

# **PROPULSION AND MIXING MOVEMENT OF GIT**

# 1-Ingestion of Food

مضغ

They are multiple voluntary reflexes

■ Mastication (Chewing) : *chewing reflex* بهموك لو حولت أسنان هههه

■ Swallowing (Deglutition) : larynx - في البلع لازم الجهاز التنفسي يسكر، لازم ال trachea يسكر عشان ما يروح ال food ع ال

■ Buccal Stage (Voluntary Stage) which initiates the swallowing process , as tongue pushes the bolus of food to pharynx.

■ Pharyngeal Stage which is Involuntary and constitutes passage of food through the pharynx into the esophagus.

■ Esophageal Stage another Involuntary phase that transports food from the pharynx to the stomach.

الغذاء food يصل إلى oropharynx

## Pharyngeal Stage of Swallowing

(Upper esophageal sphincter)

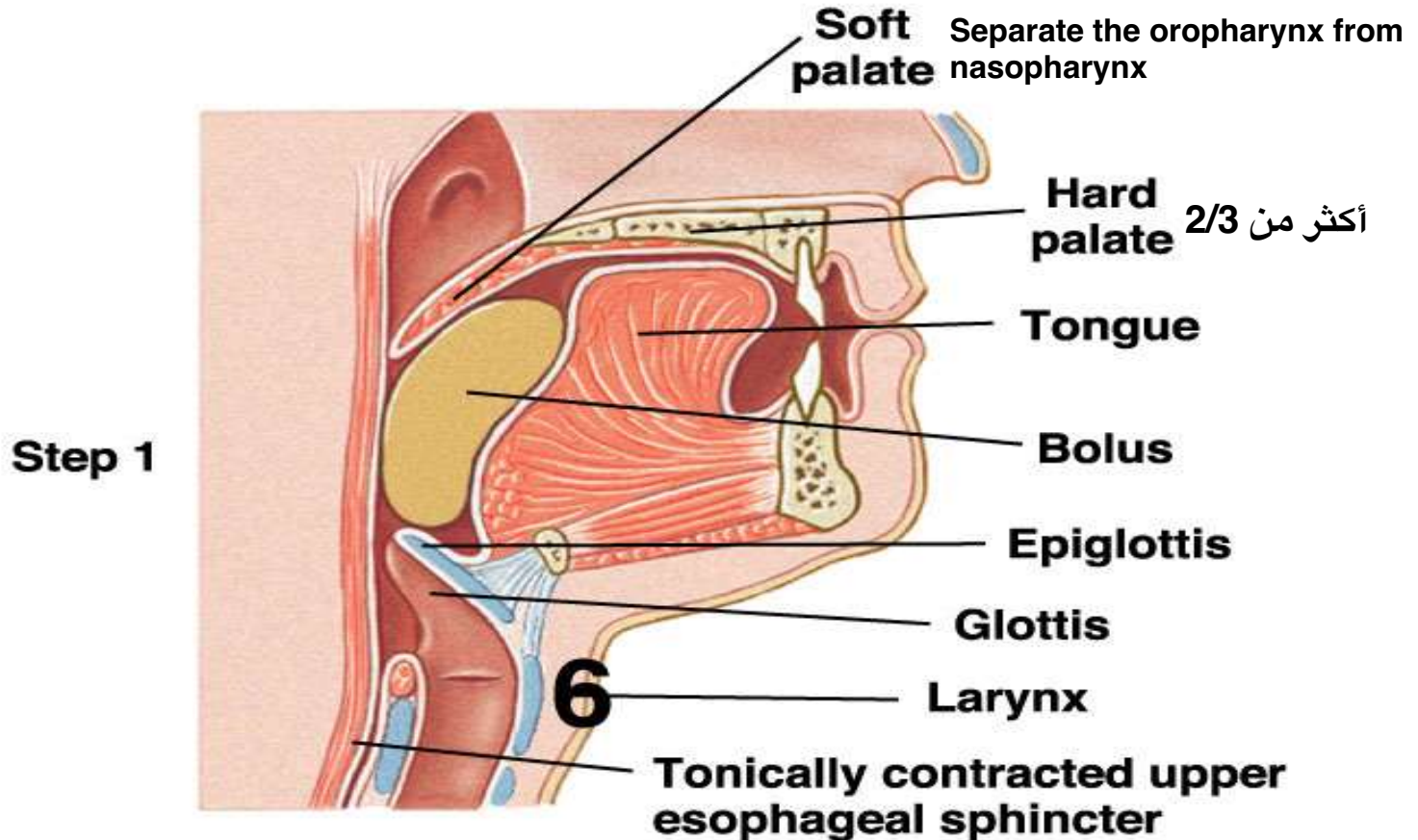
- The trachea is closed, the esophagus is opened, and a fast peristaltic wave initiated by the nervous system of the pharynx forces the bolus of food into the upper esophagus, the entire process occurring in less than **2 Seconds.**
- **Afferent nerves**: the sensory portions of the **Trigeminal and Glossopharyngeal** nerves.
- **Reflex centre** : The deglutition or swallowing center in the medulla and lower pons.
- **Efferent nerves** : To pharynx and upper esophagus by the **5th, 9th, 10th, and 12th** cranial nerves and even a few of the superior cervical nerves.

