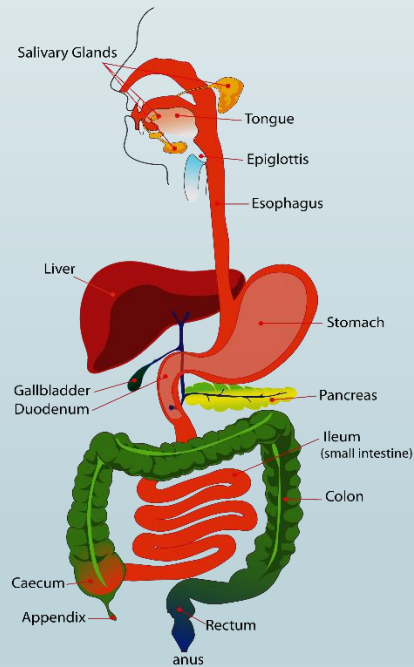




4. PANCREATIC SECRETION.



Prof. Sherif W. Mansour
Physiology dpt., Mutah School of medicine
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Pancreatic secretion

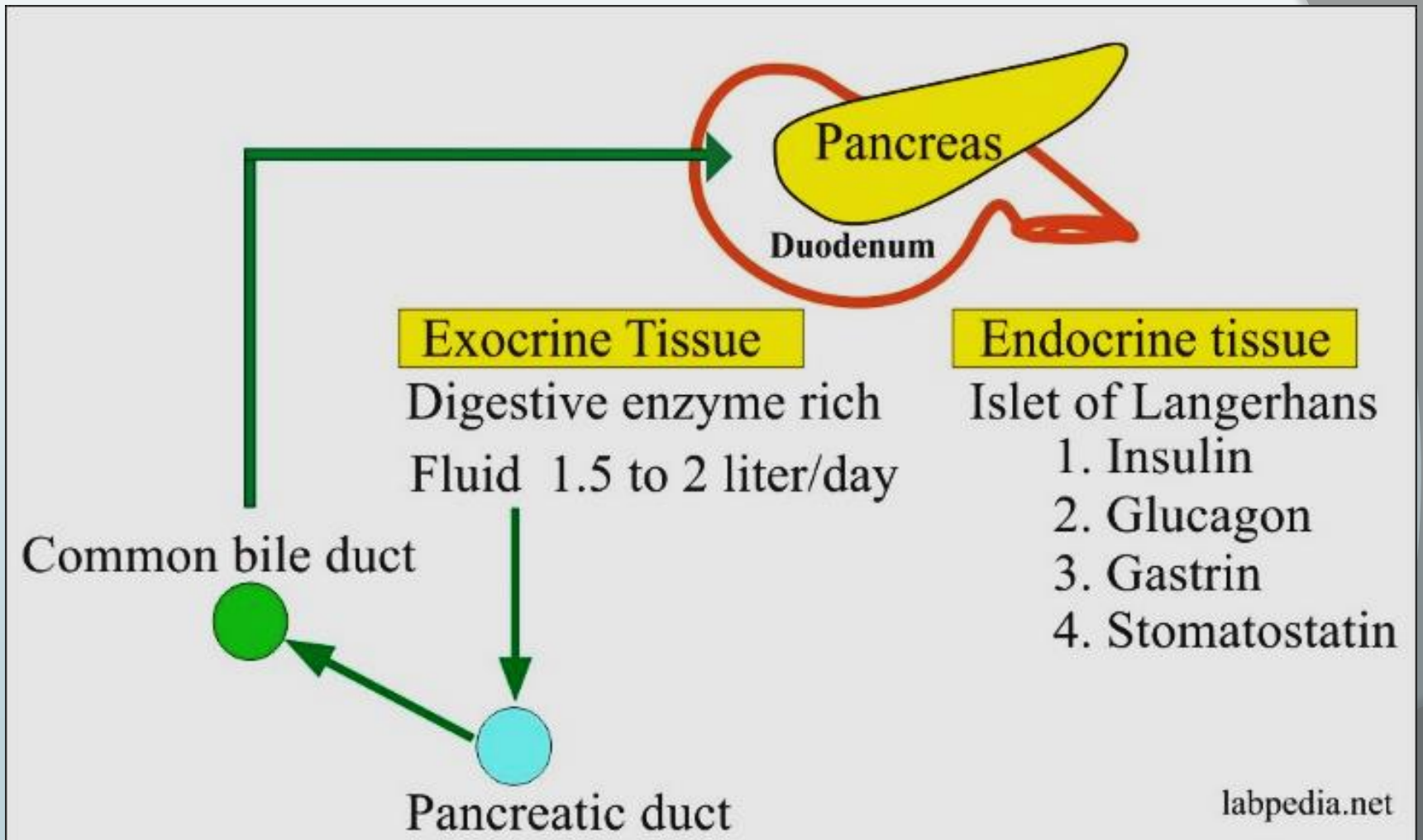
-The pancreas has both :

1- Endocrine gland : Alpha cells → glucagon. Beta cells → insulin.

