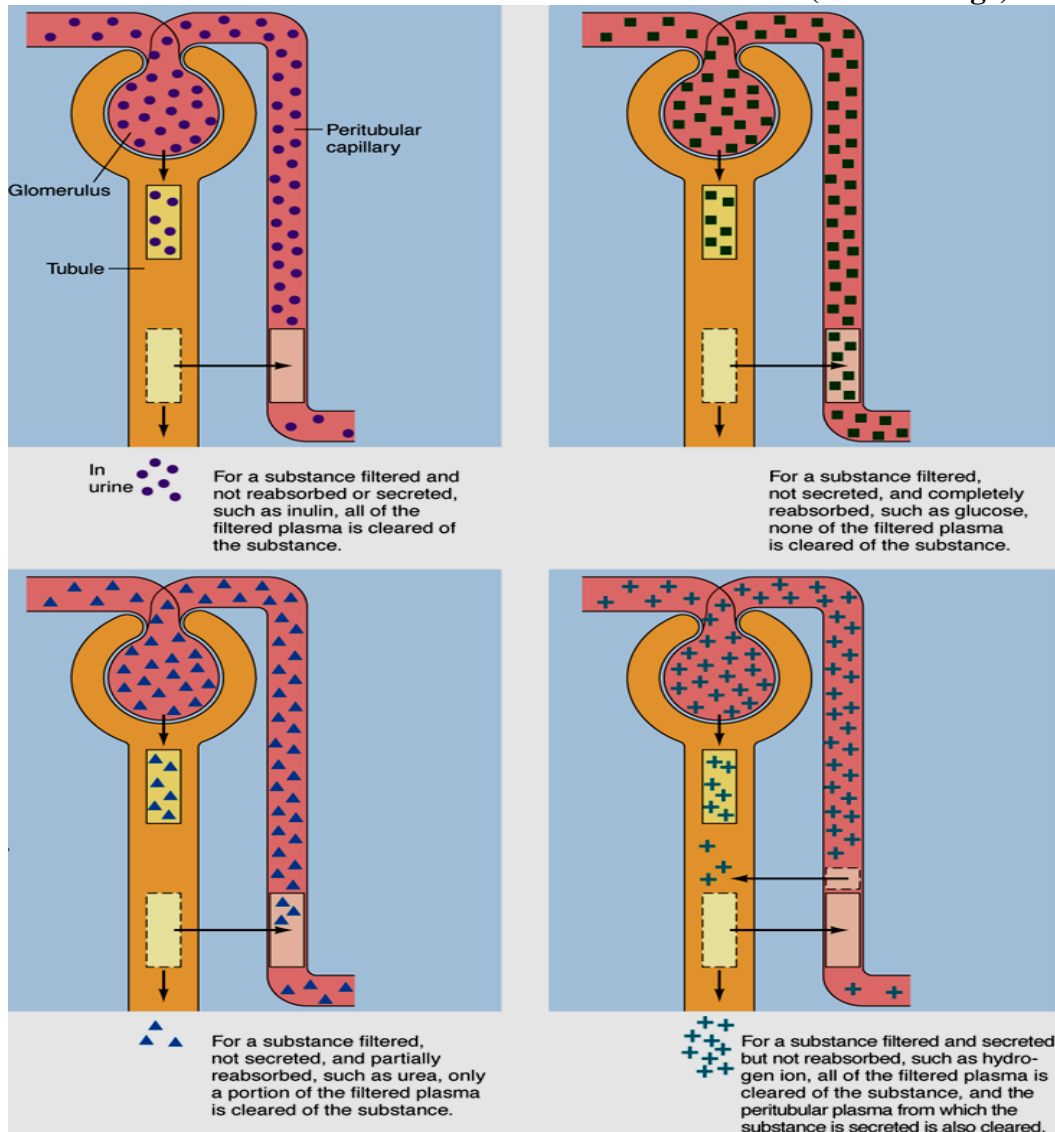




- **Net urinary excretion of a substance:**

- (GFR) = 125 ml/min:
  - ✓ 124 ml/min is reabsorbed!
  - ✓ 1 ml/min is excreted in the urine.
- Different conditions in excretion of substances in the urine (see the image).



- **Renal Clearance:**

- **Definition:** it is the volume of plasma completely cleared of a particular substance by kidneys/ minute.
- **Importance of clearance:** kidney's effectiveness in removing various substances from body fluid
- **Clearance of any substance X is given by:**

$$C_X = \frac{U_X \cdot V}{P_X}$$

$U_X$ : urine concentration of substance X.

$V$ : urine volume or urine flow rate.

$P_X$ : plasma concentration of substance X.

- **Urinary excretion of substance X =  $U_X \cdot V$**

- **Glomerular Filtration Rate (GFR):**

- A substance that is freely filtered from the plasma and not secreted or absorbed by the tubule will have a clearance that equals (GFR).
- **Inulin clearance is used for measurement of (GFR):**



✓  $GFR = C_{inulin} = \frac{U_{inulin} \cdot V}{P_{inulin}} = 125 \text{ ml/min.}$

• **Measurement of (GFR) with creatinine clearance:**

- ✓ Used in clinical setting to measure (GFR) but less accurate than inulin method.
- ✓ It is cleared from the body almost entirely by glomerular filtration. Small amount secreted from the tubule.

- **Paraminohippuric Acid (PAH) clearance:**

- It is an organic acid which is almost cleared in circulation (90%) through kidneys since it is both filtered and secreted by the tubules.
  - ✓ It is neither metabolized nor synthesized by kidneys.
  - ✓ (PAH) does not alter (RPF).
  - ✓ No other organ extracts (PAH).

• **Hence clearance of (PAH) estimates the Renal Plasma Flow (RPF).**

•  $C_{PAH} = \text{Effective Renal Plasma Flow (ERPF)} = \frac{U_{PAH} \cdot V}{P_{PAH}}$

• **To calculate actual (RPF), one must correct for incomplete extraction of (PAH):**

✓  $E_{PAH} = \frac{Arterial_{PAH} - Venous_{PAH}}{Arterial_{PAH}} = \frac{1-0.1}{1} = 0.9$

✓  $(RPF) = \frac{ERPF}{E_{PAH}}$

- **Clearance ratio:**

• **Clearance of any substance (X) compared with clearance of inulin =  $\frac{C_X}{C_{inulin}}$**

✓  $\frac{C_X}{C_{inulin}} = 1$  (substance is filtered and neither reabsorbed nor secreted).

✓  $\frac{C_X}{C_{inulin}} < 1$  (substance is filtered and reabsorbed).

✓  $\frac{C_X}{C_{inulin}} > 1$  (substance is filtered as well as secreted).