- بما إنها عبارة عن reflux معناها ال center  
واله afferent sensory و efferent motor

Vagus

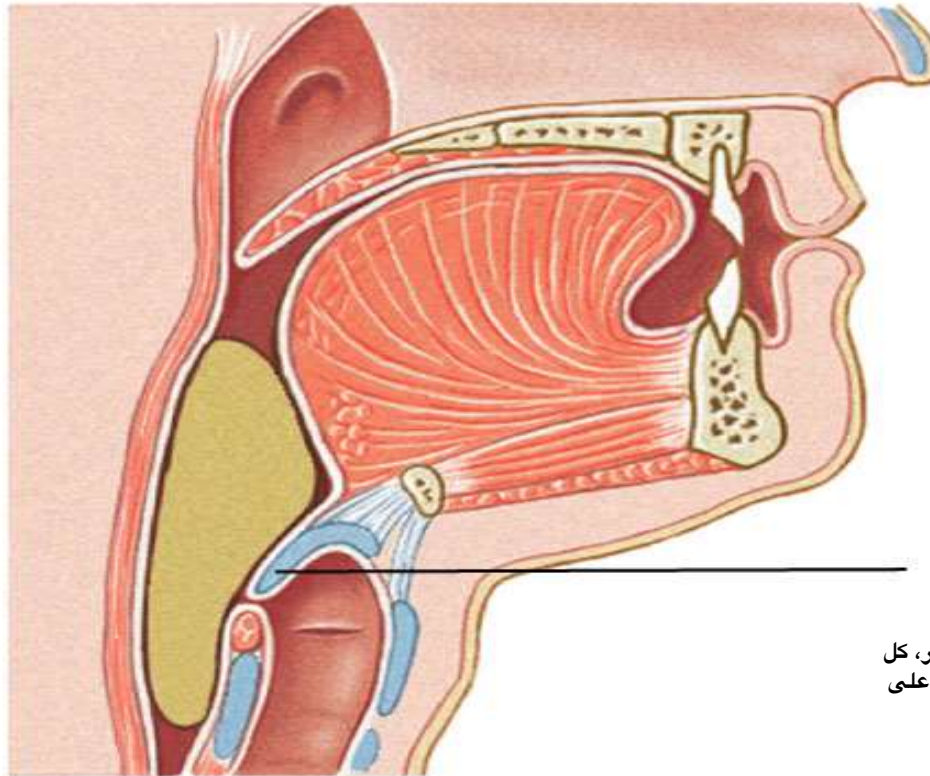
Hypoglossal

# Steps of swallowing



1. Tongue pushes bolus against soft palate and back of mouth, triggering swallowing reflex.

## Step 2

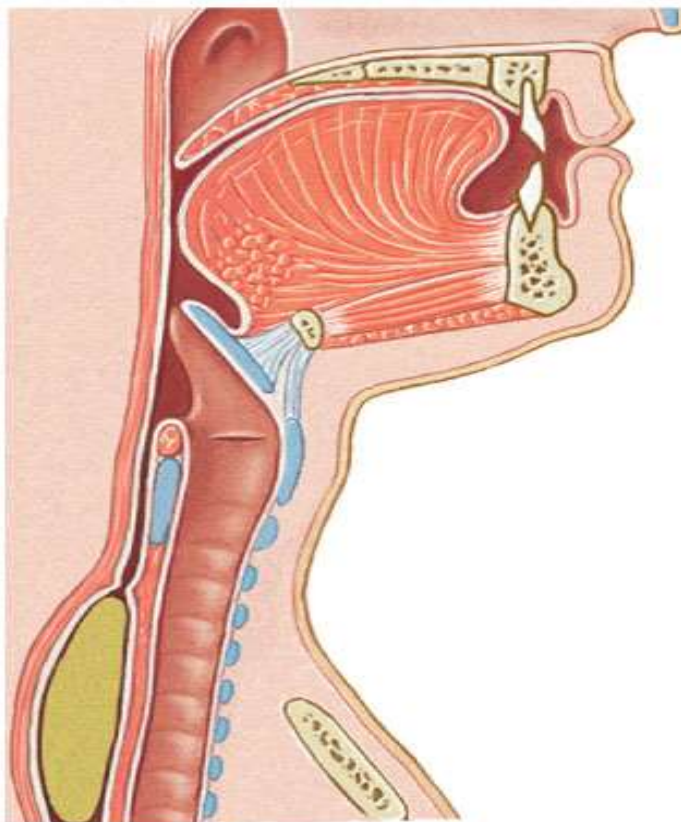


**Epiglottis**  
بسكر ال trachea

وكممان ال vocal cord بتسكر، كل  
هاد عشان ال food ما يروح على  
ال respiratory system

**2. Upper esophageal sphincter relaxes while epiglottis closes to keep swallowed material out of the airways.**

**Step 3**



**3. Food moves downward into the esophagus, propelled by peristaltic waves and aided by gravity.**

- Effect of the Pharyngeal Stage of Swallowing on Respiration.
- The entire pharyngeal stage of swallowing usually occurs in less than 6 seconds, thereby interrupting respiration for only a fraction of a usual respiratory cycle.
- The **Swallowing Center specifically inhibits the Respiratory Center** of the medulla during this time.