2- Exocrine gland : consisted of blind secretory acini, ducts which drain in **pancreatic duct** which unites with **common bile duct** and open together at the **ampulla of Vater** in the duodenum. The common opening is surrounded by **sphincter of Oddi**.

-Exocrine pancreatic secretion :

- Volume : 1 – 1.5 L/day.
- PH : 7.8 – 8.3
- Osmolarity : iso-osmotic with plasma.
- Ions :
 - Na⁺ & K⁺ : the same conc. of plasma.
 - HCO₃⁻ : **higher** than in plasma (140 mEq/L).
 - CL⁻ : **lower** conc. than plasma.



Types :

1- Aqueous alkaline juice:

-Large in volume, rich in bicarbonate.

-Secreted by duct cells.

-Stimulated by **secretin** hormone & inhibited by **sympathetic**.

- Mechanism of secretion:

- In duct cells : $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{HCO}_3^- + \text{H}^+$.

- HCO_3^- is actively secreted in lumen.

- H^+ ion is pumped out to the plasma (acid tide) in exchange for Na^+ which is pumped into the cell then diffuse to lumen.

- H_2O diffuse passively into the lumen by osmotic forces of Na^+ & HCO_3^- .

N.B.: Acid- tide: $\uparrow \text{H}^+$ conc. in **venous blood** drain the pancreas to neutralize alkaline tide of gastric secretion → **acid – base balance.**

Regulation of Pancreatic Secretion

Acid from stomach releases secretin from wall of duodenum; fats and amino acids cause release of cholecystokinin

2

Common bile duct

1

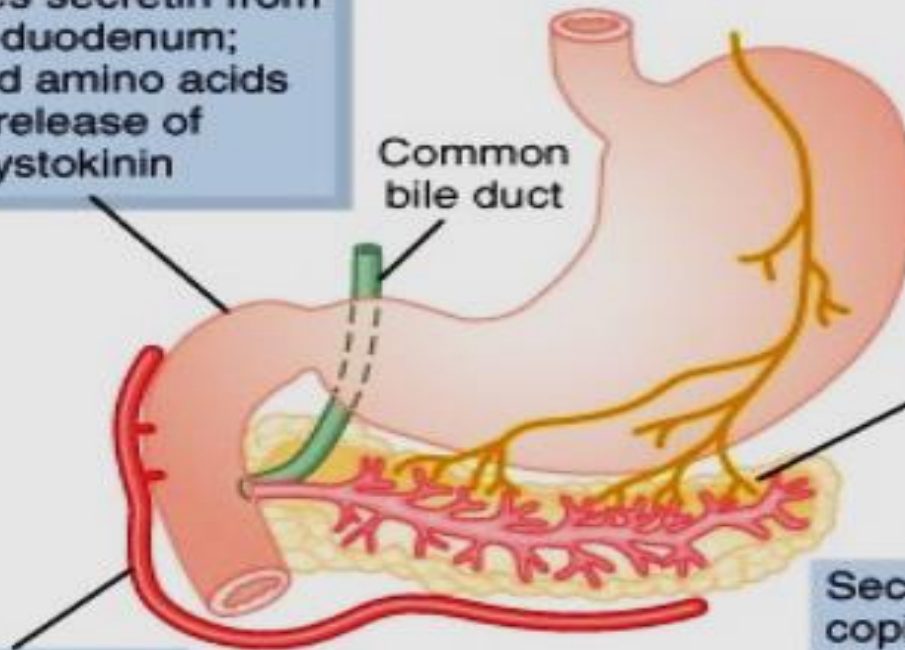
Vagal stimulation releases enzymes into acini

Secretin and cholecystokinin absorbed into blood stream

3

4

Secretin causes copious secretion of pancreatic fluid and bicarbonate; cholecystokinin causes secretion of enzymes



2- Enzymatic juice :

- Small in volume, rich in enzymes.
- Secreted by Acinar cells.
- Stimulated by CCK – PZ & vagus nerve.
- There are 3 classes of enzymes :

• **Pancreatic amylase:** starch → maltose.

