

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ  
(وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ)



جلیل

GI Pharmacology | FINAL 1

# Peptic Ulcer Treatment



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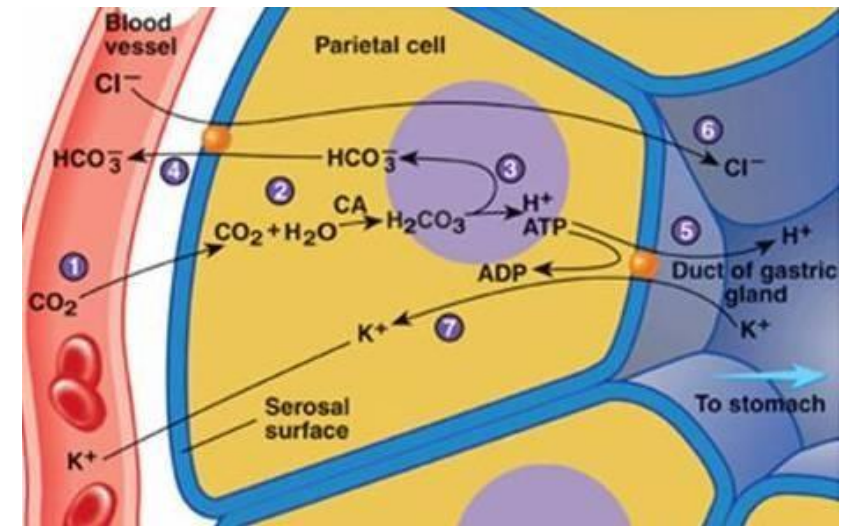
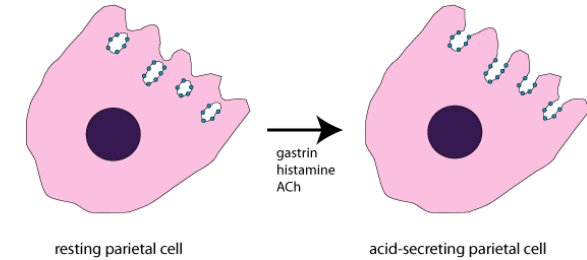
Amjad Al Omoush

# **Drugs Used in the Treatment of Gastrointestinal Diseases.**

**Manar Zraikat**

# Physiology of gastric Secretion

- Parietal cells secrete 2 liters of acid/day; **a huge amount that aids in digestion.**
- Optimal pH (between 1.8-3.5) for the function of the digestive enzyme pepsin.
- Stimulation of acid secretion **from the parietal cells** involves translocation of H<sup>+</sup>/K<sup>+</sup>-ATPase to the apical membrane of parietal cell.
- H<sup>+</sup>/K<sup>+</sup>-ATPase (proton pump) uses the energy derived from ATP hydrolysis to pump H<sup>+</sup> into the lumen **of stomach** in exchange for potassium ions.
- Chloride and hydrogen ions are secreted separately from the cytoplasm of parietal cells and mixed in the canaliculi (**lumen**).



## Stimulants of acid secretion:

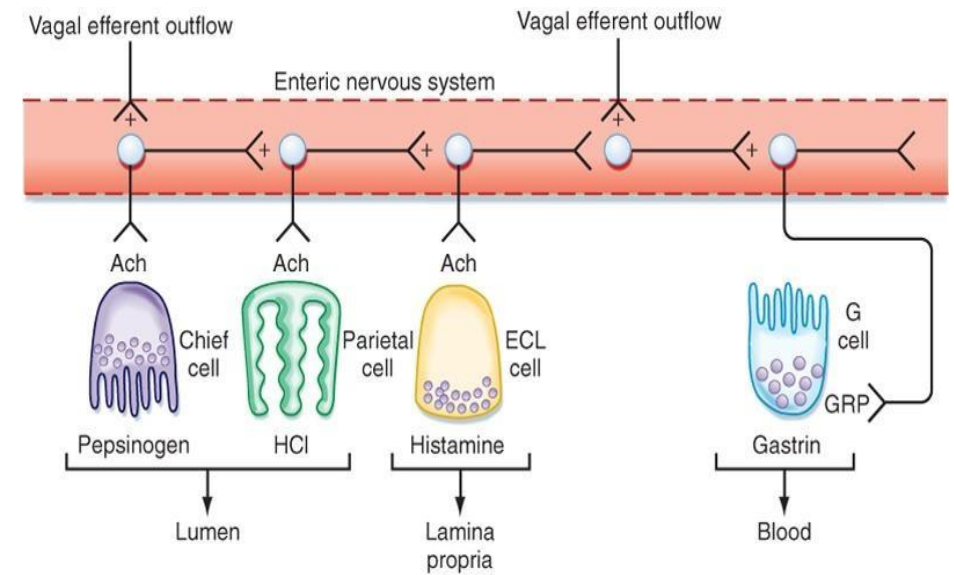
1. Ach from enteric neurons **that results in the secretion of pepsinogen.**
2. Histamine from ECL (enterochromaffin - like) cells.
3. Gastrin released by G cells.

