

Lecture series

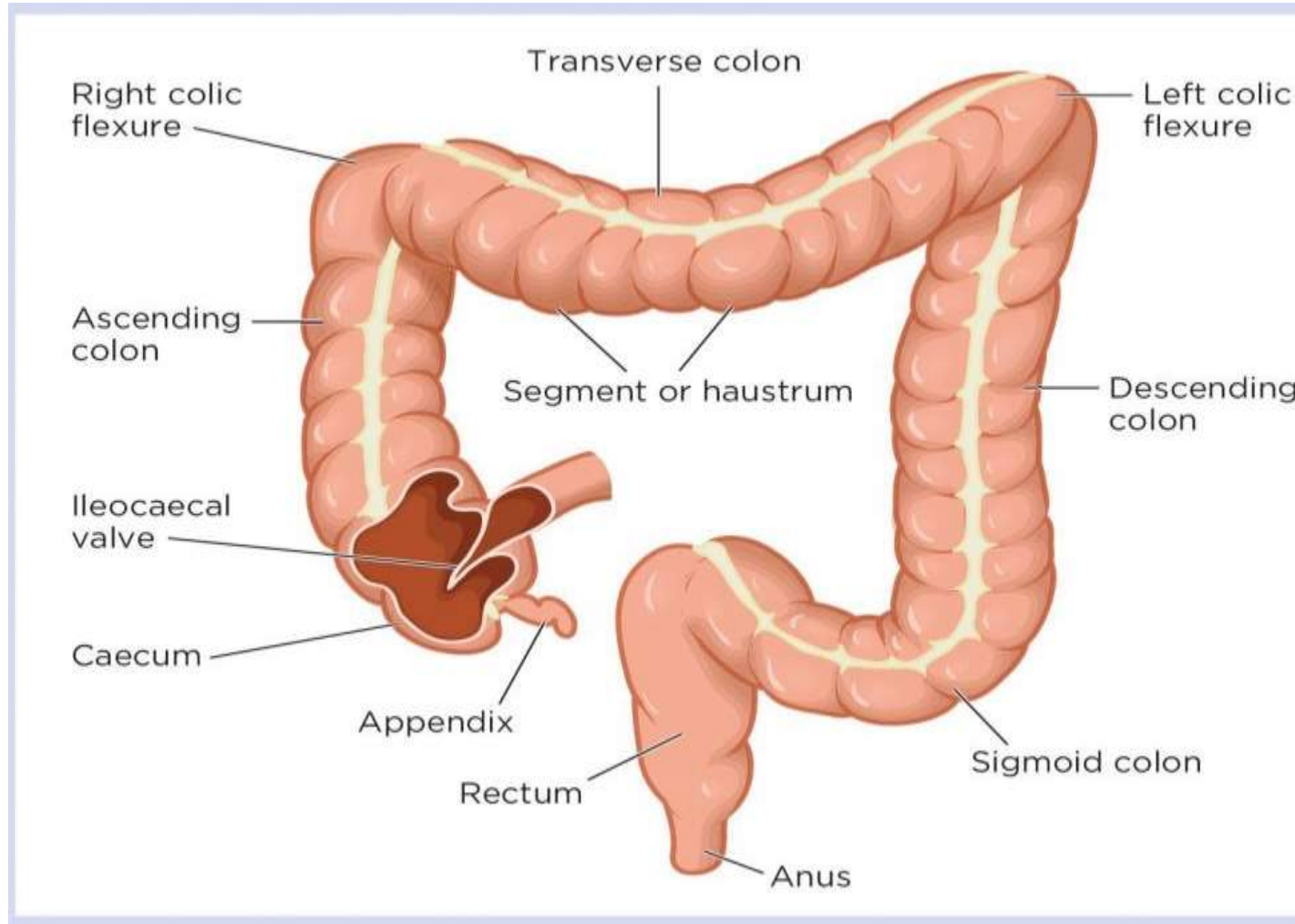
Gastrointestinal tract



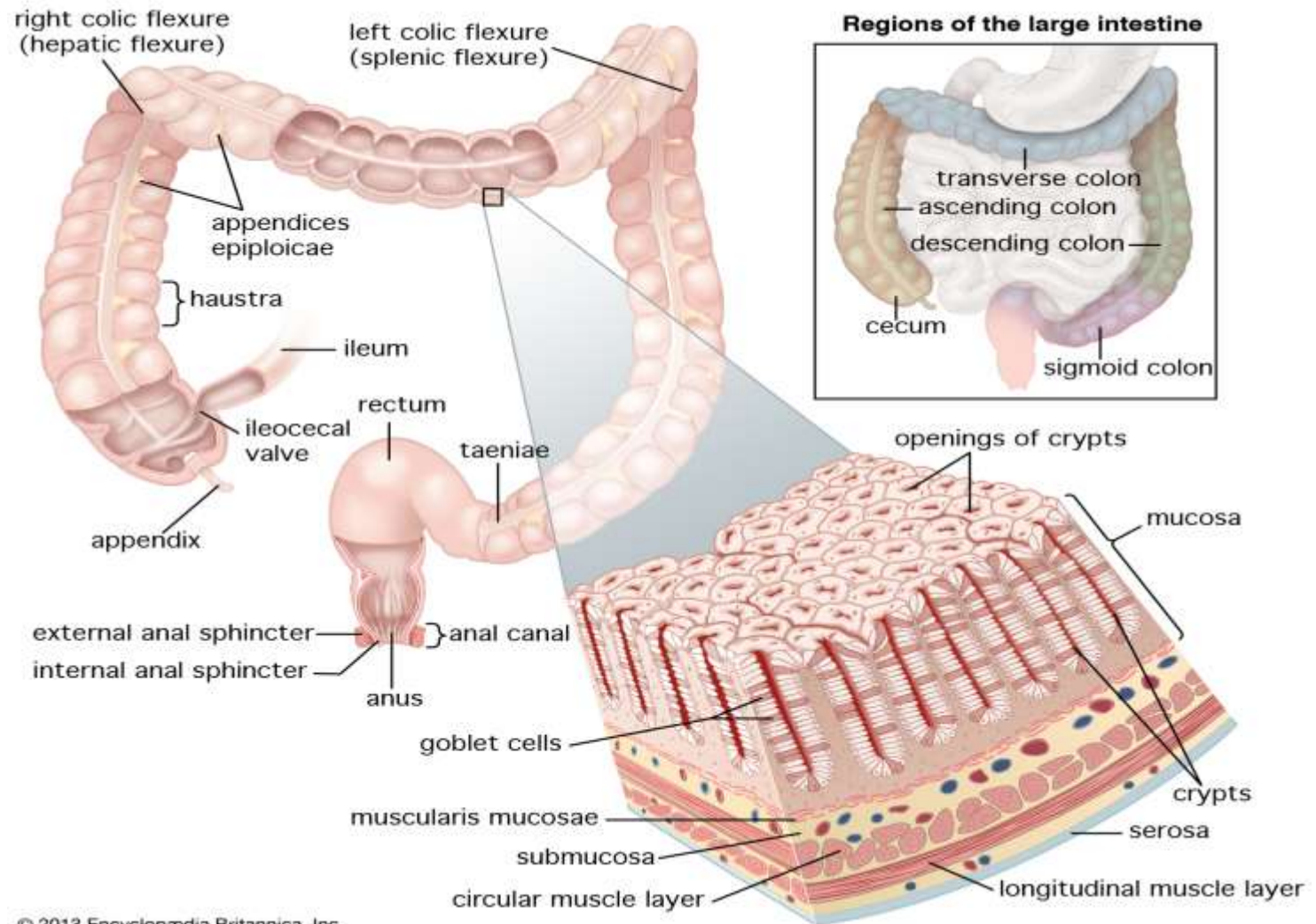
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FUNCTIONS OF LARGE INTESTINE AND ITS APPLIED

