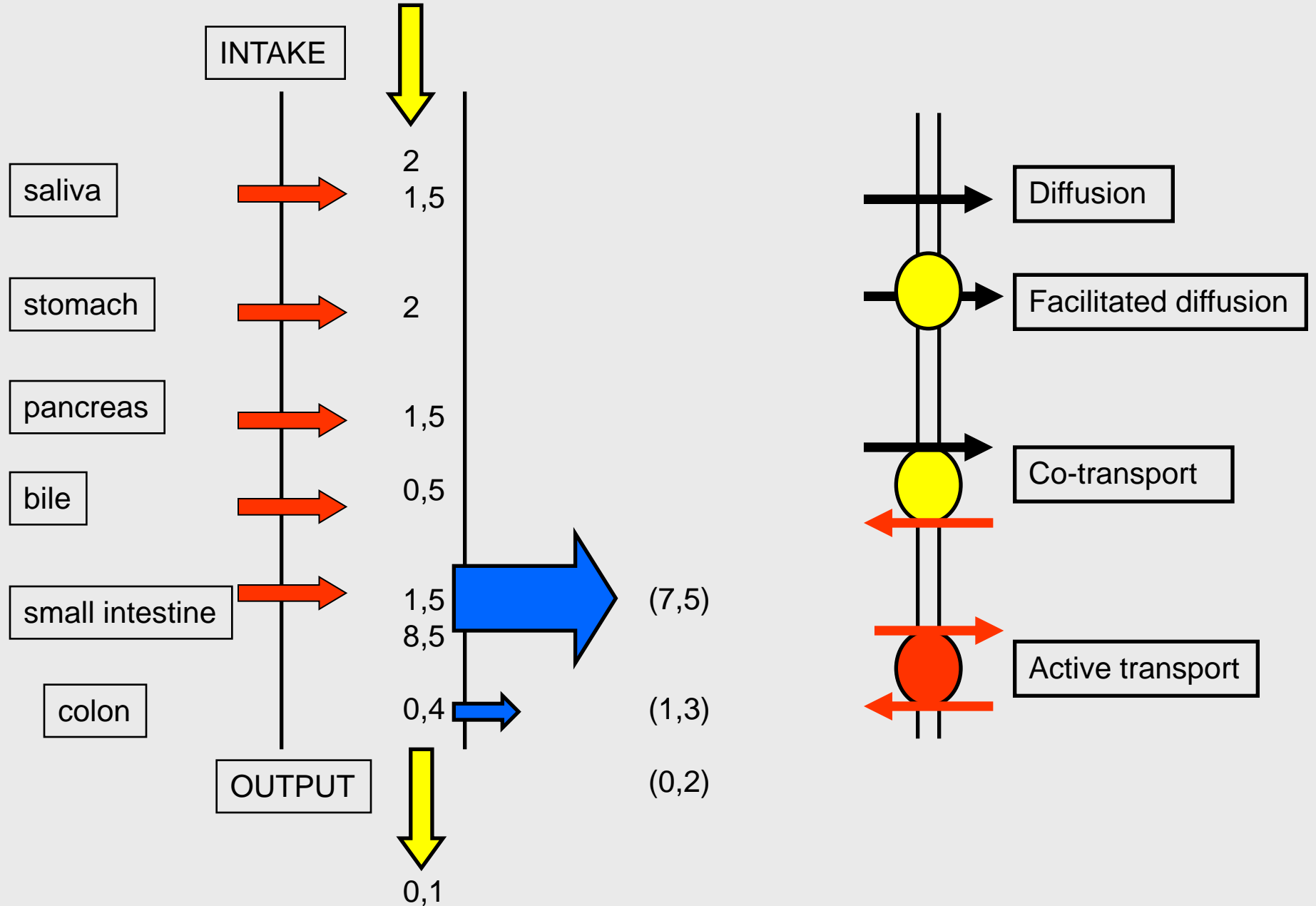


- Both active and passive mechanisms participate in GIT absorption
- Both paracellular and transcellular movements are involved
- Absorption area is enlarged by folds, villi and microvilli (mostly in small intestine)
- Absorption of water and electrolytes occurs in both small and large intestine, absorption of nutrients occurs only in small intestine
- Small intestine absorbs water and electrolytes and secretes  $\text{HCO}_3^-$ , large intestine absorbs water and electrolytes and secretes potassium and  $\text{HCO}_3^-$
- Water „follows“ electrolytes, eventually is „drafted“ by osmotically active substances
- Numerous absorption mechanisms depend on sodium gradient

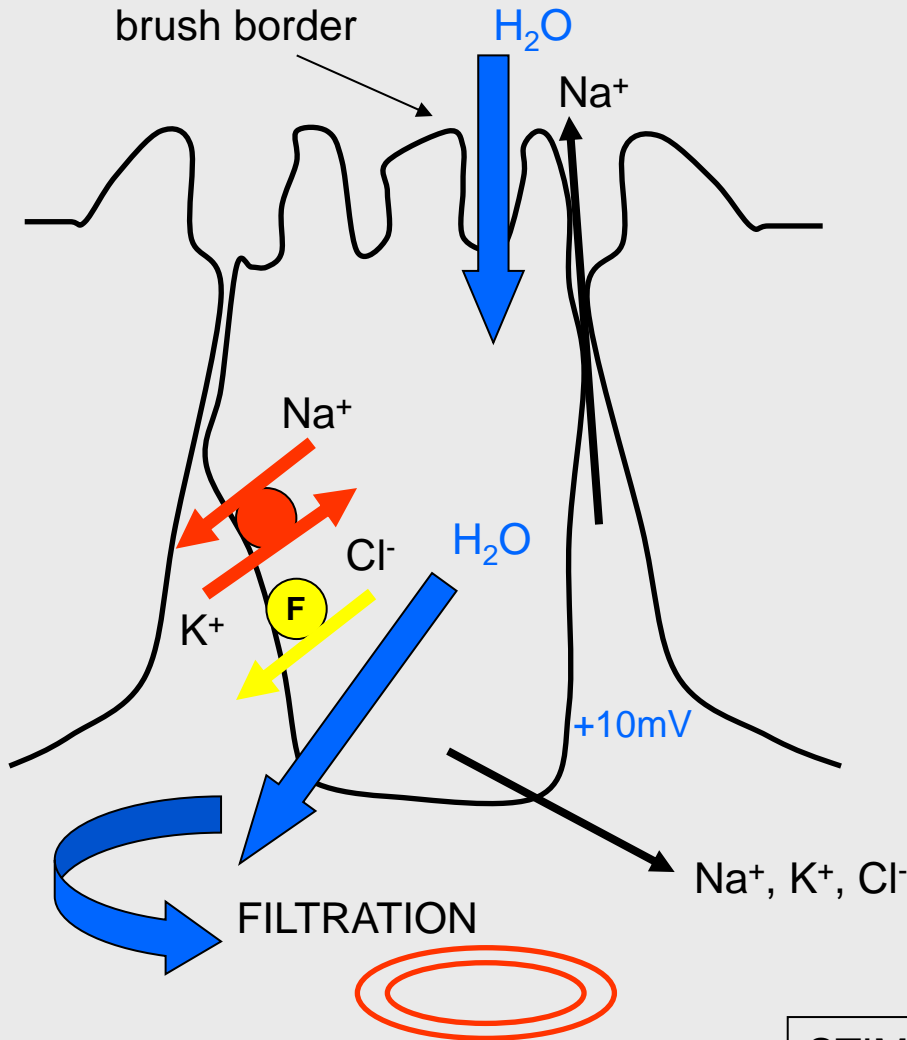
# WATER BALANCE ( l / DAY )