## ■ Esophageal Stage of Swallowing

■ Primary peristalsis :is simply continuation of the peristaltic wave that begins in the pharynx and spreads into the esophagus during the pharyngeal stage of swallowing.

■ This wave passes all the way from the pharynx to the stomach in about 8 to 10 seconds (upright position 5 to 8 seconds). اعدل حالك وأنت بتاكل يباشا

■ Secondary peristaltic waves result from Distention of the esophagus itself by the retained food , causing stimulation of local axon reflexes ( Myenteric plexus ) these waves continue until all the food has emptied into the stomach.

طبعاً بمساعدة ال gravity

## Receptive Relaxation of the Stomach

- A wave of relaxation, transmitted through Myenteric inhibitory neurons, precedes the peristalsis.
- The entire stomach and, to a lesser extent, even the duodenum become relaxed as this wave reaches the lower end of the esophagus .
- **Function of the Lower Esophageal Sphincter (Gastroesophageal Sphincter)**
- This sphincter normally remains tonically constricted with an intraluminal pressure at this point in the esophagus of about 30 mm Hg, in contrast to the mid portion of the esophagus, which normally remains relaxed.
- When a peristaltic swallowing wave passes down the esophagus, there is "receptive relaxation" of the lower esophageal sphincter ahead of the peristaltic wave, which allows easy propulsion of the swallowed food into the stomach. Rarely, the sphincter does not relax satisfactorily, resulting in a condition called Achalasia.
- Additional Prevention of Esophageal Reflux by Valve-like Closure of the Distal End of the Esophagus.

- وانت ما بتاكل، ال esophagous is completely closed مسكر من ال sallowing upper esophageal sphincter وال lower كمان، لما يصير ال food يصير reflexes ال upper esophageal sphincter ولما ال food يصير lower esophageal sphincter لازم ال inside the esophagous relaxation عشان يصل ال food لل stomach، لو ما صارله relaxation، هيصير dysphagia وهاد أساس المرض الي اسمه Achalasia والي بتعني failure of relaxation of the lower esophageal sphincter بسبب degeneration في ال Auerbach's plexus

- ال pressure at rest in the lower esophageal sphincter is 30mm Hg، لما تاكل لازم يصيرله relaxation ويقل هاد ال pressure قبل ما ال food يصله (بوطى من 5 ل 6)

- receptive relaxation:

mean the lower esophageal sphincter will relax ahead of the bolus of the food

## *2-Motor Functions of the Stomach*

Motor functions of the stomach are :

- Storage of large quantities of food until the food can be processed in the stomach, duodenum, and lower intestinal tract .
- Mixing of this food with gastric secretions until it forms a semi fluid mixture called Chyme.
- Slow emptying of the chyme from the stomach into the small intestine at a rate suitable for proper digestion and absorption by the small intestine.

 **Secretory Glands** : produce digestive enzymes present from Mouth to Terminal ileum.

 **Mucus Glands:** lubricants from mouth to anus.  
= goblet cells

- Reservoir part

Fundus + 1/3 corpus  
(tonic contraction)

- Antral pump

2/3 corpus + antrum & pylorus  
(phasic contraction)

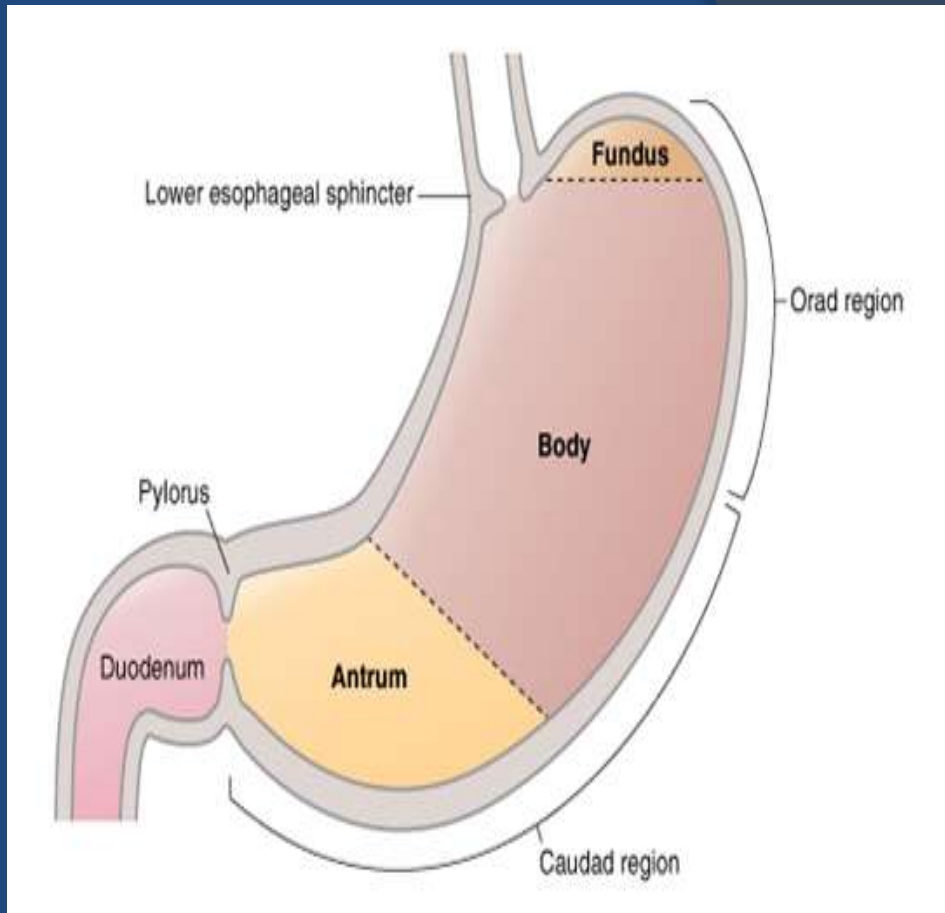
- Physiologically, it is more appropriately divided into