STRUCTURE OF LARGE INTESTINE



CROSS SECTION OF LARGE INTESTINE

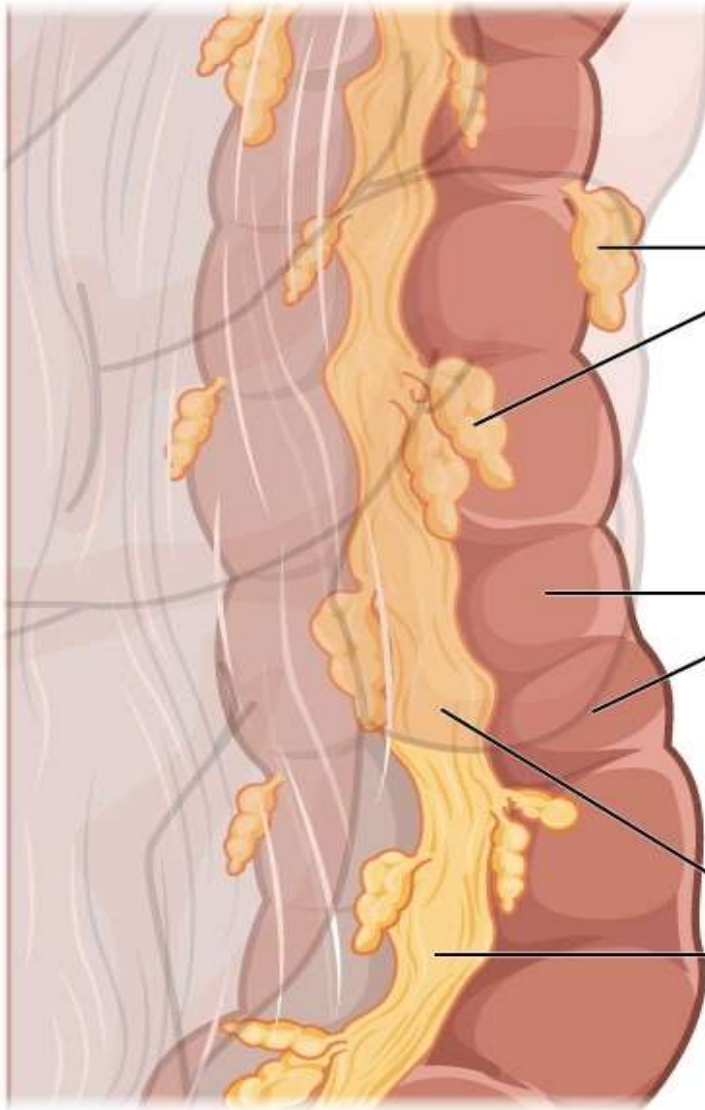


COMPOSITION OF THE LARGE INTESTINE SECRETION

1. Water
2. Mucus
3. Sodium
4. Chloride
5. Bicarbonate
6. Potassium
7. Calcium

CHARACTERISTICS OF LARGE INTESTINE

- ***Haustra***-Ring like contractions of the circular muscle divide the colon into pockets called haustra
- ***Teniae coli***- Three separate longitudinal ribbons of smooth muscle on outside of ascending,transverse,descending & sigmoid colons.they are visible below the serosa
- ***Epiploic appendages***-small pouches of peritonium filled with fat ,situated along the colon



Epiploic appendages

Haustra

Teniae coli

FUNCTIONS OF LARGE INTESTINE

- 1) *MUCUS SECRETION***- It has no villi, almost no digestive enzymes like small intestine
- It has crypts of Lieberkuhn and epithelial lining which contain mucous cells that secrete mucus
 - Mucus contains bicarbonate ions