# WATER ABSORPTION

(small intestine, gallbladder, stomach, colon)

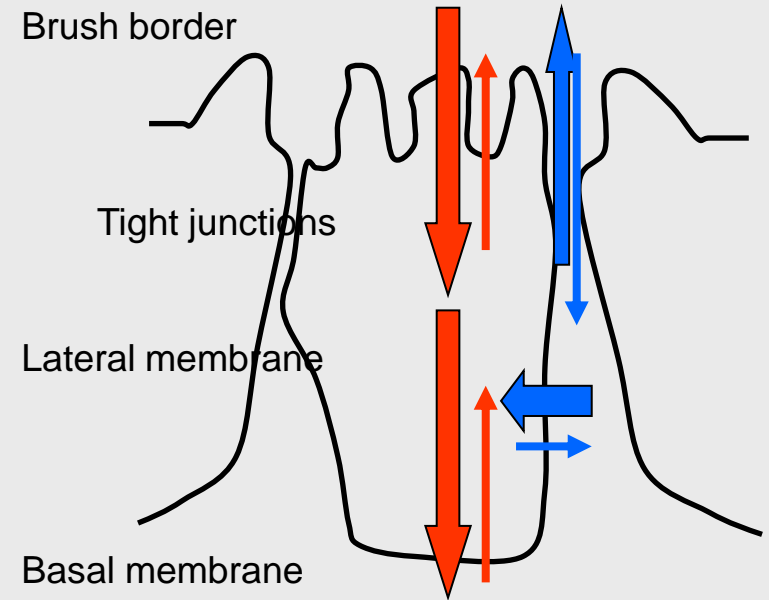
(duodenum - osmotic draft of H<sub>2</sub>O)



Continuous osmotic gradient

TRANSPORT

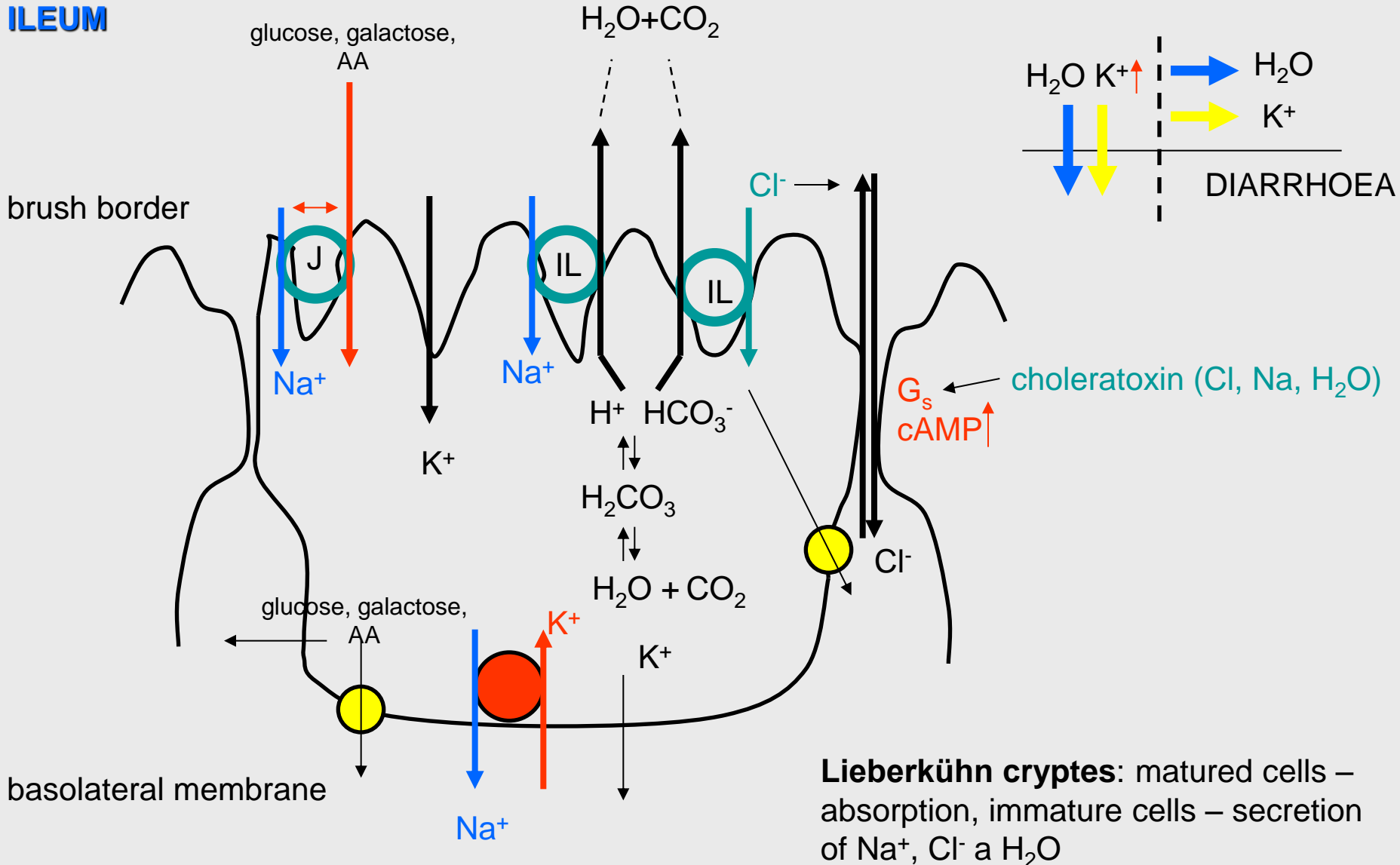
- Transcellular
- Paracellular



STIMULATION: digestion products (AA, sugars)

