Micturition reflex:

- The act of passing the urine to the exterior is called as micturition. It is carried out by both voluntary and involuntary nerve impulses.
- When urine accumulates in the bladder, sufficiently (about 300 ml) it results into stretching of bladder wall and stimulates the nerves to initiate sensory impulses transmitted to the lower portion of the spinal cord.
- These impulses by way of sensory tracts to the cortex, initiate a conscious desire to expel urine.
- By way of micturition reflex, of which the centre is in sacral spinal cord; the bladder muscles are stimulated to contract and the internal urethral sphincter to relax.
- By way of sensory tracts to the cortex the conscious desire to expel urine is felt.
- These higher centres in the brain can voluntarily control contraction or relaxation of external urethral sphincter.
- When voluntarily external urethral sphincter is relaxed, the micturition occurs.

Role of Kidneys in acid base balance:

The kidneys control acid-base balance by excreting either acidic or basic urine.

Excreting acidic urine reduces the amount of acid in extracellular fluid.

Excreting basic urine removes base from the extracellular fluid.

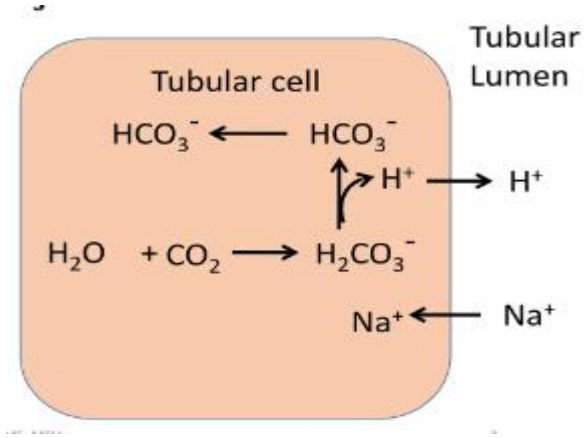
The kidneys regulate extracellular fluid H^+ conc. Through three fundamental mechanisms:

- Secretion of H^+
- Reabsorption of filtered HCO_3
- Production of new HCO_3

In acidosis, the kidneys do not excrete HCO_3 into the urine but reabsorb all the filtered HCO_3 which is added back to the extracellular fluid. This reduces the extracellular fluid H^+ conc. Back toward normal.

In alkalosis, the kidneys fail to reabsorb all the filtered HCO_3 thus increasing the excretion of HCO_3. This raises the extracellular fluid H^+ concentration back toward normal.

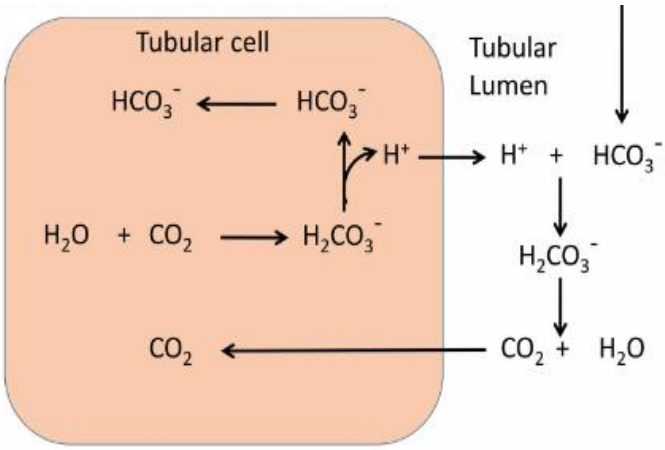
Excretion of H^+:



- Occurs in proximal tubule
- CO_2 combines with H_2O to form H_2CO_3.
- It dissociates to form HCO_3^- and H^+.
- H^+ secreted in exchange for Na^+.
- Net production of HCO_3^- and net excretion of H^+.
- Mechanism serves to increase the alkali reserve.