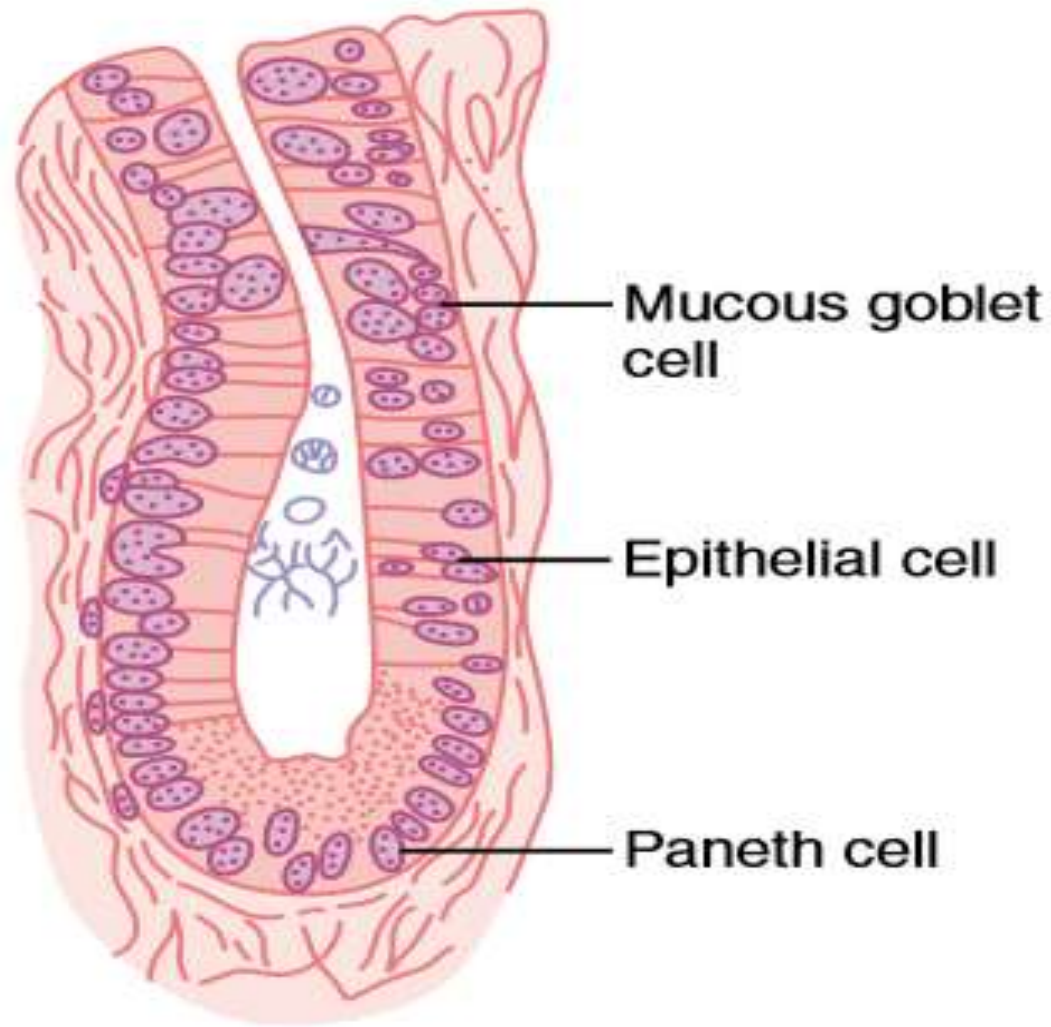


Figure 64-13 A crypt of *Lieberkühn*, found in all parts of the [REDACTED] intestine between the villi, which secretes almost pure extracellular fluid.

RATE OF SECRETION OF MUCUS

- Direct tactile stimuli
- Local nervous reflex
- Stimulation of pelvic nerves from spinal cord which carry parasympathetic innervation



Increased mucus production



Increased bowel movements

Functions of mucus

- Protect intestinal wall against excoriation
- Hold fecal matter together
- Protect from bacterial enzymes & toxicity
- Mucus & alkalinity by HCO_3^- provide barrier to keep acid in feces, from destroying intestinal wall

2. Formation of feces

- Around 1500ml of chyme/day from ileum is moved to caecum, of which maximum amount is absorbed in proximal colon. only 100ml of fluid & 1-5meq of sodium, chloride is excreted in feces
- Distal colon act as storage of feces called as storage colon
- LI has tight junction between epithelium cells prevents back diffusion of ions back
- .LI secretes HCO_3 , chloride ions. Bicarbonates neutralises acidic products of bacterial action
- .Absorption of sodium & chloride ions creates an osmotic gradient which in turn causes the absorption of water

3. FERMENTATION

- Bacteria mainly anaerobic & yeast break down substrates mainly starch, fibers, protein to give energy

COMPOSITION OF FECES

3/4 water, 1/4 solid

Solid -30% dead bacteria

- -10-20% fat
 - -10-20% inorganic matter
 - -2-3% Protein
 - -30% undigested roughage
-
- Stercobilin, urobilin to give colour to feces & urine
 - Others - indole, skatole, mercaptans, hydrogen sulphide etc

Substrates for fermentation

- Carbohydrate - starch, dietary fiber , pectin, cellulose ,hemicellulose ,unabsorbed sugars, modified cellulose, polydextrose
- Protein – dietary protein ,endogenous protein such as digestive enzymes.
- Others- intestinal glycoprotein, mucopolysaccharides