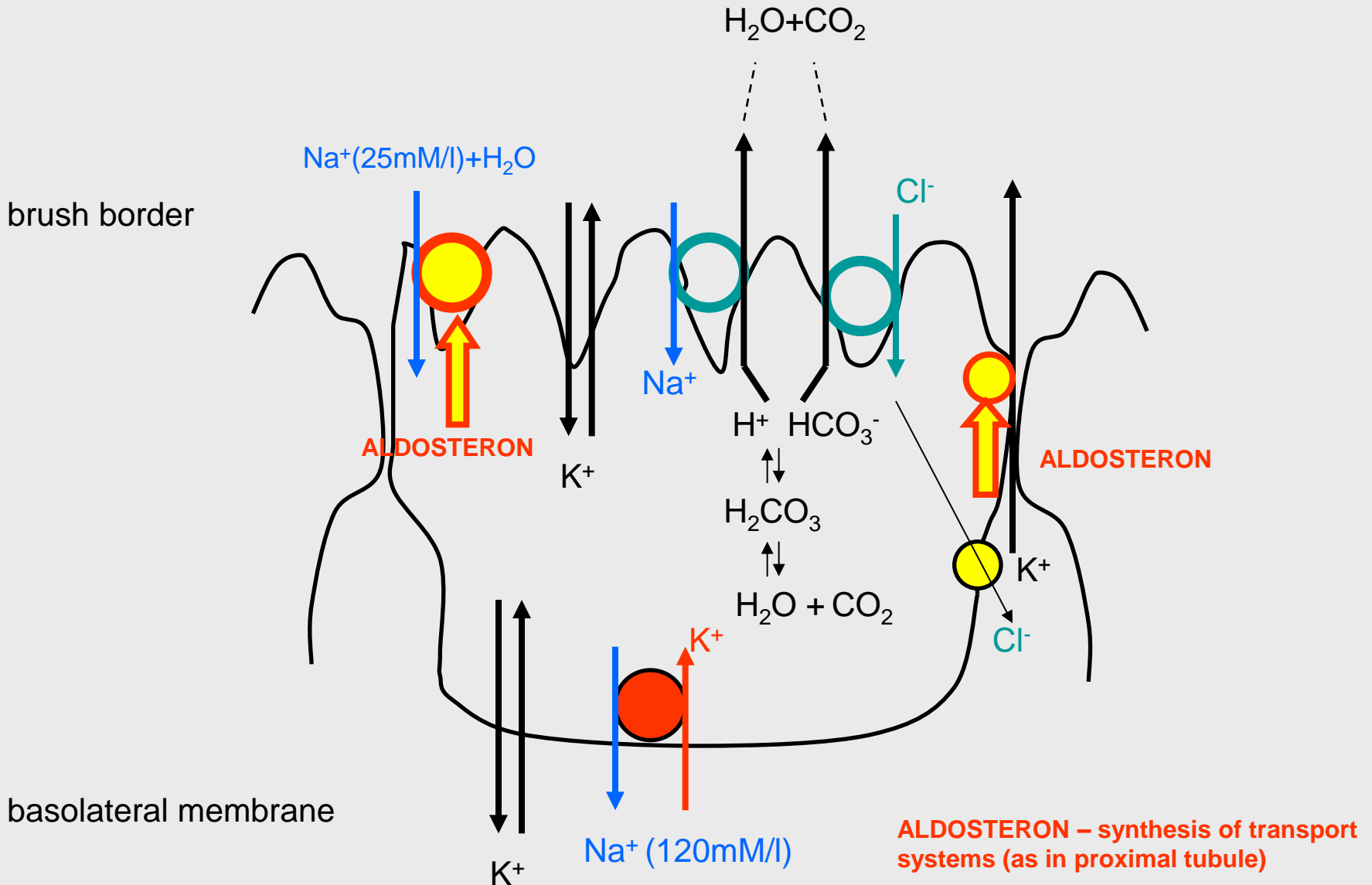
# TRANSPORT OF ELECTROLYTES

JEJUNUM  
ILEUM



# TRANSPORT OF ELECTROLYTES

## COLON



**ALDOSTERON – synthesis of transport systems (as in proximal tubule)**

# REGULATION OF TRANSPORT OF WATER AND ELECTROLYTES

1. **Autonomous nervous system:** **SYMP** (noradrenaline, enkefalins) + **somatostatin** – increase of absorption of water, sodium and chlorine
2. **Aldosterone:** colon – stimulation of secretion of potassium and absorption of sodium and water (up-regulation of Na/K-ATPase, Na-channel)
3. **Glucocorticoids:** small intestine and colon - absorption of sodium, chlorine and water (up-regulation of Na/K-ATPase)