- The “Orad” Portion:

comprising about the first Two thirds of the body, and is thin wall .

- The “Caudad” Portion:

comprising the remainder of the Body plus the Antrum, and is thick wall.



- ال stomach مقسومة ل two portions:

- ال Orad portion وهو الجزء الأمامي من ال stomach، هو عبارة عن ال fundus وال proximal 2/3 of the body وهادي يتكون thin wall

ال Caudad portion اسمها ال distal third of the body & antrum

- لو لاحظت في الصورة الي فوق بتلاقي انه العضلات تبع ال stomach كل ما تقرب على ال pylorus بتصير stronger، فبكون ال mixing عشان الخلط وعشان الأكل يصير سائل بتكون في ال antrum وال lower body عن ال Orad region

- ال Orad portion هي ال reservoir part، ليش هاد الكلام مهم؟  
يعني مثلاً واحد بده يعمل عملية سمنة، أو بده يحط بلون، البلون بنحطه في المنطقة الي الأكل بكون فيها قاعد الي هي ال Orad region

# Relaxation in gastric reservoir

لما أنت تاكل لازم جدار المعدة يصيرله relaxation عشان حجمها يكبر وتقدر تاكل براحتك

- **Receptive Relaxation** المعدة بترخي قبل ما الأكل يوصلها، يعني هادي تبعث ال condition و uncondition reflexes

- Triggered by swallowing reflex.

- **Adaptive Relaxation** بال myenteric plexus أهمهم

- Triggered by stretch receptors (vago-vagal reflex) 0.8 to 1.5 liters. من غير ما تحس انه في distention

- lost in vagotomy . fullnes ال بتصير عندك ال vagus nerve لو قطعت

⇒ threshold of fullness and pain.

- **Feedback Relaxation**

- Triggered by chyme in small intestine.

ترخي المعدة لما يصير الأكل في ال duodenum، بمعنى انه ما يصير contraction، لأنه طالما ال duodenum مليان أكل ما بده كمان chyme يجيه