### **Somatostatin in D cells inhibits acid secretion.**

When gastric pH < 3, gastric D cells release somatostatin, which will inhibit acid secretion **and keep the pH around 3.**

### **Somatostatin inhibits acid secretion by 2 mechanisms:**

- 1 direct effects on parietal cells **and inhibiting their functions.**
- 2 inhibiting release of histamine & gastrin **or both.**



Gastrin releasing peptide (**GRP**)

# Three phases in gastric acid secretion.

## ❖ Cephalic Phase:

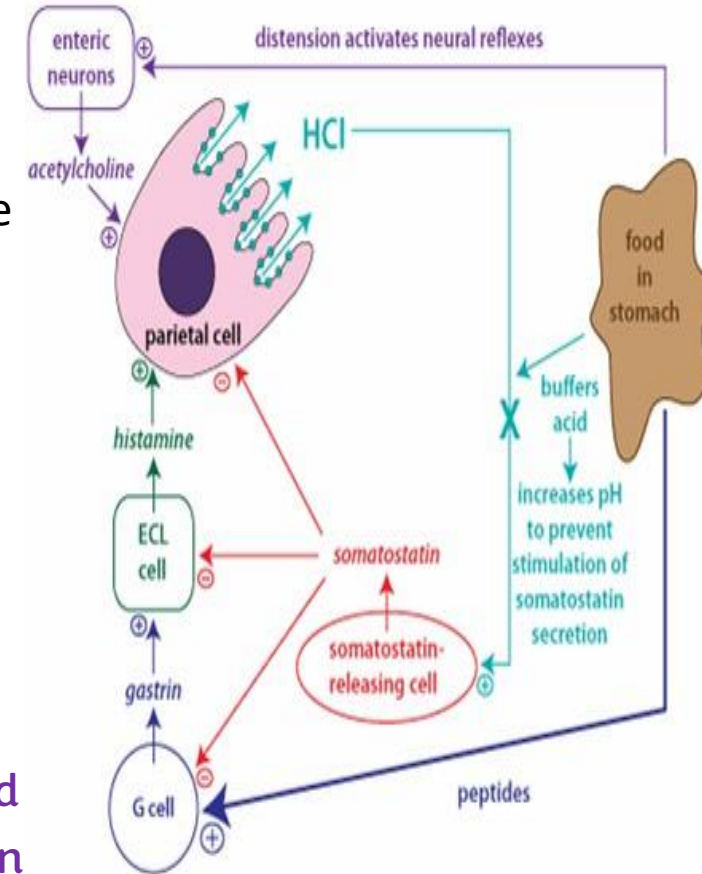
- sight, smell, taste or thought of food, activate enteric neurons **that induce the Ach to be secreted and induce parietal cells to work.**
- In humans, the major effect of **gastrin** is indirect through the release of histamine from ECL cells not through direct parietal cell stimulation.

## ❖ Gastric Phase:

- Food stretch stomach walls activating a neural reflex to stimulate acid secretion.
- Peptides & amino acids stimulate G cells to release gastrin leading **to induce the ECL cells and the PH will decrease.**
- Food acts as a buffer, raising the pH & thus removing the stimulus for somatostatin secretion, **then somatostatin inhibits the secretion of HCl, the food act as a buffer that will increase the PH which will inhibit somatostatin secretion**

## ❖ Intestinal Phase:

- Once chyme enters the duodenum, it activates negative feedback mechanisms to reduce acid secretion.



# Pathological conditions related to the GIT : Peptic ulcer

- A defect in the lining of the stomach or the duodenum.