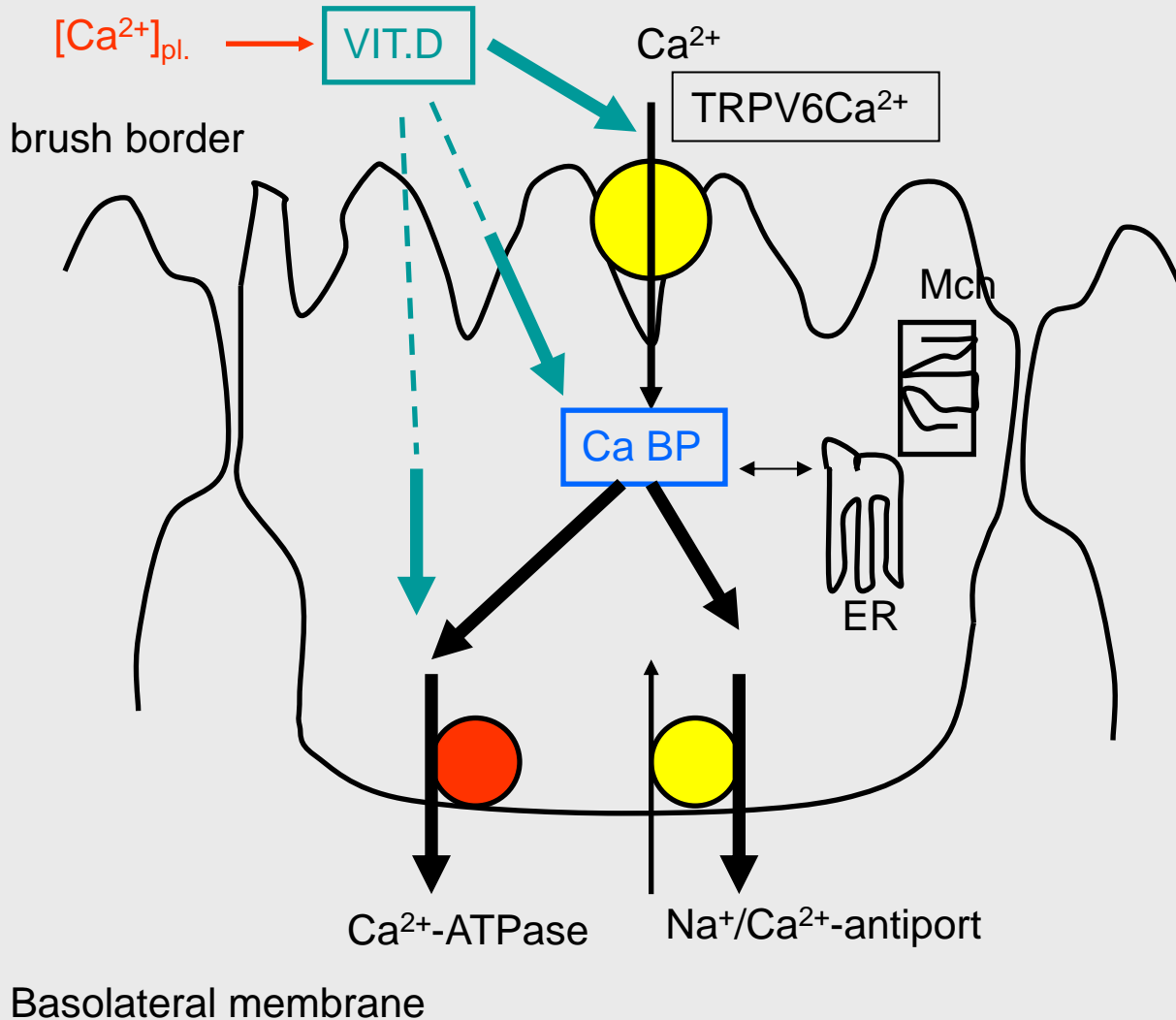
# ABSORPTION OF $\text{Ca}^{2+}$

INTAKE: 1000mg/day  
ABSORPTION: 350mg/day

Absorption against concentration gradient (1:10) in all GIT (D, J), 50x slower than absorption of  $\text{Na}^+$

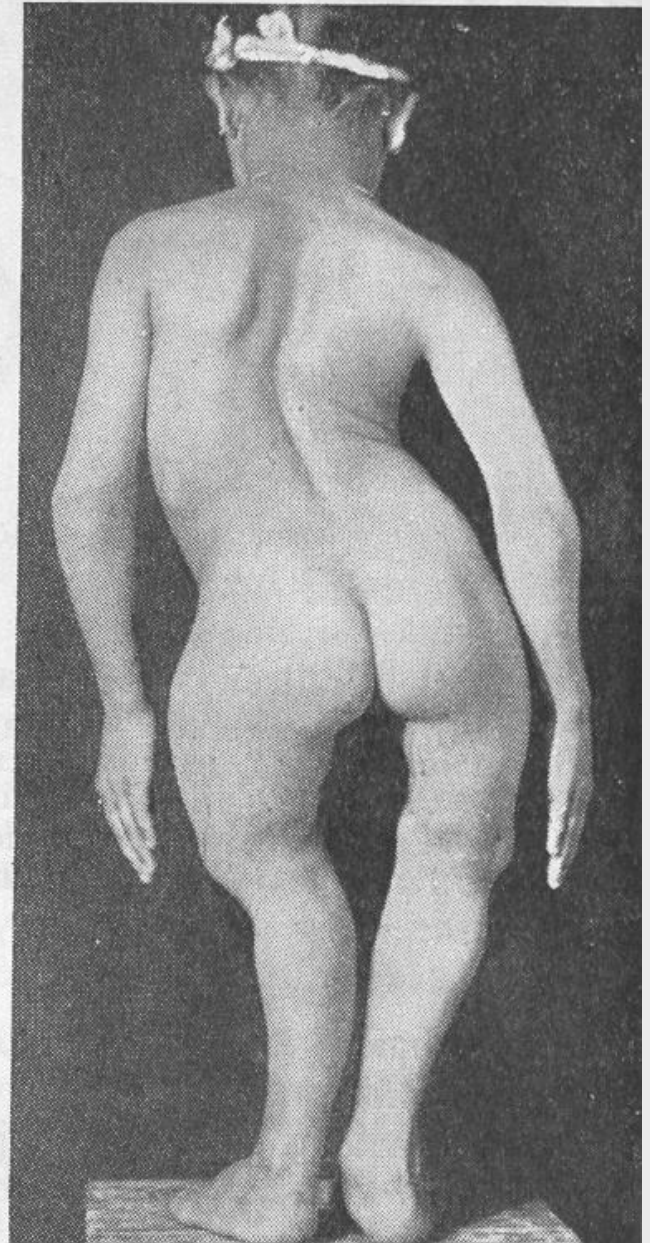
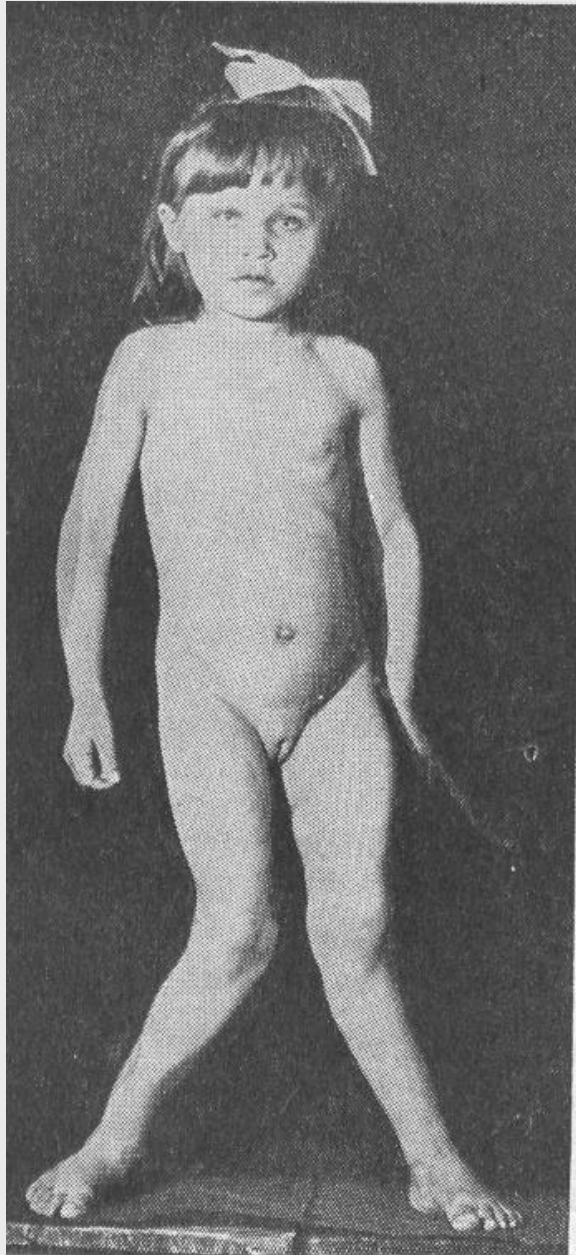
1,25-dihydrocholecalciferol