3. BACTERIAL ACTION IN Large Intestine

- Coliform bacilli is present which causes digestion of small amount of cellulose
- Substances formed by bacterias are vit-k, vit B12, thiamine, riboflavin gases (CO₂, H₂S, CH₄)
- Vit b12 helps in iron absorption
- Vit k is used in blood coagulation

SUBSTRATES



Bacterial +yeast enzymes breakdown



Breakdown products



Acetic acid,propionic acid,butyric acid,carboxylic acid,phenolic acid,amines,ammonia



Fate of substrates



Absorbed/Eliminated in feces/Rectal gases/ Utilized by microflora

SUMMARY OF THE FUNCTIONS OF LARGE INTESTINE

- Reabsorption of water and maintenance of fluid and electrolyte balance
- Helps in formation of stools
- Facilitate fermentation processes
- Absorption of certain product of fermentation such as butyrate ,vit. B12 ,vit k, thiamine, riboflavin
- Storage of fecal matter until eliminated.

CALCIUM ABSORPTION IN INTESTINE

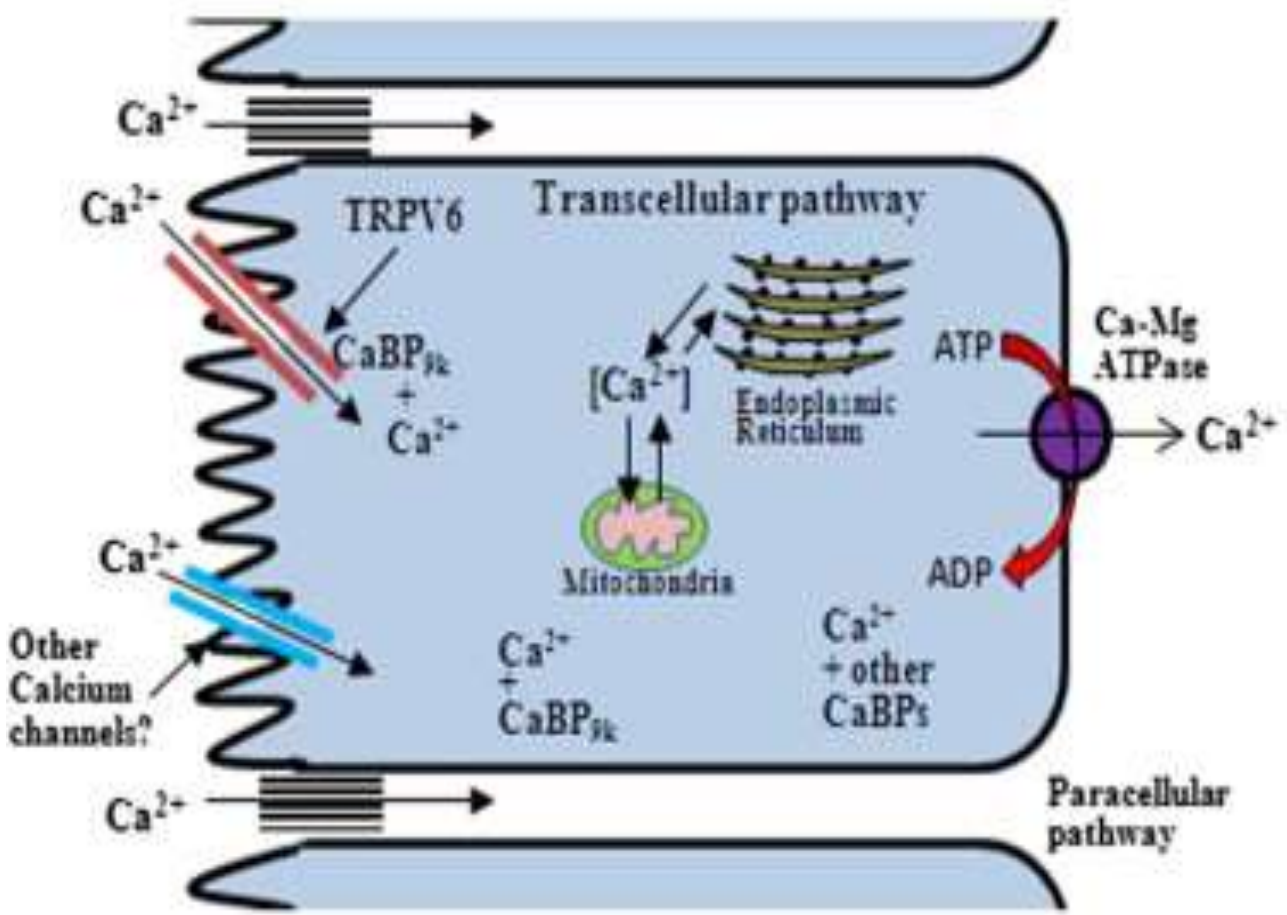
- Calcium entering in GIT is about 1 gm/day of which 40% is absorbed
- Absorbed mainly in duodenum and jejunum