## Causes of Peptic Ulcer:

- *Helicobacter pylori* (most common).
- Drugs such as aspirin & other NSAIDs

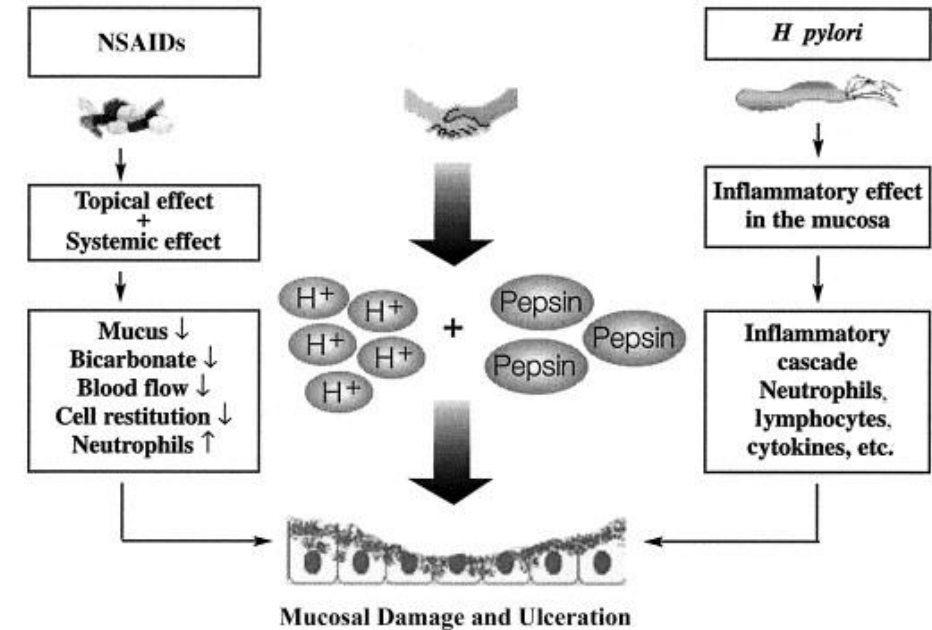
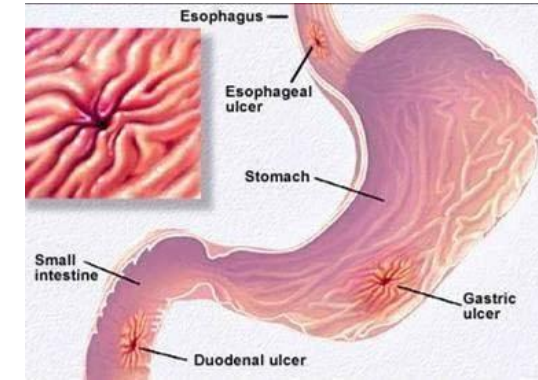
## Other factors:

Smoking, Stress, alcohol.

- **Gastrinomas** (Gastrinomas are neuroendocrine tumors **in the stomach** characterized by the secretion of gastrin with resultant excessive gastric acid production causing severe peptic ulcer disease and diarrhea, a combination referred to as the Zollinger-Ellison syndrome (ZES))

## ➤ Zollinger Ellison syndrome

- a rare gastrin-secreting tumors.

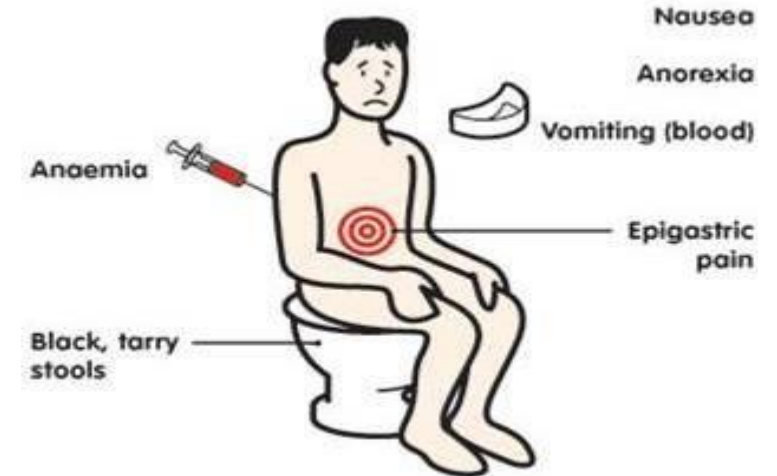


## Symptoms:

- burning pain in stomach between meals or at night, bloating, heartburn, nausea or vomiting.

