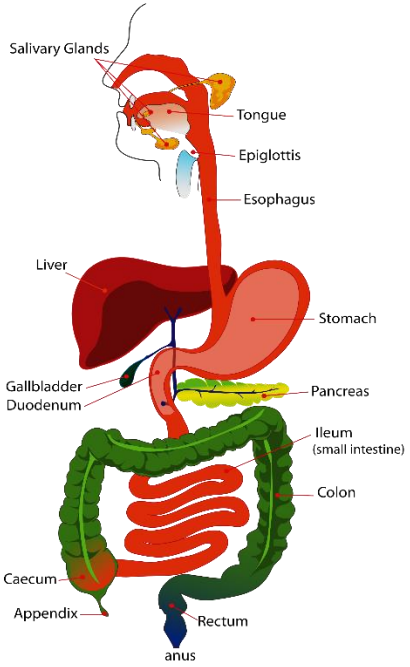
5. BILIARY & INTESTINAL SECRETION.



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2020-2021

liver & bile

The liver is the largest gland in the body (1.5 kg).

* Function of the liver :

1) Metabolic function:

-CHO metabolism :

Glucostat function: the liver maintain the blood glucose within 70-110 mg % via:

- Glycogenesis & gluconeogenesis.
- Conversion of galactose to glucose

-**Protein metabolism**: synthesis of nonessential mains acids, proteins, urea ,uric acid

-**Fat metabolism**: Synthesis of lipoprotein , cholesterol & phospholipid.

-FFA oxidation and ketone bodies formation.

2) Storage function:

The liver stores glycogen, vitamins A,D,E,K&B12 and metals as iron &copper.

3) blood clotting factors : the liver needs vit. k to synthesis factors II, VII, IX, X.

4) Vascular function :

-Storage of blood.

-By kupffer cells removal of bacteria & blood clots

5)Drug and hormonal inactivation: e.g. steroid H., pencillin & others.

6) Immune response : the liver is a part of the reticule endothelial system

7) Bile formation :

- Formation and secretion of about 0.2gm of bile salts/day.
- Formation and excretion of bile pigments

Gall bladder

•**Motility of the gall bladder**

- At meal time the gall bladder contract and sphincter of Oddi relaxes → evacuation of bile.

- **Cholagogues**: factors increase evacuation of the bile as vagal stimulation, cholecystokinin hormone and magnesium sulphate.

•**Functions of gall bladder :**

1) Storage of bile in between meals as the sphincter is closed and the liver continue to secrete bile.

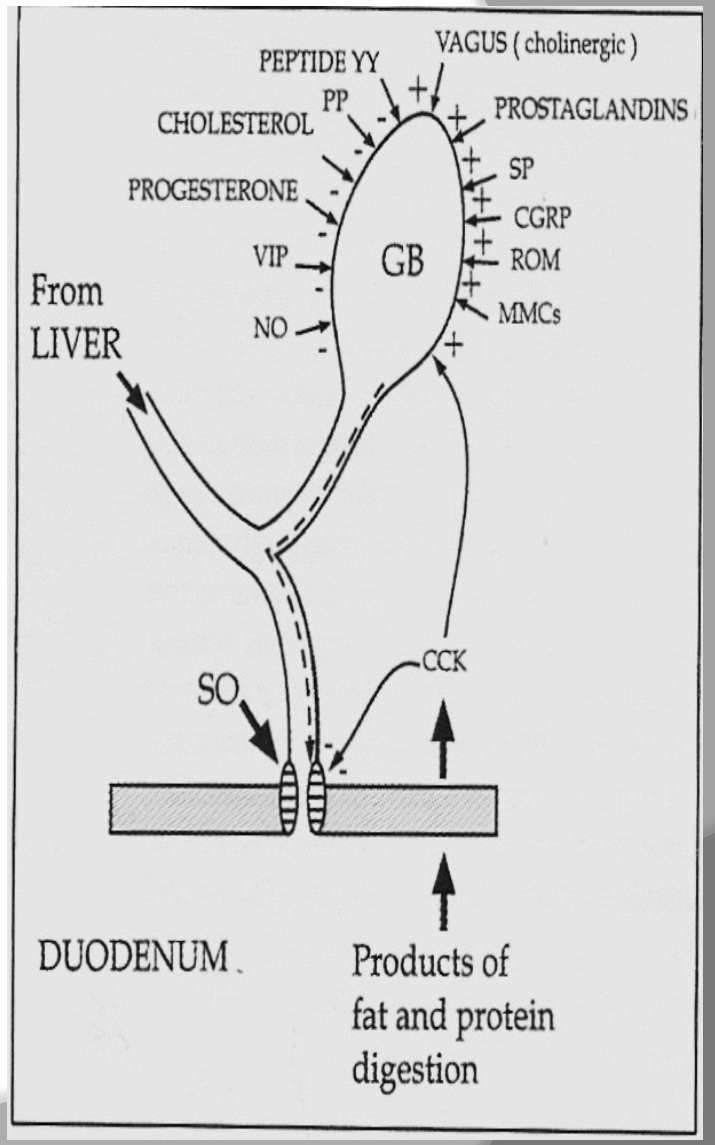
2) Concentration of bile : by absorption of water, Na+ and CL- to accommodate large volume of stored hepatic bile.