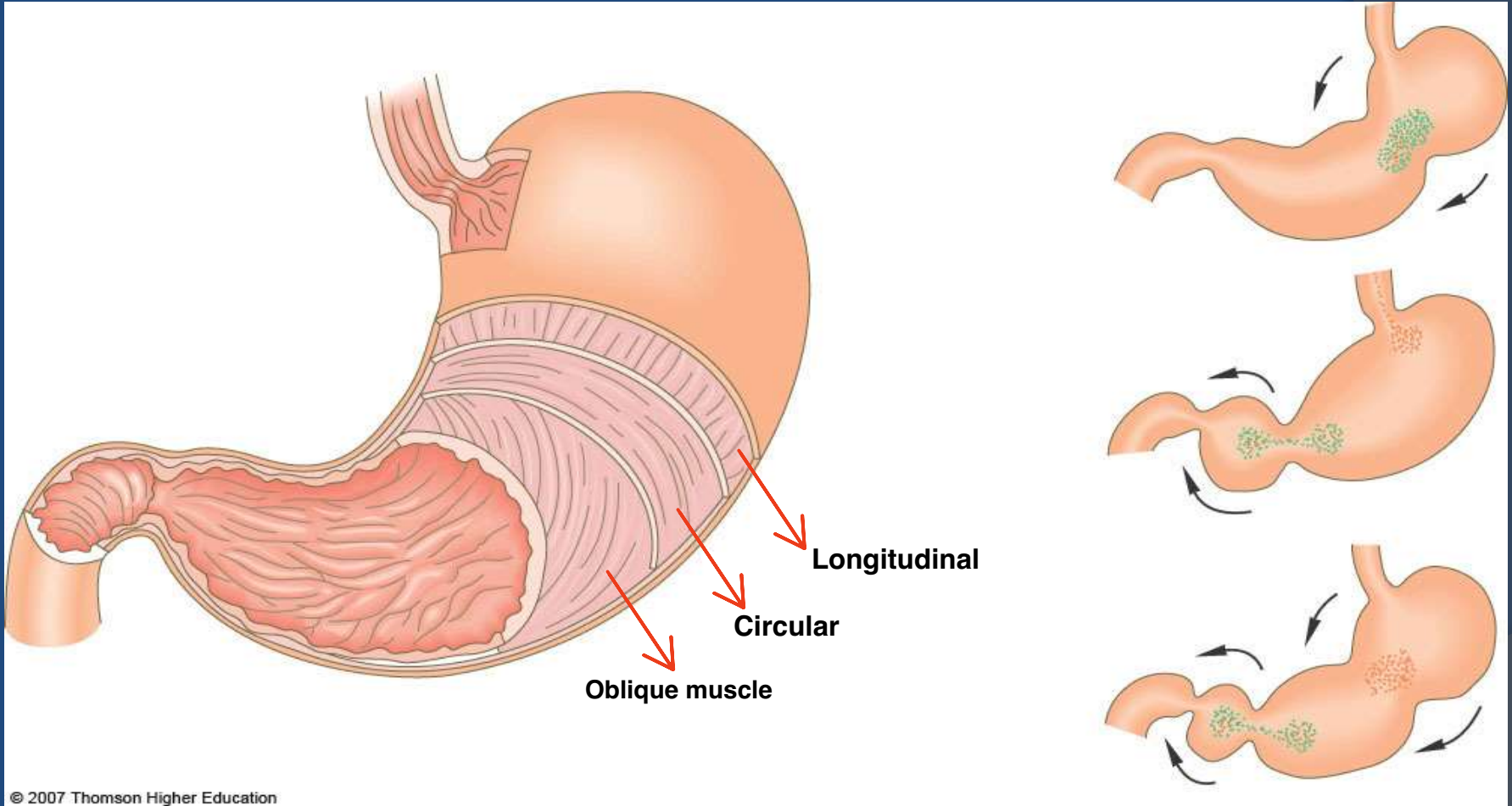
# Storage Function of the Stomach

- As food enters the stomach, it forms concentric circles in the orad portion of the stomach, the newest food lying closest to the esophageal opening and the oldest lying nearest the outer wall of the stomach.
- Normally, when food stretches the stomach, a “VagoVagal Reflex” reduces the tone in the muscular wall of the body of the stomach so that the wall bulges progressively outward, accommodating greater and greater quantities of food up to a limit in the completely relaxed stomach of 0.8 to 1.5 liters.
- The pressure in the stomach remains low until this limit is approached.

# Mixing and Propulsion of Food in the Stomach

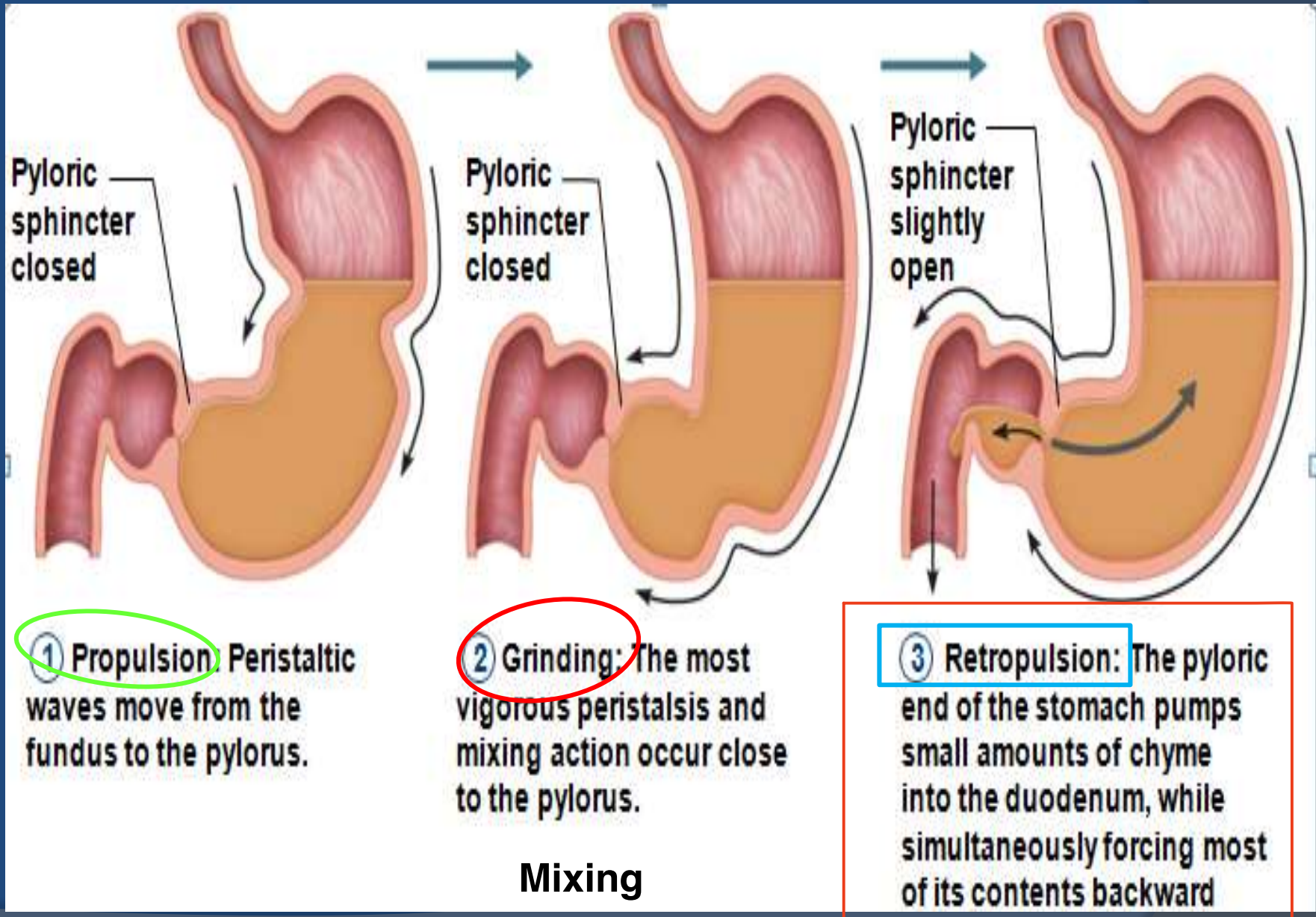
- **The Basic Electrical Rhythm of the Stomach**  
**Wall** contraction wave، ولما تكون strong بيحي وراها كل 15s
- As long as food is in the stomach, weak peristaltic **Constrictor Waves**, called **Mixing Waves**, begin in the mid- to upper portions of the stomach wall and move toward the antrum about once every 15 to 20 seconds.
- These waves are initiated by the gut wall **Basic electrical rhythm** consisting of electrical “slow waves” that occur spontaneously in the stomach wall.