### In severe cases, symptoms include:

- Dark or black stool (due to bleeding)
- Vomiting blood **because of the high bleeding in the stomach.**
- Weight loss & severe pain
- in the mid to upper abdomen.



## Complications of peptic ulcer

- Gastrointestinal bleeding. (Sudden large bleeding can be life threatening).
- Cancer (Helicobacter pylori as the etiological factor)
- Perforation (hole in the wall) Penetration (**this case is life-threatening** )

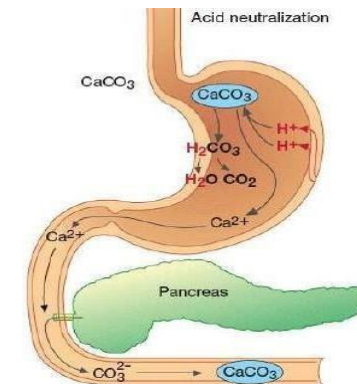
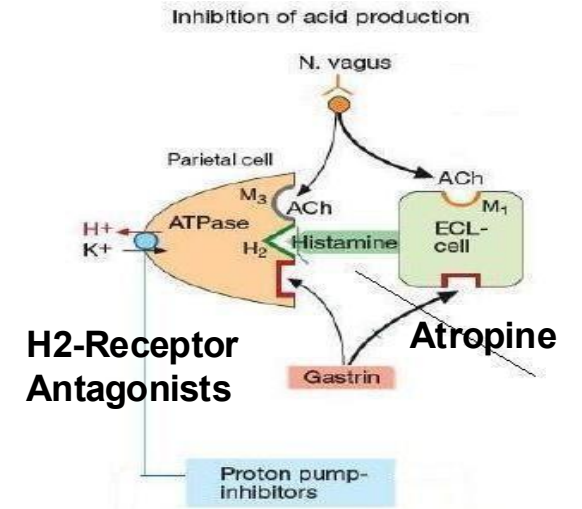
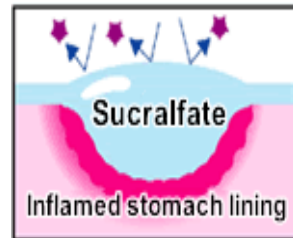
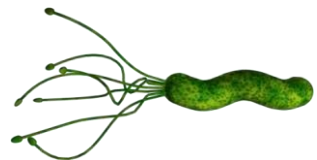
# Treatment options

1. **Reduce** acid secretion by agents such as H2 receptor antagonists.

2. **Neutralize** acid in the lumen by antacids.

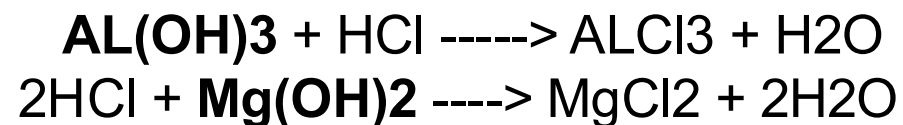
3. **Protect** the mucosa from acid destruction.

4. **Antibiotics** to eradicate *Helicobacter pylori*. If this is successful then the ulcer should begin to heal on its own.



# Neutralization of acid (Antacids)

- Nonprescription remedies which don't need prescription for treatment of **heartburn & dyspepsia**.
- Given 1 hour after a meal effectively neutralizes gastric acid for up to 2 hours.
- The doctor mistakenly said that the drug should be taken before meals



As seen here, they combine with HCL and reduce its concentration.

Antacids are mainly classified into two major groups of compounds:

1. **Aluminum** antacids cause constipation, interfere with absorption of many drugs.

2. **Magnesium** antacids have laxative action; diarrhea.

ionic magnesium stimulates gastric release (acid rebound)

**Magnesium trisilicate** slow-acting antacid, thereby increasing the duration of action of the drug.

**Combination of Magnesium & aluminum antacids are most commonly used (No diarrhea or constipation).** This combination decrease the amount of aluminum hydroxide, thereby reducing its interference with the absorption of other drugs.

