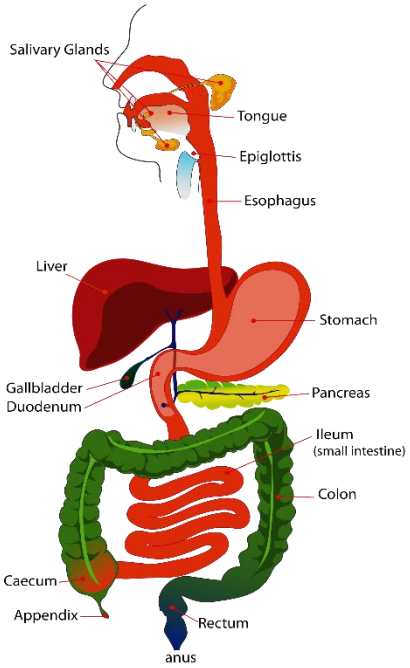
6. Absorption in GIT.



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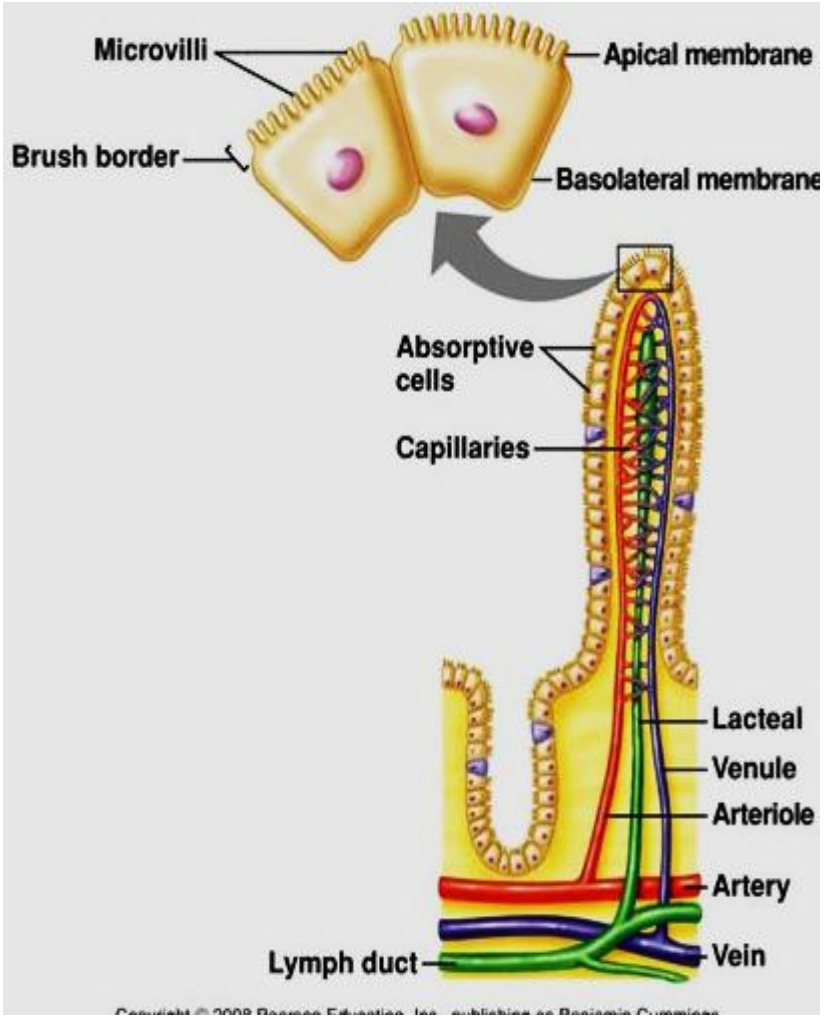
Gastro intestinal absorption

The total quantity of fluid that must be absorbed = 2 lit. (ingested) + 7 lit. (secreted) = 9 lit. /day. Mainly via the villi of small intestine.