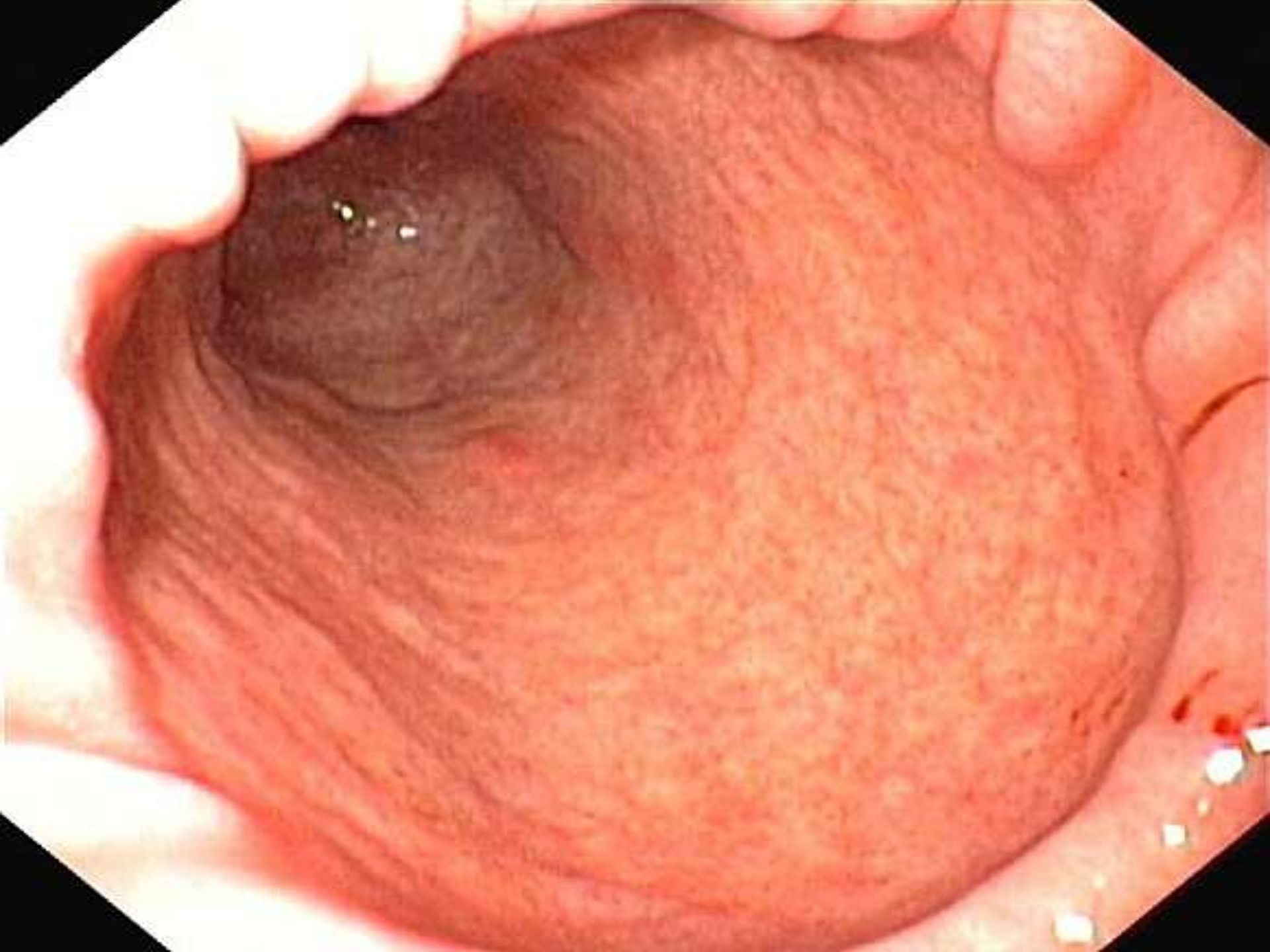
- As the constrictor waves progress from the body of the stomach into the antrum, they become more intense, some becoming extremely intense and providing powerful *peristaltic action potential*–driven **constrictor rings** that force the antral contents under higher and higher pressure toward the pylorus.