• **Pancreatic lipolytic enzymes: Lipase and phospholipase** (facilitated by bile).

- Triglycerides → FFA & monoglycerate.

- Phospholipase A: act on lecithin → lysolecithin.

• **Proteolytic enzymes:**

- **Endopeptidases** as trypsin & chymotrypsin.

- **Exopeptidases** : carboxypeptidases.

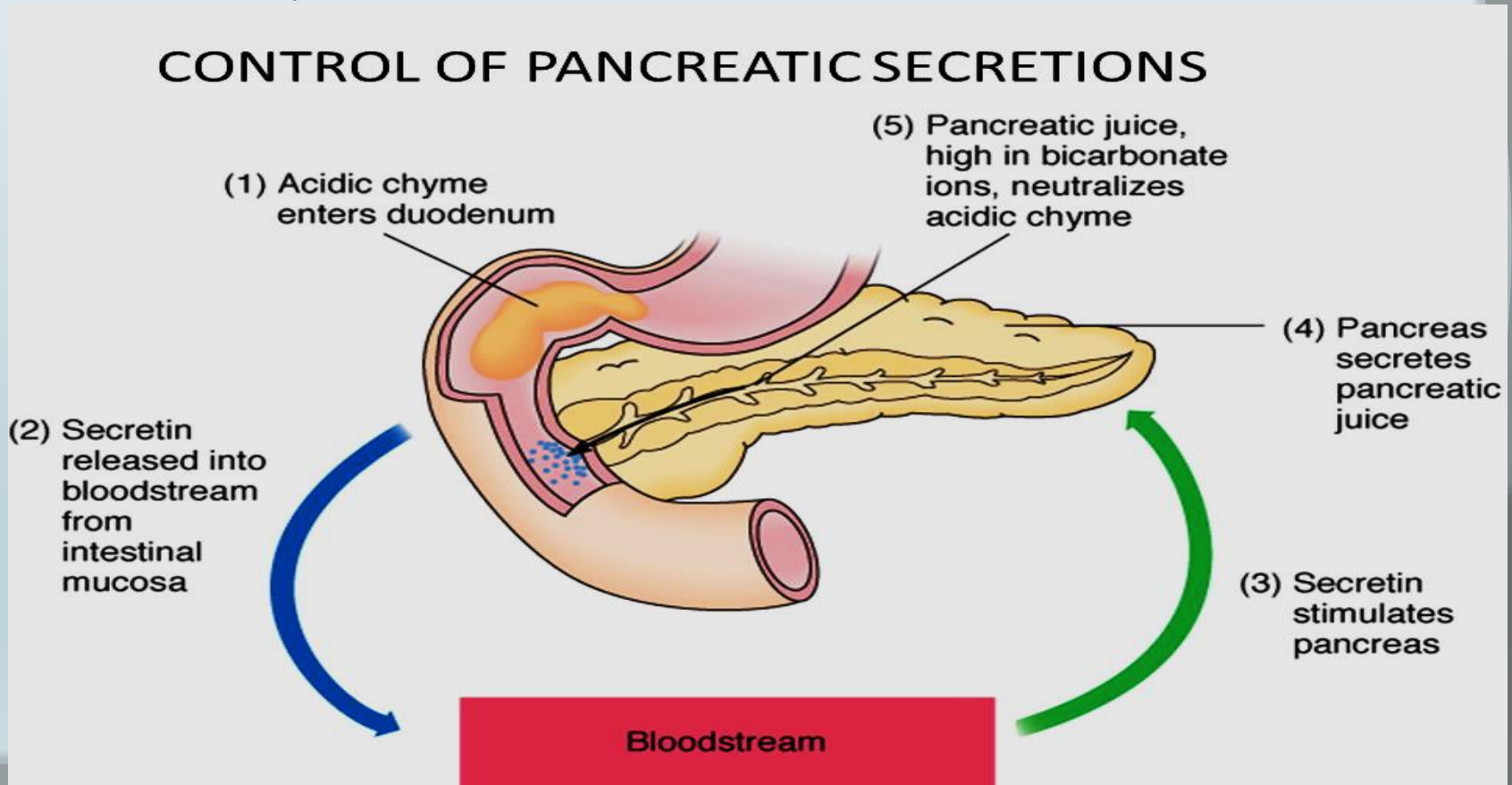
It is secreted in inactive form and activated by enterokinase and the active trypsin to prevent auto digestion of pancreas (also the pancreas has **trypsin inhibitor**).