# Antacids

| Magnesium Hydroxide  | Aluminum Hydroxide                 |
|--|------------------------------------|
| React slowly and without gas formation.  |                                    |
| Metabolic alkalosis is also uncommon.  |                                    |
| Magnesium salts cause diarrhea.  | Aluminum salts cause constipation. |
| Usually given in combination, <b>to avoid the problem of constipation caused by aluminum salts and diarrhea caused by magnesium salts.</b> |                                    |
| Contraindicated in renal failure, <b>because these drugs are primarily excreted by the kidneys.</b>  |                                    |

# Neutralization of acid (Antacids)

## 1. Calcium carbonate (associated with "acid rebound")

with excessive chronic use, it may cause milk-alkali syndrome with elevation of serum calcium, phosphate, urea, nitrogen, creatinine & bicarbonate levels, **so it should be given with caution, ensuring adherence to the prescribed dose.**



- **This reaction decreases acid secretion by binding to HCl, producing calcium chloride and carbon dioxide.**

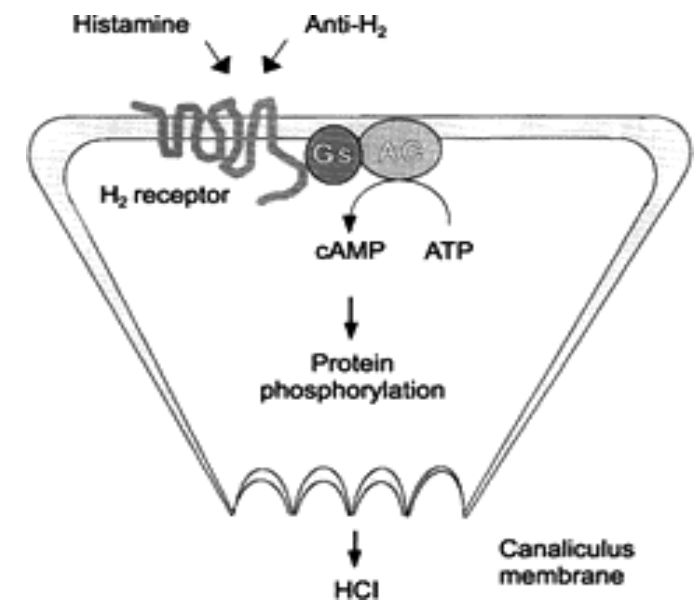
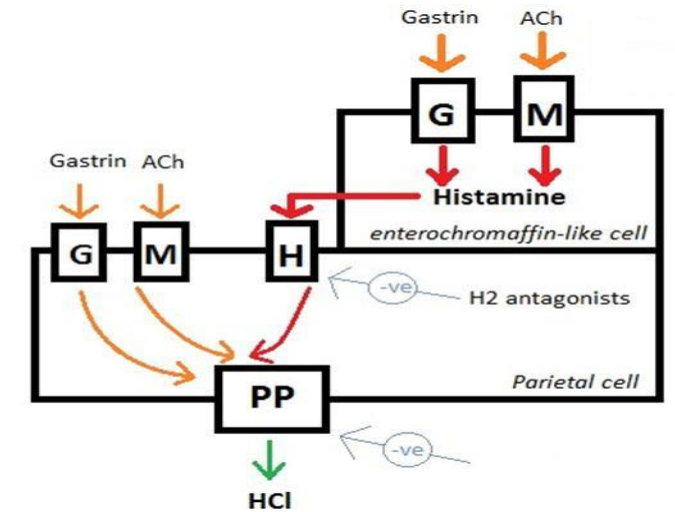
## 2. Sodium bicarbonate

- Should be avoided as it counteracts diuretic therapy for hypertension, **thus people with hypertension shouldn't be given this drug.**
- Short duration of action, followed by acid rebound.
- Highly absorbed, potentially causing **metabolic alkalosis.**
- CO<sub>2</sub> results in **belching.**