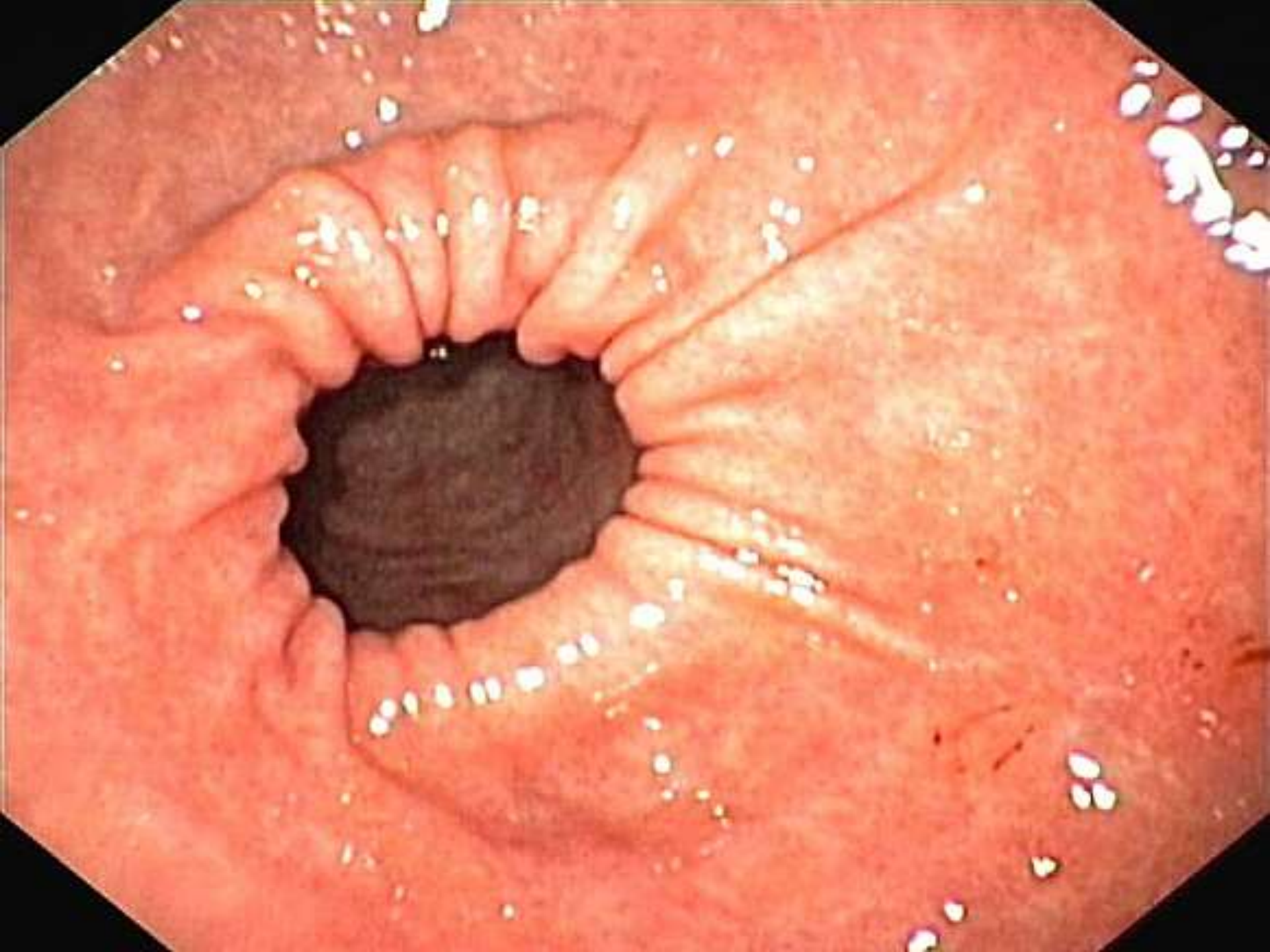
- ال peristalsis كل ما تصل لتحت في المعدة بتقوى،  
وذلك لأنه العضلات بتصير thick أكثر وأقوى