Reabsorption of filtered HCO_3^-

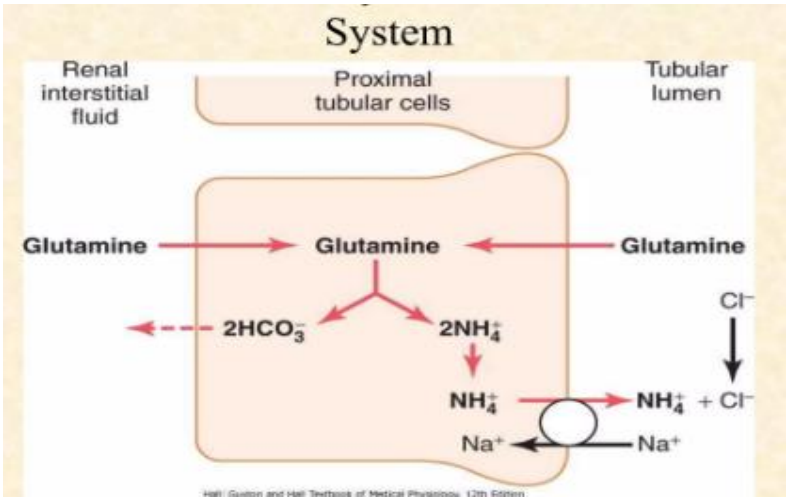
- HCO3- is very precious substance: we can't really afford losing any in urine. (Full reabsorption, primarily in the proximal tubules)
- 80-90% of the HCO3- reabsorption and thus H+ secretion occurs at proximal tubule, 10% in thick ascending, 4.9 % in collecting duct and distal tubule, and less than 0.1% is excreted.



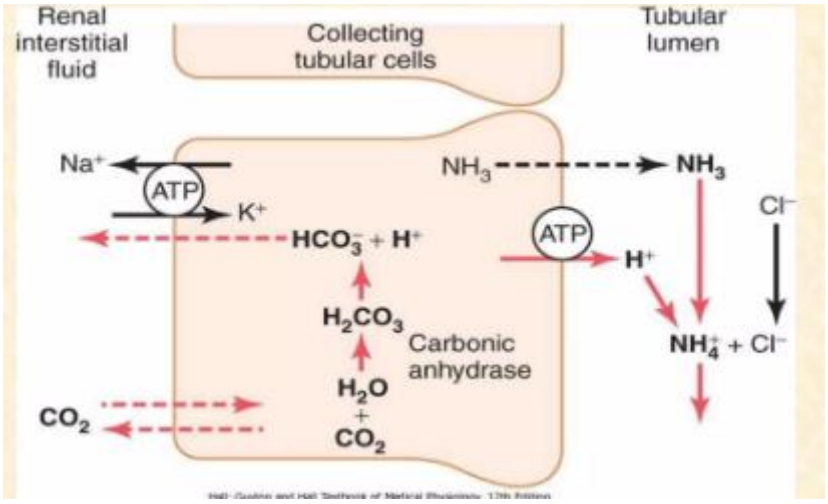
- The filtered load of the bicarbonate is equal to 180L/day * 24mEq/L = 4320 mEq/day.
- Quantity aspect: The reabsorption is more important than the production since its amount (4320) is greater.

Production of new HCO_3^-

- Excretion of excess H^+ and generation of new bicarbonate by the ammonia buffer system



- Buffering of H^+ ion secretion by ammonia in the collecting tubules.



Renal Correction of Acidosis-

- Increased Excretion of H+ and Addition of Bicarbonate to the ECF.
- Acidosis decreases the ratio of Bicarbonate/Hydrogen ion in Renal Tubular Fluid
- As a result, there is excess H+ in the renal tubules, causing complete reabsorption of bicarbonate and still leaving additional H+ available to combine with the urinary buffers (phosphate and ammonia).

- Thus, in acidosis, the kidneys reabsorb all the filtered bicarbonate and contribute new bicarbonate through the formation of ammonium ions and titratable acid.

Renal Correction of Alkalosis-

- Decreased Tubular Secretion of H+ and Increased Excretion of Bicarbonate
- Alkalosis increases the ratio of bicarbonate/hydrogen ion in renal tubular fluid
- The compensatory response to a primary reduction in PCO2 in respiratory alkalosis is a reduction in plasma concentration, caused by increased renal excretion of bicarbonate.