3) Help continuous flow of hepatic bile in between meals by storage and concentration.

4) Acidification of bile by absorption of Na+ bicarbonate to prevent precipitation of Ca++ bile stones (pH changed from 7.8 to 7).

5) Evacuation of bile in the duodenum.

6) Secretion of white bile as mucus to protect the bladder wall from the concentrated bile.



Bile

* Volume : 1 – 1.5 L/day.
* PH : in liver bile : alkaline - in gall bladder bile : acidic.
- Constituents :

Liver bile	Gall bladder bile
• H_2O : 97.5 gm%.	• 92 gm %.
• Inorganic : Na^+, Hco_3, CL^-.	• Less concentrated ions
• Organic : less - bile salts : 1.1 gm % -others: cholesterol, fat lecithin, F.A, bile pigments	- 6 gm %. - More concentration.
• PH : 7.8 – 8.5.	• 7.0 – 7.4.

- **Regulation of bile :**
- **a. Choleretics**: factors stimulate bile secretion and flow as:
- 1- Vagal stimulation to liver and gall bladder.
- 2- Bile salts (via enterohepatic circulation)
- 3- Secretin hormone is hydrochloretic, as it increases the bile flow via increasing bicarbonate and water secretion.

- **b. Cholagogue** : factors evacuate the bile from gall bladder as : 1- Vagal. 2- Mg++ sulphate. 3- CCK – PZ. H.

*** Mechanism of bile secretion :**

a) Between meals:

The sphincter of Oddi is closed and the hepatic bile is stored in the bladder to be concentrated and acidificated.

b) During food intake:

• Swallowing causes reflex vagal relaxation of sphincter and evacuation of bile.

•The CCK enzyme from duodenum → evacuation of bile into the intestine.

c) After meal: 90 % to 95 % of bile salts are actively reabsorbed from the terminal ileum back to the liver via the portal vein and re-excreted in the bile stimulating more bile secretion (enterohepatic circulation), the normal rate of bile salts secretion is 0.3 gm/day and recycles 6 – 8 times/day → total amount of 3.5 gm/day of bile salts.

Small Intestine Secretions

- Mucus
  - Protects against digestive enzymes and stomach acids
- Digestive enzymes
  - Disaccharidases: Break down disaccharides to monosaccharides
  - Peptidases: Hydrolyze peptide bonds
  - Nucleases: Break down nucleic acids
- Duodenal glands
  - Stimulated by vagus nerve, secretin, chemical or tactile irritation of duodenal mucosa

Intestinal secretion (succus entericus)

(1)The small intestine has 3 types **of secretory cells**:

- Crypts of lieberkuhn.
- Brunner's gland and Goblet cells.
- Enterochromaffin cells which secrete serotonin.

(2)The intestinal secretion is **made up of**:

- Mucus:

-Secreted by Brunner's glands & goblet cells.

-Important for protection and lubrication.

-Stimulated by vagus, local distension or acidic chyme & secretin.

-Inhibited by sympathetic stimulation so, irritable persons have high incidence of duodenal ulcers.

-Alkaline fluid: (Na HCo3):

- Dissolves the chyme.
- Stimulated by secretin, CCK, VIP and PGS.
- Inhibited by sympathetic.

-**Sloughed Mucosa (enzymes):**

-The intestinal secretion is about 1 liter/day of pH 7.5 and have no enzymes secreted from Crypts of lieberkuhn.

-The sloughed cells contain disaccharides (sucrase, maltase& lactase) di-peptidases (Amino-peptidase, enterokinase) and phosphatases.

Control of intestinal secretion:

Nervous: - local enteric reflexes →↑ secretion .

- Vagal →↑ mucus secretion only.

Hormonal: VIP, secretin, CCK → ↑secretion.