Calbindin – prevention of formation of insoluble salts (phosphates, oxalates)



Basolateral membrane

# RACHITIS (rickets)





# ABSORPTION OF Fe<sup>2+</sup>

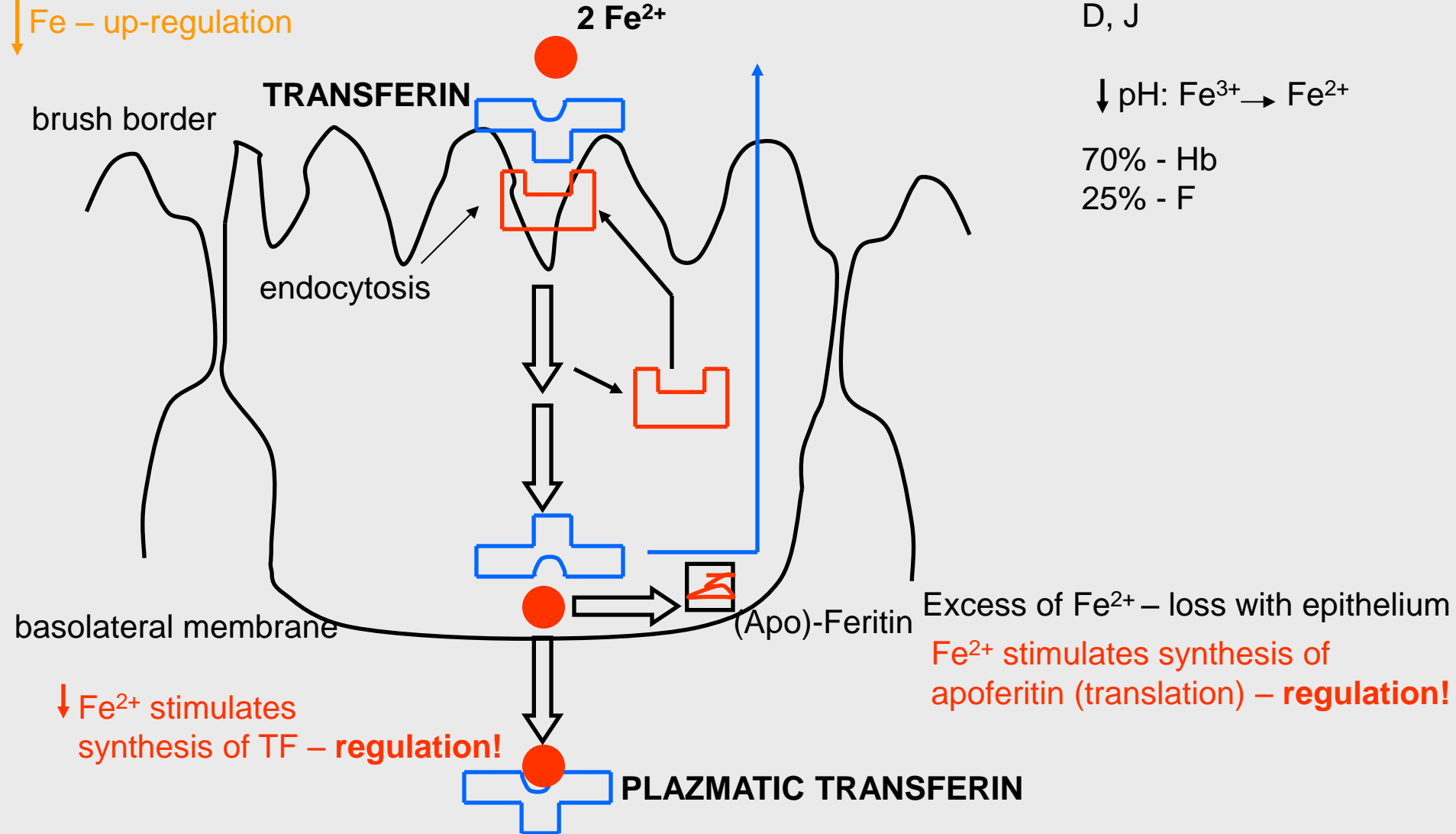
INTAKE: 15-20mg/day  
ABSORPTION:  
Men: 0,5 - 1mg/day  
Women: 1 - 1,5mg/day  
D, J

↓ pH: Fe<sup>3+</sup> → Fe<sup>2+</sup>

70% - Hb  
25% - F

Insoluble salts and complexes (20:1) – limitation of absorption  
Decrease of pH

↓ Fe – up-regulation



Excess of Fe<sup>2+</sup> – loss with epithelium  
Fe<sup>2+</sup> stimulates synthesis of apoferitin (translation) – regulation!