Absorption takes place by 3 steps:

- a) Passive diffusion at enterocyte through ca channel
- b) Inside the cell binds with ca-binding protein ***calbindin D(CaBP)*** & sequestrated in ER ,Golgi apparatus
- c) At basolateral membrane ca transported to blood via ca-atpase pump
- d) Active form of vit D stimulates uptake, increase CaBP & Ca-ATPase pump

Lumen

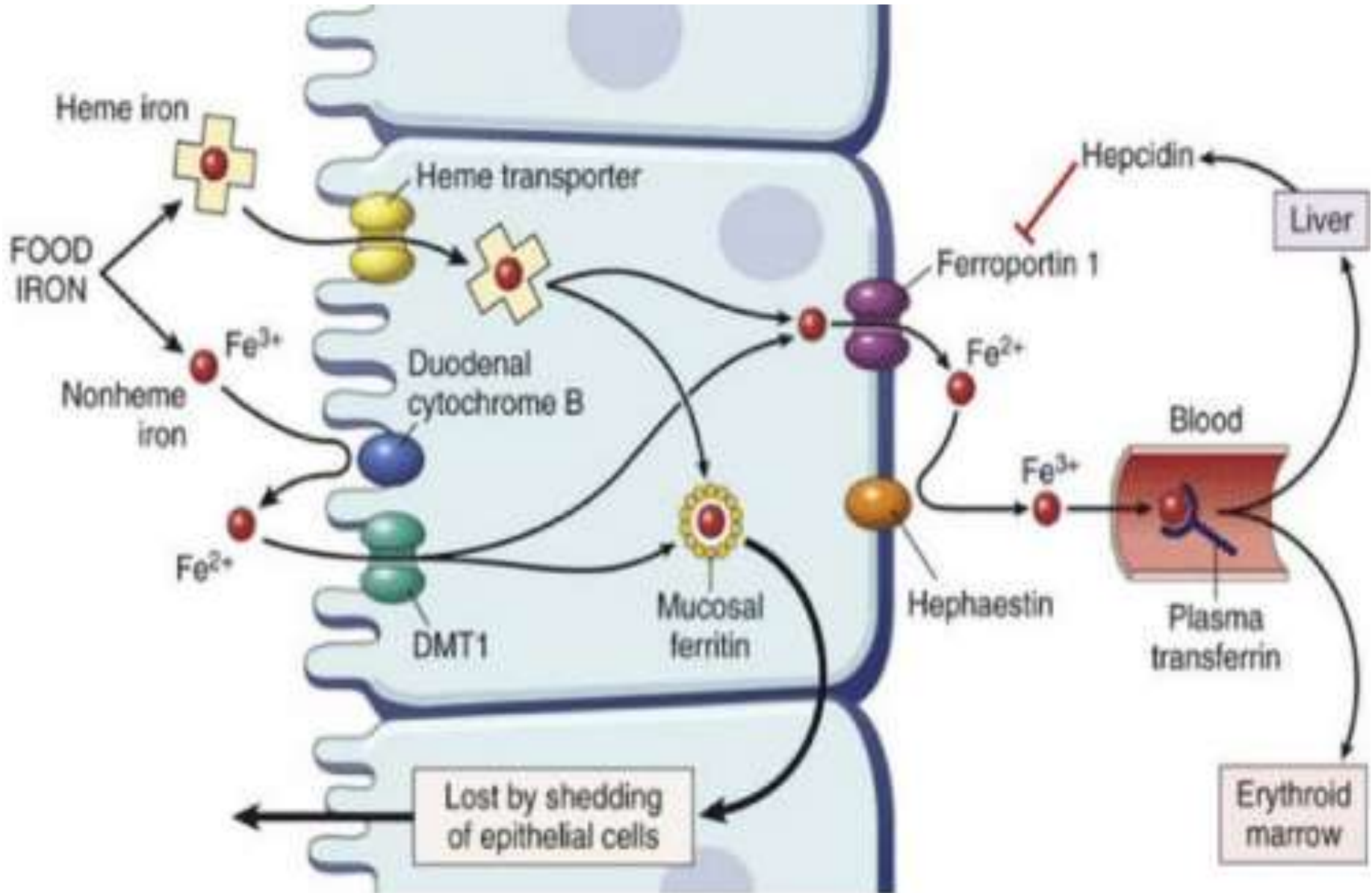
Basolateral



IRON ABSORPTION IN INTESTINE

- About 12-15mg/day of iron is absorbed in GIT
- Two form of dietary iron :heme &non heme
- Enterocytes absorbs heme iron
- Iron is mainly absorbed in duodenum &jejunum
- Iron is absorbed in ferrous form
- Heme in cytoplasm oxidised by heme oxygenase into iron
- Iron is stored as ferritin by help of protein *apoferritin*
- Iron goes to blood with the help of b-globulin synthesis by liver known as *transferrin*

IRON ABSORPTION IN INTESTINE



APPLIED OF LARGE INTESTINE

CONSTIPATION

- It is the slow movement of feces through the large intestine
- Associated with dry hard feces in the colon due to excess absorption of fluid or insufficient fluid intake.
- Causes
 - Obstruction
 - Tumor
 - Adhesion
 - Constriction
 - Ulcer

DIETARY FIBERS

- Also known as ROUGHAGE
 - It consist of non-starch polysaccharide such as cellulose ,waxes and pectin.
 - Advantage
 - it increases bulk ,soften stools, shortens transient time in intestinal tract.
 - reduces colon carcinoma
 - lower blood cholesterol , by binding with bile acid formed from cholesterol
- Examples-fruits &vegetables

Steatorrhea

It means excess ,bulky,pale,oily apperance,fowl smelling stool.

CAUSES

- Cystic fibrosis
- Celiac disease
- Crohn's disease
- GB Stone/cancer
- Hypoparathyroidism
- Pancreatic/renal/hepatic disease

DIAGNOSIS