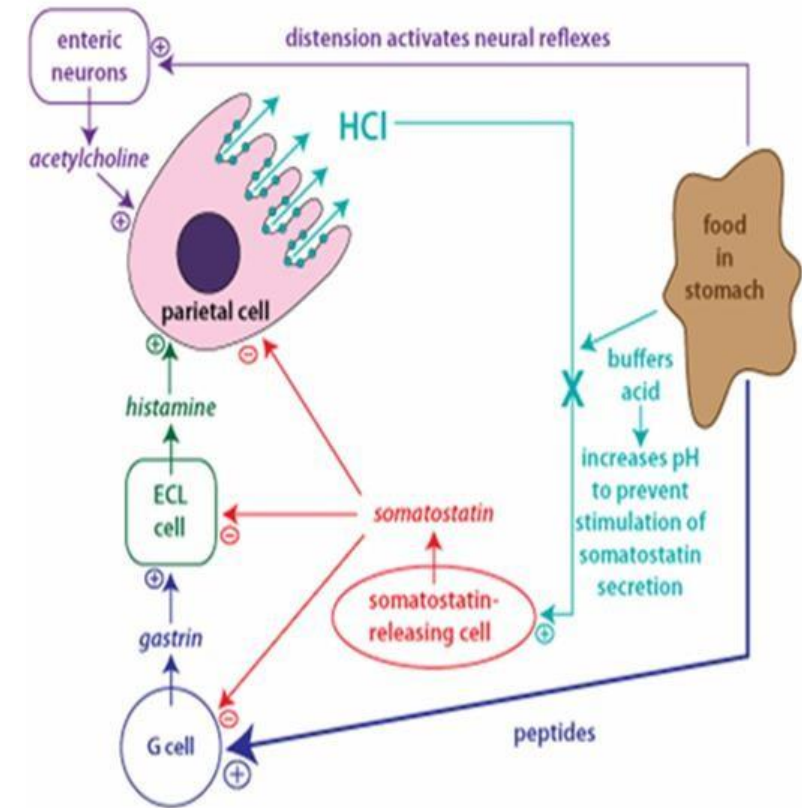
# H<sub>2</sub>- Receptor Antagonists

- In the normal situation, acetylcholine and gastrin induce the release of Histamine, which bind to H<sub>2</sub> receptors and activate the proton pump (K<sup>+</sup>/H<sup>+</sup>) to produce HCl.
- When H<sub>2</sub> receptor antagonists are used, they block the action of histamine, thereby preventing activation of the proton pump and reducing HCl production.
- H<sub>2</sub> receptor antagonists block the action of histamine, interrupting the downstream signaling pathway, particularly protein phosphorylation, which ultimately **stops HCl production**.



# Histamine H<sub>2</sub> receptor antagonists

- Selective competitive inhibitors of the parietal cell H<sub>2</sub> receptor suppress basal and meal-stimulated acid secretion in a dose-dependent manner.
- They also decrease volume of secretion and pepsin concentration.
- Remember, Histamine works on H<sub>2</sub> receptors, so blocking them counteracts its function (acid secretion), so no secretion.



# H<sub>2</sub> Receptor Antagonists (1970s-1990s)

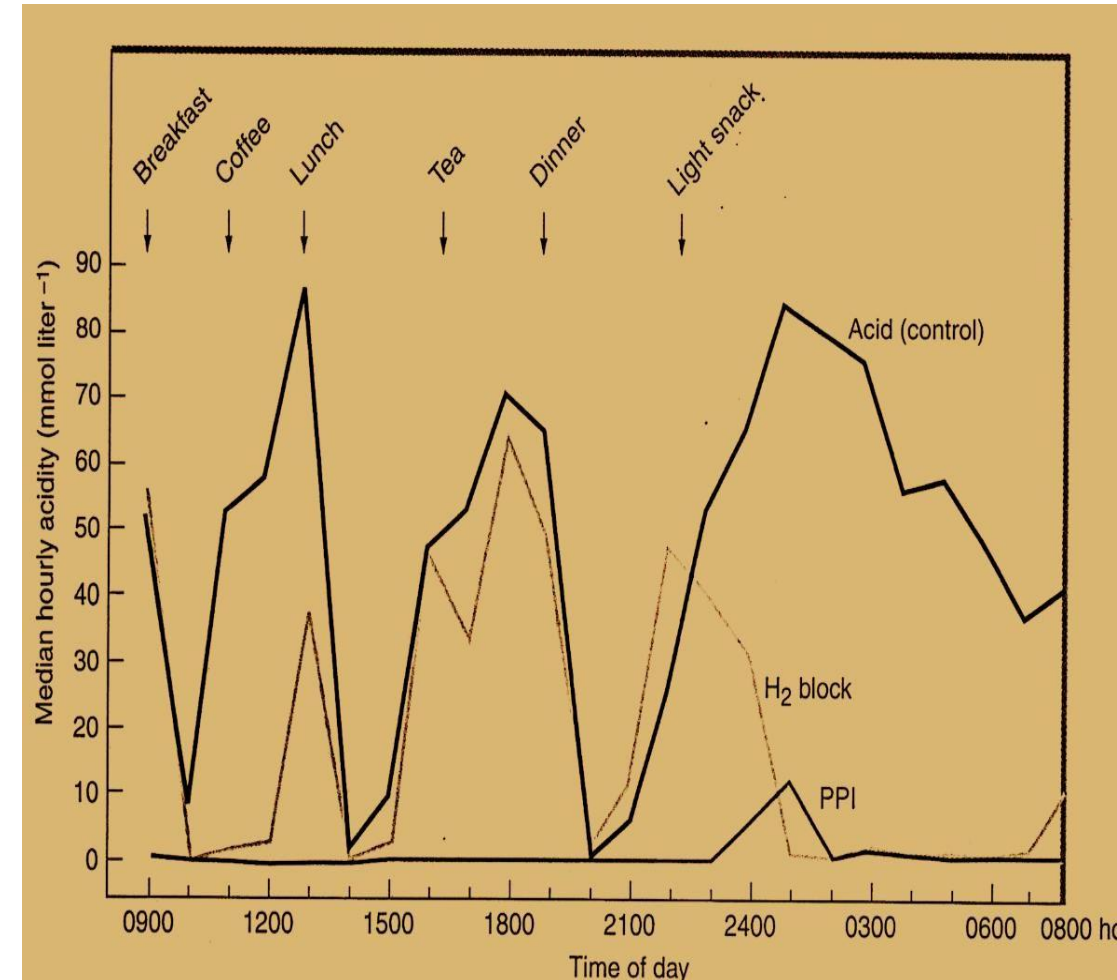
Were the most commonly prescribed drugs in the world, **proton pump inhibitors are considered the alternative of these drugs.**