↓ Fe<sup>2+</sup> stimulates synthesis of TF – regulation!

Hemosiderin – deposits of Fe in desmosomes

# VITAMIN B<sub>12</sub>

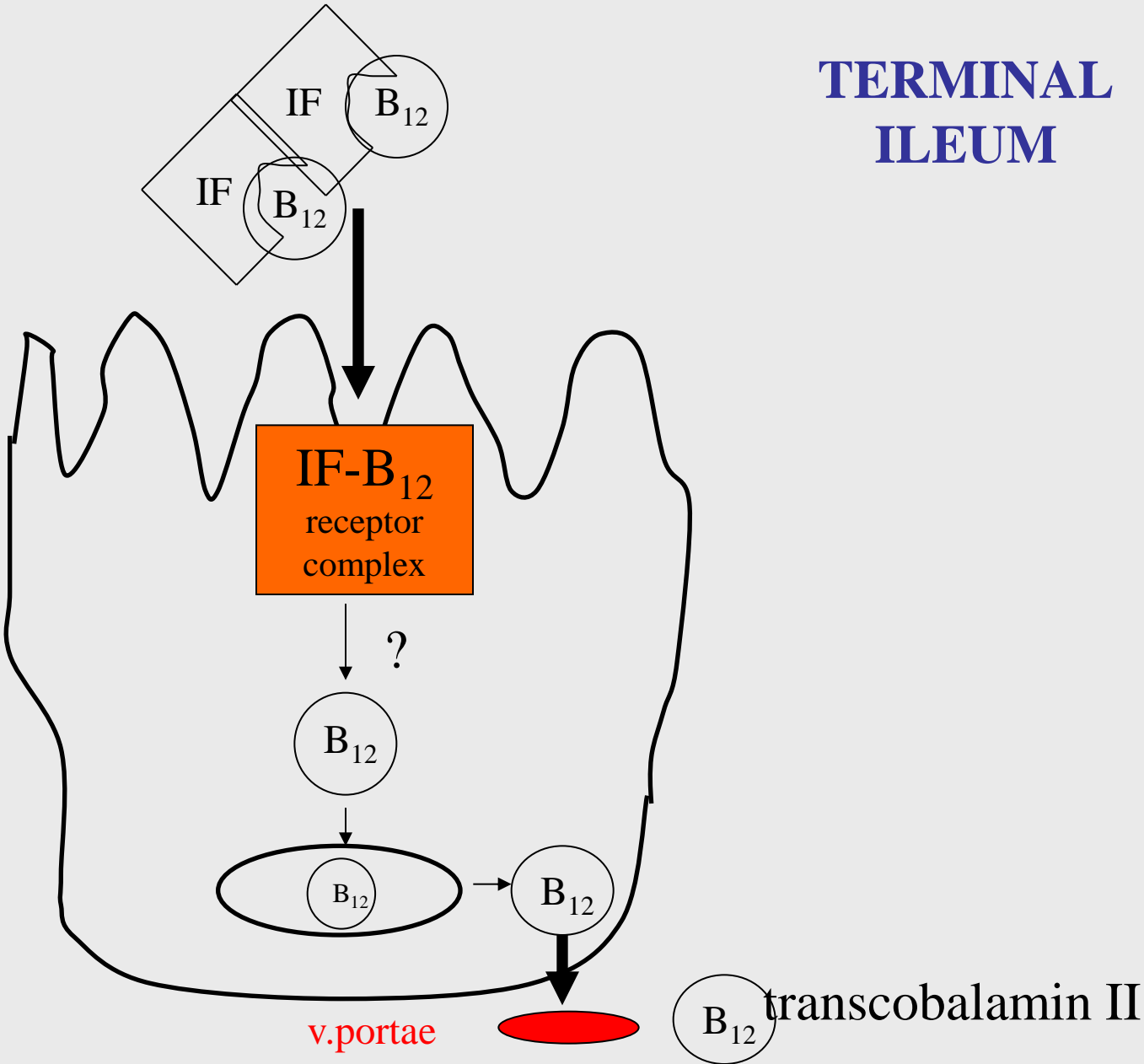
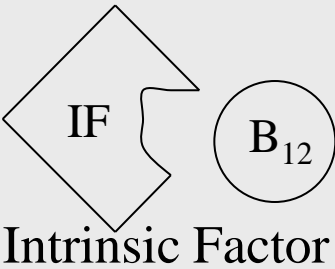
- Daily dose is close to absorption capacity
- Synthesised by bacteria in colon – BUT there is not absorption mechanism
- Store in liver (2-5mg)
- In bile 0,5-5mg / day, reabsorbed
- Daily loss – 0,1% of stores → stores will last for 3-6 years