- Examination of stool for presence of fat by Sudan III staining

CELIAC DISEASE

- Celiac disease is an autoimmune disorder.
- Characterized by the damage of mucosa and atrophy of villi in small intestine, resulting in impaired digestion and absorption.
- It is also known as gluten sensitive enteropathy

HIRSCHSPRUNG/MEGACOLON DISEASE

It is due to lack or deficiency of ganglion cell in the myenteric plexus in a segment of the sigmoid colon causing dilatation of colon proximal to it.

IRRITABLE BOWEL SYNDROME

Common disorder that affects the large intestine

SIGN & SYMPTOMS

- Cramping
- Abdominal pain
- Bloating
- Diarrhea/Constipation
- Mucus in stool

CAUSES

- Prolonged & strong muscle contraction of intestine
- Nervous system
- Inflammation in the intestine
- Severe infection
- Change in microflora of gut
- Food allergy/stress/hormones

RISK FACTORS

- Young female
- Family history of IBS
- Mentaly unstable person

COMPLICATIONS

- Poor quality of life
- Mood disorders

INFLAMMATORY BOWEL DISEASE

- **Crohn's disease**-it effect any segment of git from mouth to anus
- Symptom –abdominal pain,diarrhea,fever,weight loss, anemia,skin rash,arthritis,bowel cancer.
- Onset--20-30 years
- Diagnosis-biopsy
- Medication –Corticosteroid
-Methotrexate

ULCERATIVE COLITIS- it is a disease in which extensive area of the wall of the large intestine become inflammed and ulcerated

Symptoms-stool with mucus and blood

-Tenesmus

-fever

-weight loss

-Fatigue

Medication-cortocosteroid

-ileostomy

References

- Lippincott's Illustrated Reviews: Physiology (2013)
- Medical Physiology, Updated second edition (walter F. Boron, MD, phd)
- Berne & levy, physiology, sixth edition, updated edition
- Ganong's Review of Medical Physiology, 26 t h e d i t i o n