-The Villus :

- It is finger – like projection – 0.5-1 mm. Long.
- Covered by single layer of epithelium.
- It has smooth muscle to help its movements.
- It has a brush border of minute microvilli to increase the absorption surface to 200 m2.
- The life span of mucosal cells is 3-5 days.
- It has 2 types of movements :
  - Lashing : from side to side.
  - Lumping : shortening & elongation.

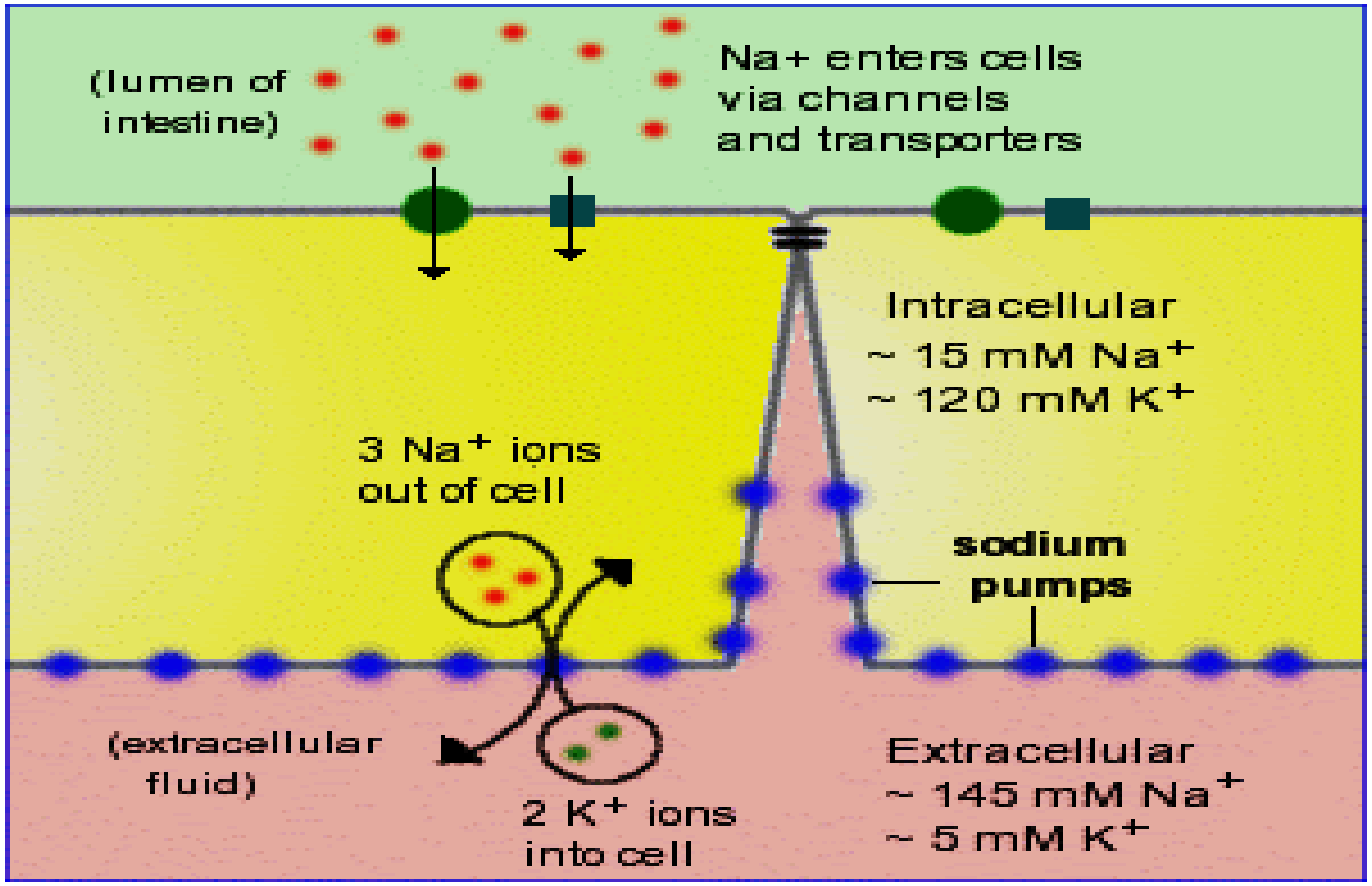


* **Mechanism of absorption :**
- Active : with carrier, energy & against gradient.
-Simple : (passive) according to conc. & electrical gradient.