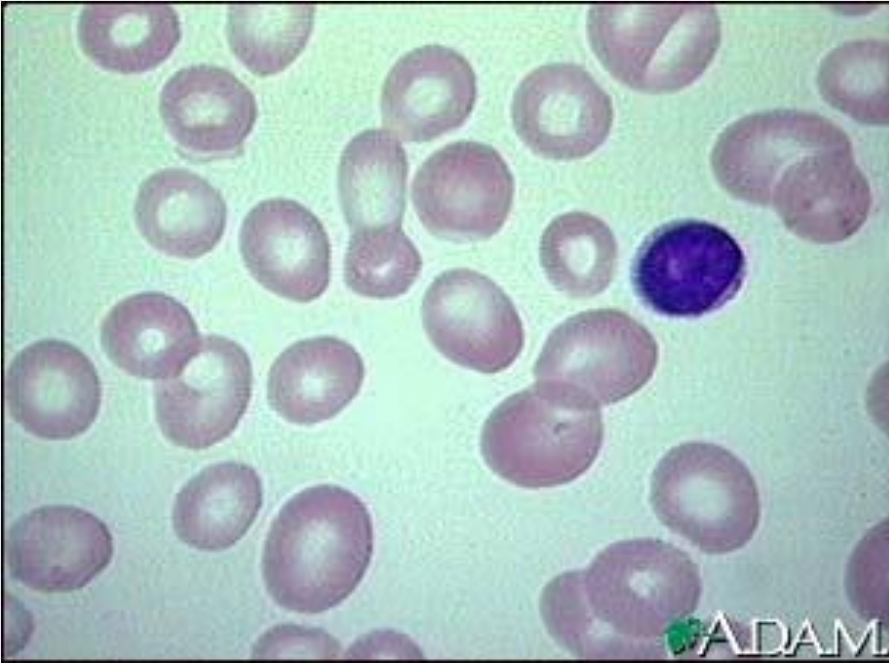
## ABSORPTION

1. **Gastric phase:** B<sub>12</sub> is bound to proteins, low pH and pepsin release it; bound to glycoproteins – **R-proteins** (saliva, gastric juice), almost pH-undependable; intrinsic factor (**IF**) – parietal cells of gastric mucosa; most of vitamin bound to R-proteins
2. **Intestinal phase:** pancreatic proteases, cleavage of R-B<sub>12</sub>, bound to IF (resistant to pancreatic proteases)

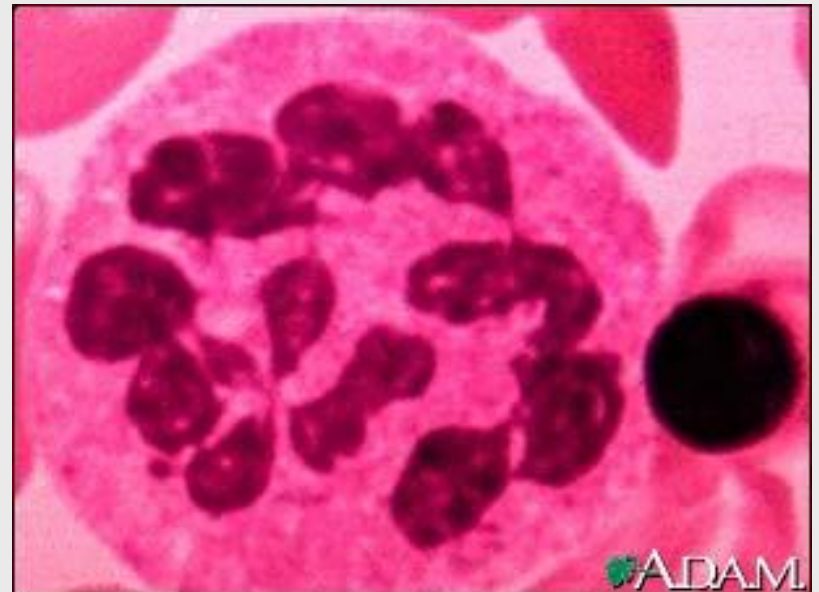
# ABSORPTION OF B<sub>12</sub> VITAMIN

TERMINAL ILEUM

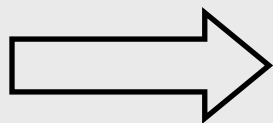




Pernicious anaemia  
(megaloblastic)



# DIGESTION AND ABSORPTION OF SACCHARIDES

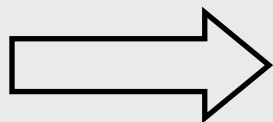


**POLYSACCHARIDES**  
( $\alpha$ -glycosylated s.)

salivary amylase  
 $\alpha$ -amylase

AMYLOPECTIN  
GLYCOGEN

Saliva  
Pancreatic juice



**OLIGOSACCHARIDES**

Epithelium of duodenum and jejunum

Isomaltase

DEXTRIN

Maltase

TRICHACHARIDES

Saccharase

DISACHARIDES:

Lactase

SACCHAROSE

MALTOSE

LACTOSE

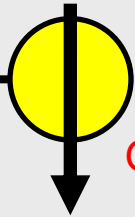


**MONOSACCHARIDES**

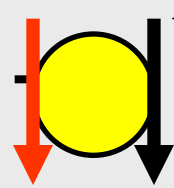
FRUCTOSE

GLUCOSE

GALACTOSE



GLUT-5



SGLT-1

Na<sup>+</sup>

2 binding sites for Na<sup>+</sup>  
1 binding site for saccharide

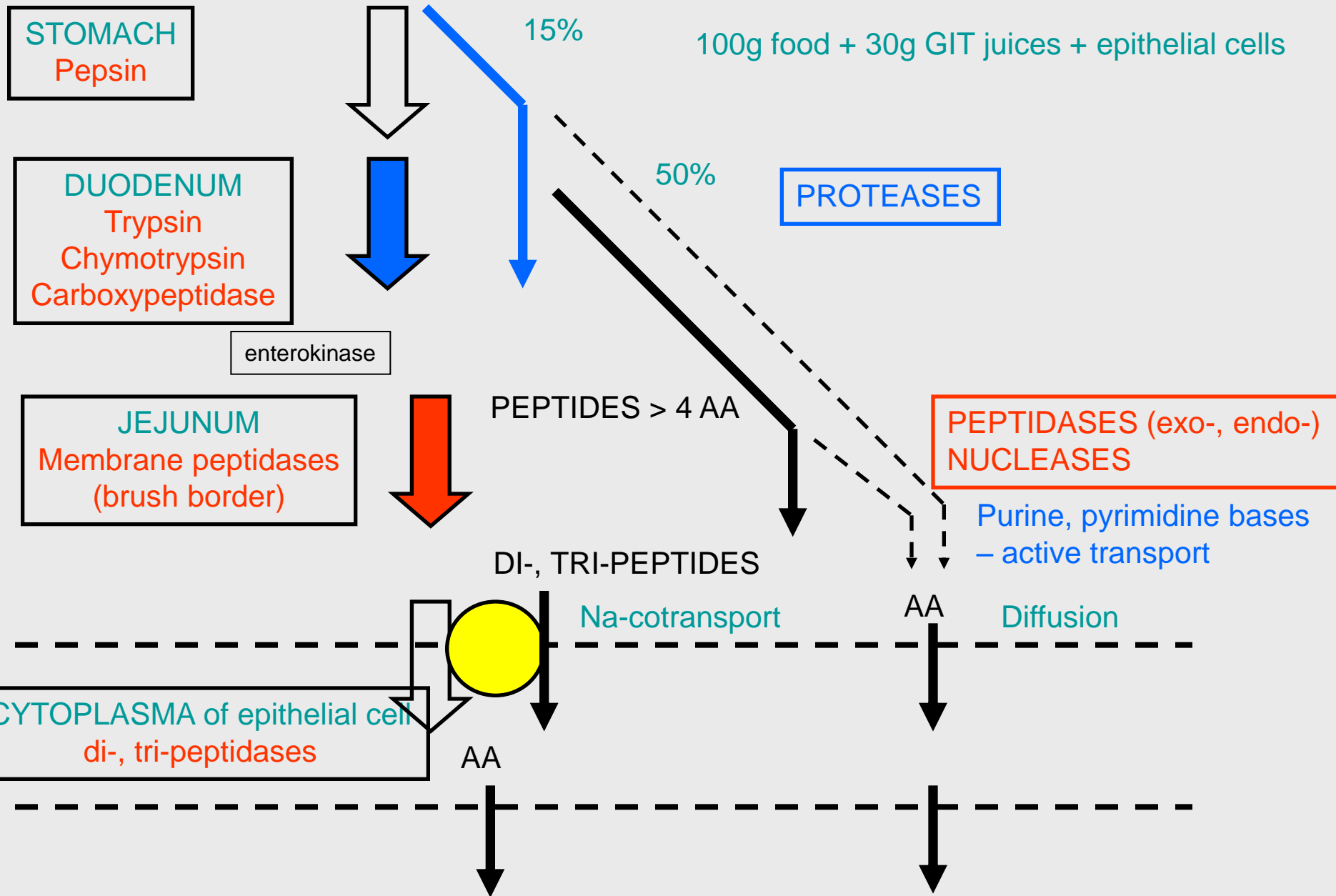


GLUT-2

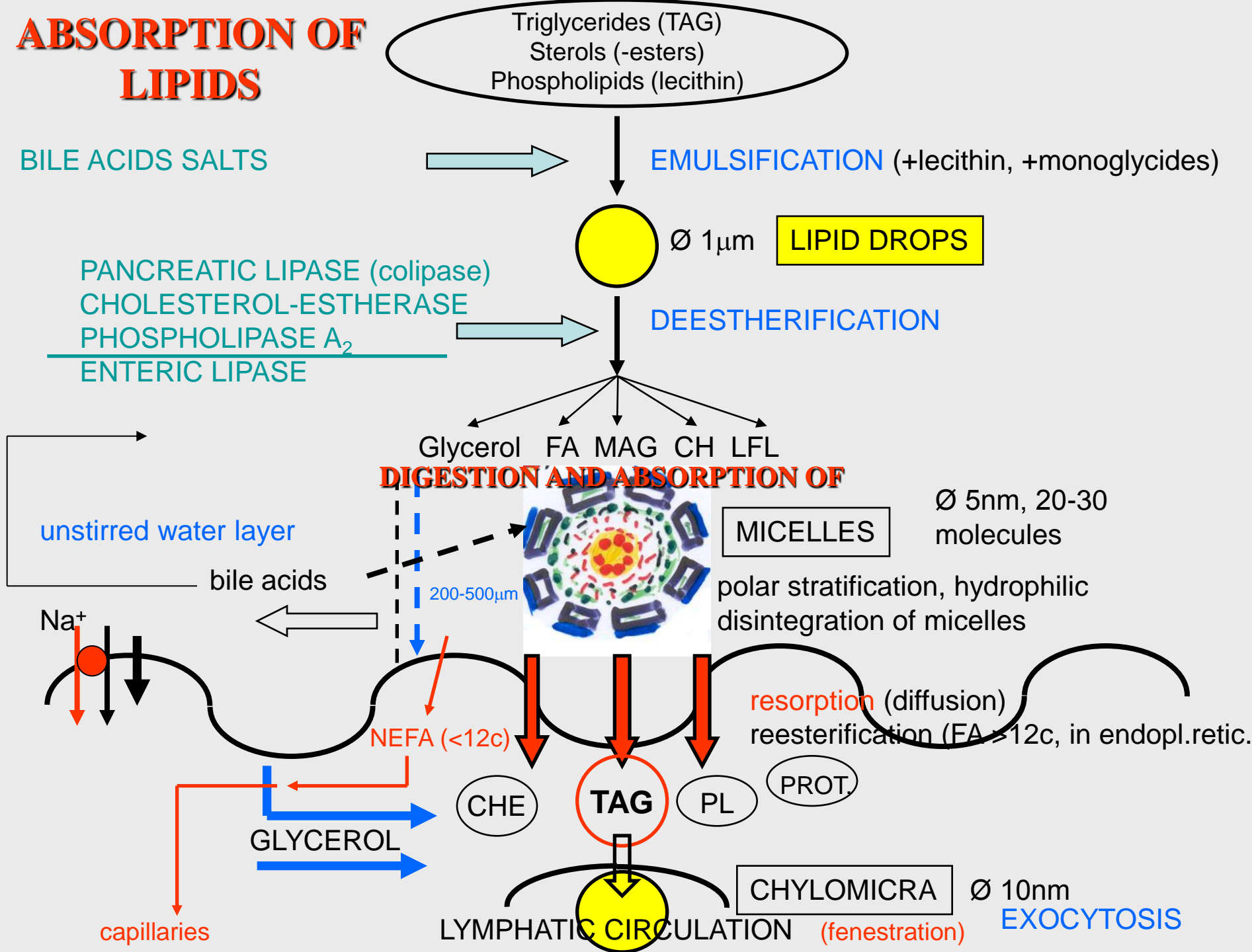
facilitated transport + diffusion

- Lactase intolerance
- Diarrhoea

# DIGESTION AND ABSORPTION OF PROTEINS



# ABSORPTION OF LIPIDS



# ABSORPTION IN COLON

- Na<sup>+</sup> (active, aldosteron)      H<sub>2</sub>O (90% water in colon)
- Cl<sup>-</sup>
- Vit. K, B
- AA, lactate, bile acids, FA

## REST OF CHYME

1. Cellulose, collagen
  2. Bile acids, epithelia, mucin, leucocytes
- Bacteria **fermenting**: fibre (pectin, cellulose) – lactate, alcohol, acetate, CO<sub>2</sub>, methane
  - Bacteria **putrescent**: residues of AA – NH<sub>3</sub>, SH<sub>2</sub>, phenol, indole, solatol (carcinogenic)

Production of vitamin K and vitamins of B group