## Examples:

- **Cimetidine**  
Prototype drug - associated with many problems.
- **Ranitidine.**
- **Famotidine.**  
50% first-pass metabolism bioavailability.
- **Nizatidine**  
has little first-pass metabolism.

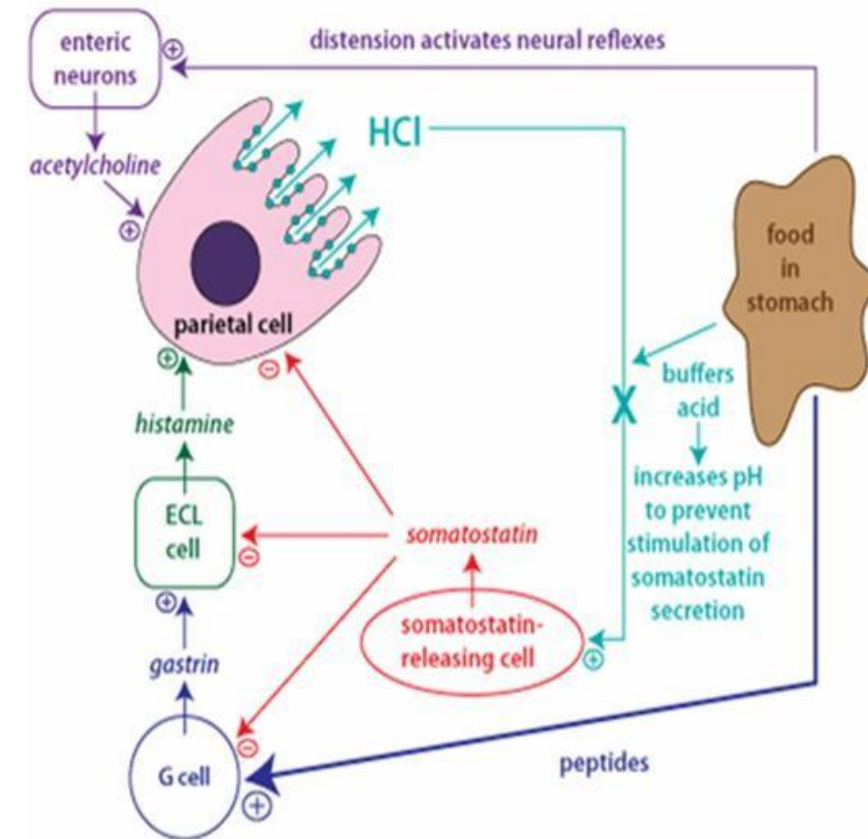
# H<sub>2</sub> Receptor Antagonists

- This picture shows a comparison between H<sub>2</sub> receptor antagonists and proton pump inhibitors.
- With H<sub>2</sub> receptor antagonists, acid secretion fluctuates throughout the day due to the intake of different meals at different times.
- With proton pump inhibitors there is a stable level of acidity. This is why we prefer proton pump inhibitors over the H<sub>2</sub> receptor antagonists.