(1) Absorption of water :
- By simple diffusion (osmosis) following absorption of electrolytes and nutrients.

(2) Absorption of sodium :
1- By active transport about 25-35 gm sodium/day is absorbed from small intestine. By three mechanisms:
a. Uniport : Active Na+ pump to the blood.
b. Symport : cotransport of Na+ with glucose by common carrier.
c. Antiport : absorption of Na+ in exchange with H+ which buffered rapidly by Hco3.
2.Na+ is actively transported to the interstitial space in exchange with K+ (Antiport) so the concentration of Na+ intracellular decreased and the sodium in the chyme is transported through the brush border into the cytoplasm.

(3) Absorption of K+ :
1. It is actively absorbed.
2. Secreted under concentration & electrical gradient.
3. Aldosterone stimulates Na abs. and K+ sec. by Na+-K+ pump at the basolateral border of intestinal mucosal cells.


(lumen of intestine)
Na+ enters cells via channels and transporters
Intracellular
~ 15 mM Na+
~ 120 mM K+
3 Na+ ions out of cell
sodium pumps
(extracellular fluid)
2 K+ ions into cell
Extracellular
~ 145 mM Na+
~ 5 mM K+

(4)Absorption of chloride & Hco3 :
(1)It passively following active Na+ abs. (in upper intestine.)
(2)Actively in exchange of Hco3 (in lower intestine).

(5)Absorption of calcium : Active at basolateral border, Facilitated diffusion at luminal border And controlled by parathormon H & vit D3.

(6)Absorption of iron : 1.Active at duodenum. 2.Stimulated by erythropoitin.

(7) Carbohydrate absorption: **at luminal border:**
-Absorption of glucose is an active sodium depend transport (common carrier for Na+ & glucose) if Na+ abs. **Is inhibited by** glycosides →↓ glucose abs.
-Galactose : the same as glucose. -Fructose : by facilitated diffusion (passive).

(8) Absorption of proteins :
- L-Amino acid absorption: the same as glucose by 4 types of carriers for neutral, basic, acidic amino acids. - Absorbed mainly in the jejunum.
- Small amount of proteins is absorbed intact by pinocytosis (endocytosis).

(9) Absorption of lipids :

By aid of conjugated bile salts, lipids are emulsified and form micelles covered with a shell of bile salts. Then micells enter the intestinal mucosa by simple diffusion. Inside the mucosal cell :

-Short F.A pass directly to the portal blood. -Long F.A are re-esterified to triglycerids.

-Some cholesterols are re-esterified. -Triglycerides and cholesterol esters are coated by protein, cholesterol and phospholipids in the Golgi complex → chylomicrons → pass into lymphatic vessels by exocytosis.

(10) Absorption of vitamins :

-Water soluble vit.: are absorbed from jejunum by simple diffusion. Vit B12 needs intrinsic factor for its absorption.

-Fat soluble vit. : absorbed by simple diffusion depend on fat digestion and absorption.

The malabsorption syndrome

• If more than 50% of the intestine is removed by resection → signs of malnutrition as:
-↓ Abs. of A.A → body wasting & edema.
-↓ Abs. of fat →↓ abs. of fat soluble vit.
-↓ Abs. & steatorrhea bleeding tendency.

• Malabsorption may caused by mal-digestion as in :
- Inadequate lipolysis (↓ pancreatic sec.)
-Obstructive jaundice →↓ digestion and absorption of fats & vitamins.

• Malabsorption due to abnormal mucosal transport as in:

1) **Non – specific defect**: as in tropics →↓ folic acid abs. → macrocytic anemia also in **Coeliac disease**: the defect in gluten hydrolase enzyme causes the gluten in wheat changes to Gliaden which causes decrease formation of microvilli →↓ absorption. Also in **Tropical sprue** there is atrophy of villi

2) Specific: absence of lactase enzyme at the brush border → milk intolerance.

Thank You