Vaso active Intestinal Peptide (VIP)

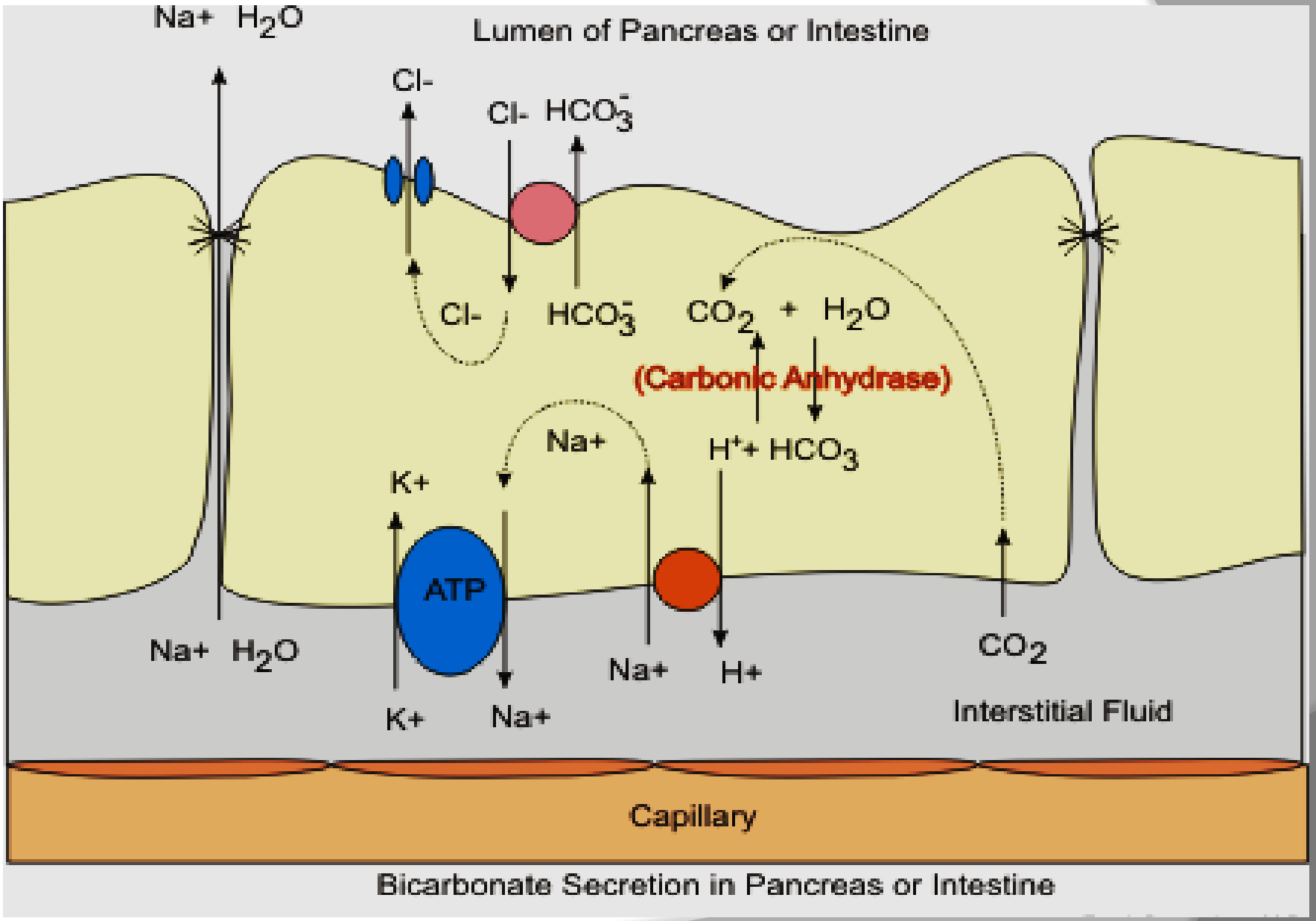
It is released from the GIT and act as a hormone or co-transmitter and has the following effects:

1-stimulate intestinal motility and secretion.

2-Causes vasodilatation.

3-Inhibition of gastric acid secretion.

4-Relaxation of L.O.S.



Bicarbonate Secretion in Pancreas or Intestine

Secretions of the Large Intestine

- Mucus protects the intestinal lining
- The bacterial flora of the large intestine consist of:
  - Bacteria surviving the small intestine that enter the cecum
  - Those entering via the anus
- These bacteria:
  - Colonize the colon
  - Ferment indigestible carbohydrates
  - Release irritating acids and gases (flatus)
  - Synthesize B complex vitamins and vitamin K
  - Constitute about 30% of the dry weight of the feces

Thank You