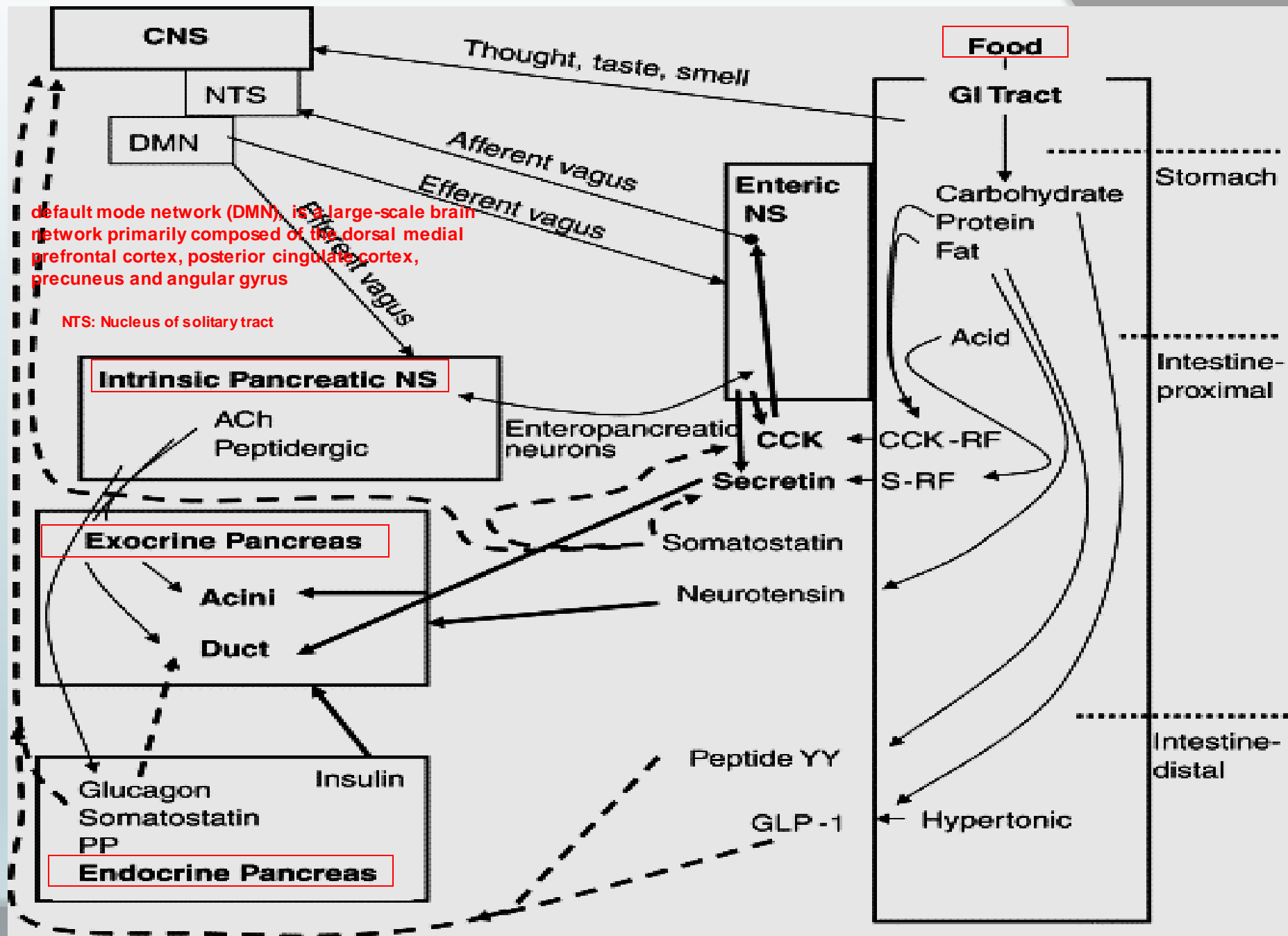
Control of exocrine pancreatic secretion

1) **Nervous** : as a part of conditioned & unconditioned reflexes → vagal stimulation of enzymatic secretion from acini.

2) **Hormonal** :

- Secretin → ↑ aqueous secretion from duct.
- CCK. PZ → ↑ enzymes from acini.





default mode network (DMN), is a large-scale brain network primarily composed of the dorsal medial prefrontal cortex, posterior cingulate cortex, precuneus and angular gyrus

NTS: Nucleus of solitary tract

Thank You