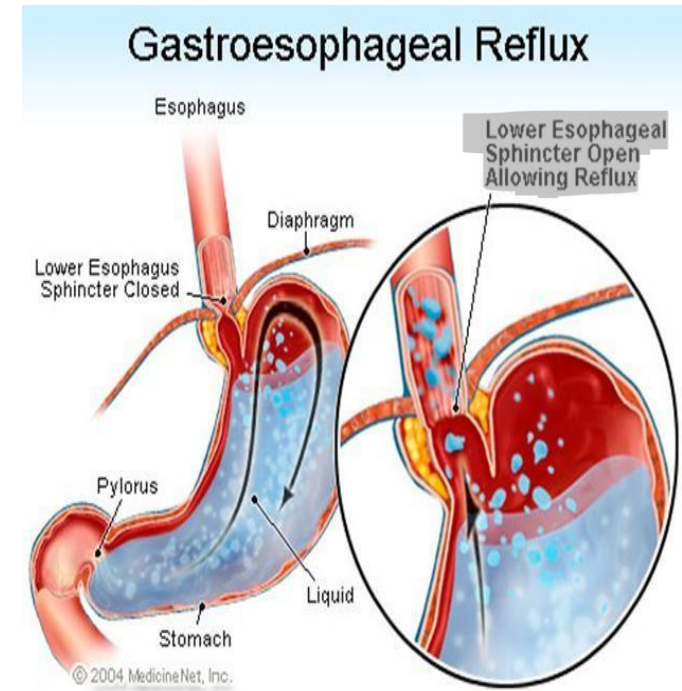
# H<sub>2</sub>- Receptor Antagonists

- Decrease secretion stimulated by:
  - Histamine.
  - Gastrin.
  - Acetylcholine.
- Duration of action: 12 hours.
- Inhibit 60-70% of total 24-h acid secretion.
  - 90% of nocturnal acid.
    - Nocturnal acid is the presence of intragastric pH < 4 during the overnight period for at least 60 continuous minutes
  - 60% of day-time, meal stimulated, acid.



# H<sub>2</sub>- Receptor Antagonists

- Clinical Uses:
- Gastroesophageal Reflux:
  - Prophylactically, before meals.
  - Afford healing for erosive esophagitis, **which is the inflammation of the esophagus because of the acid reflux**, in less than 50% of patients.
  - Proton pump inhibitors are preferred.
- Non-Ulcer Dyspepsia.
- Stress- Related Gastritis:
  - Can prevent bleeding, usually given IV.
- Peptic Ulcer Disease:
  - Replaced by PPI.
  - **H<sub>2</sub> receptor antagonists are no longer used, if used** Healing rate greater than 80-90% after 6-8 weeks, **which is considered a long time.**
  - Not effective in the presence of *H. pylori* infection.
  - Not effective if NSAID is continued, **if NSAIDs are the cause of the peptic ulcer.**



Normally, the LES is closed and prevents acid reflux into the esophagus, in pathologies that make it loose allowing acid reflux can lead to GERD, etc.

# H<sub>2</sub>- Receptor Antagonists

## Adverse Effects:

- Extremely safe drugs, but can (in 3% of patients) cause diarrhea, headache, fatigue, myalgia and constipation.
- CNS:
  - Confusion, hallucinations occur only with IV **cimetidine** to elderly patients in ICU.
- Endocrine Effects:
  - Again, only with **cimetidine**, can inhibit estradiole metabolism, and can increase prolactin serum levels, **which can be associated with infertility cases among women.**
- Pregnancy and Nursing Mothers:
  - Can cross placental barrier and appear in breast milk; **contraindicated.**
- Other Effects:
  - Rarely can cause bradycardia and hypotension.

# H<sub>2</sub>- Receptor Antagonists

## Drug Interactions:

- Cimetidine can inhibit cytochrome P450 enzymes(CYP1A2, CYP2C9, CYP2D6, and CYP3A4), so can increase half life of many drugs.
- Ranitidine binds 4-10 times less.
- Nizatidine and famotidine binding is negligible.

Test yourself by clicking on the antacid



# رسالة من الفريق العلمي:

Extra References for the Reader to Use:

1. [Abd Al Rahman Froukh Videos.](#)

اللَّهُمَّ لَسْتُ قَوِيًّا بِغَيْرِكَ، وَلَا قَادِرًا  
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فَكُنْ مَعِي، فَلَا عِزَّةَ لِي إِلَّا بِكَ،  
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