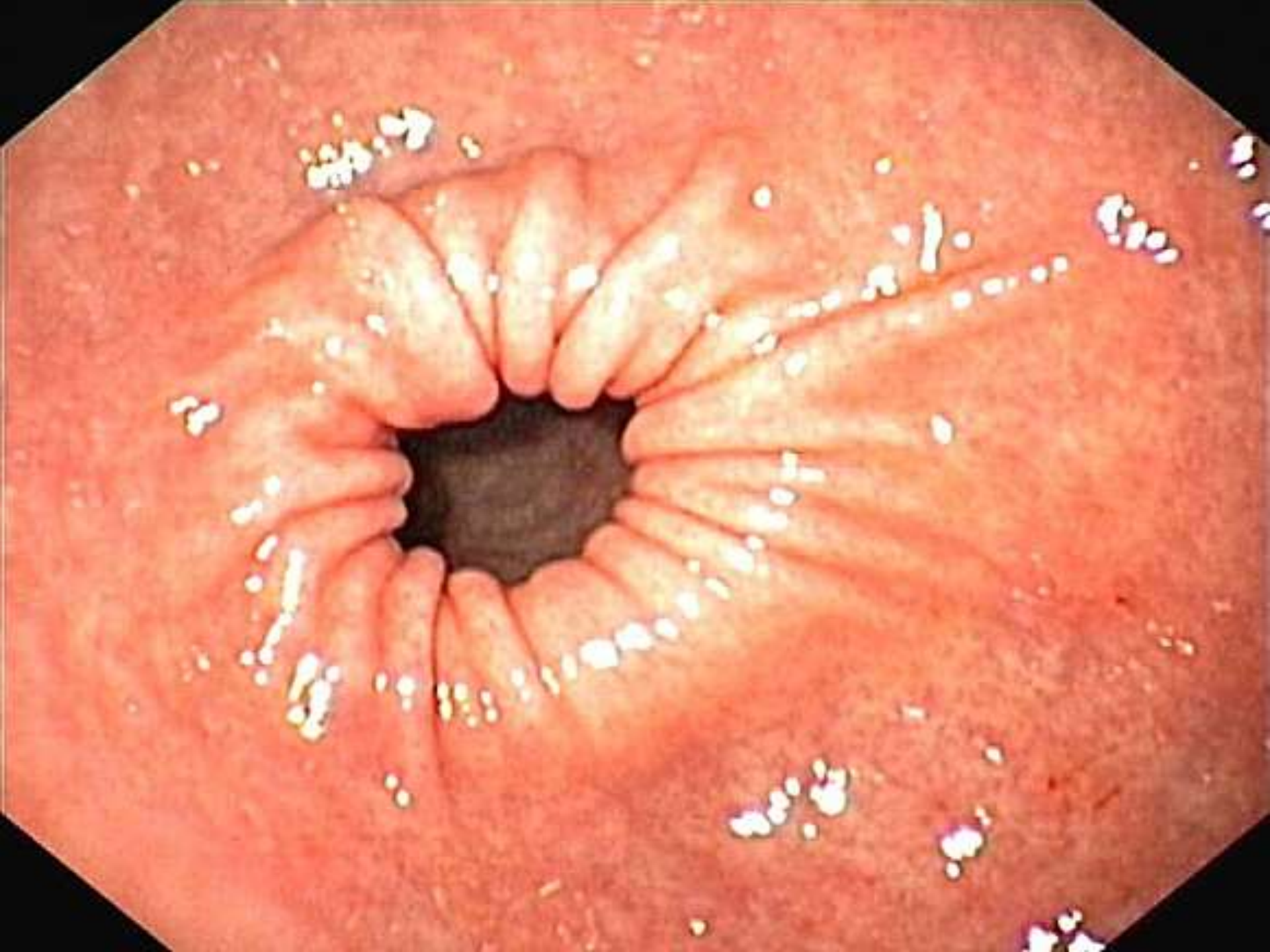
- ① *These constrictor rings also play an important role in mixing the stomach contents in the following way:*
- ② As peristaltic wave passes down the Antral wall toward the pylorus, it digs deeply into the food contents in the antrum.
- ③ Yet the opening of the pylorus is still small enough that only a few milliliters or less of chyme is expelled into the D1 with each peristaltic wave.
- ④ As each peristaltic wave reach the pylorus, the pyloric muscle contracts, which impedes emptying through the pylorus.
- ⑤ So, most of the Antral contents are squeezed upstream through the peristaltic ring toward the body of the stomach, not through the pylorus.
- ⑥ *The moving peristaltic constrictive ring, combined with this upstream squeezing action, called “Retropulsion,”* is an very important Mixing mechanism in the stomach.

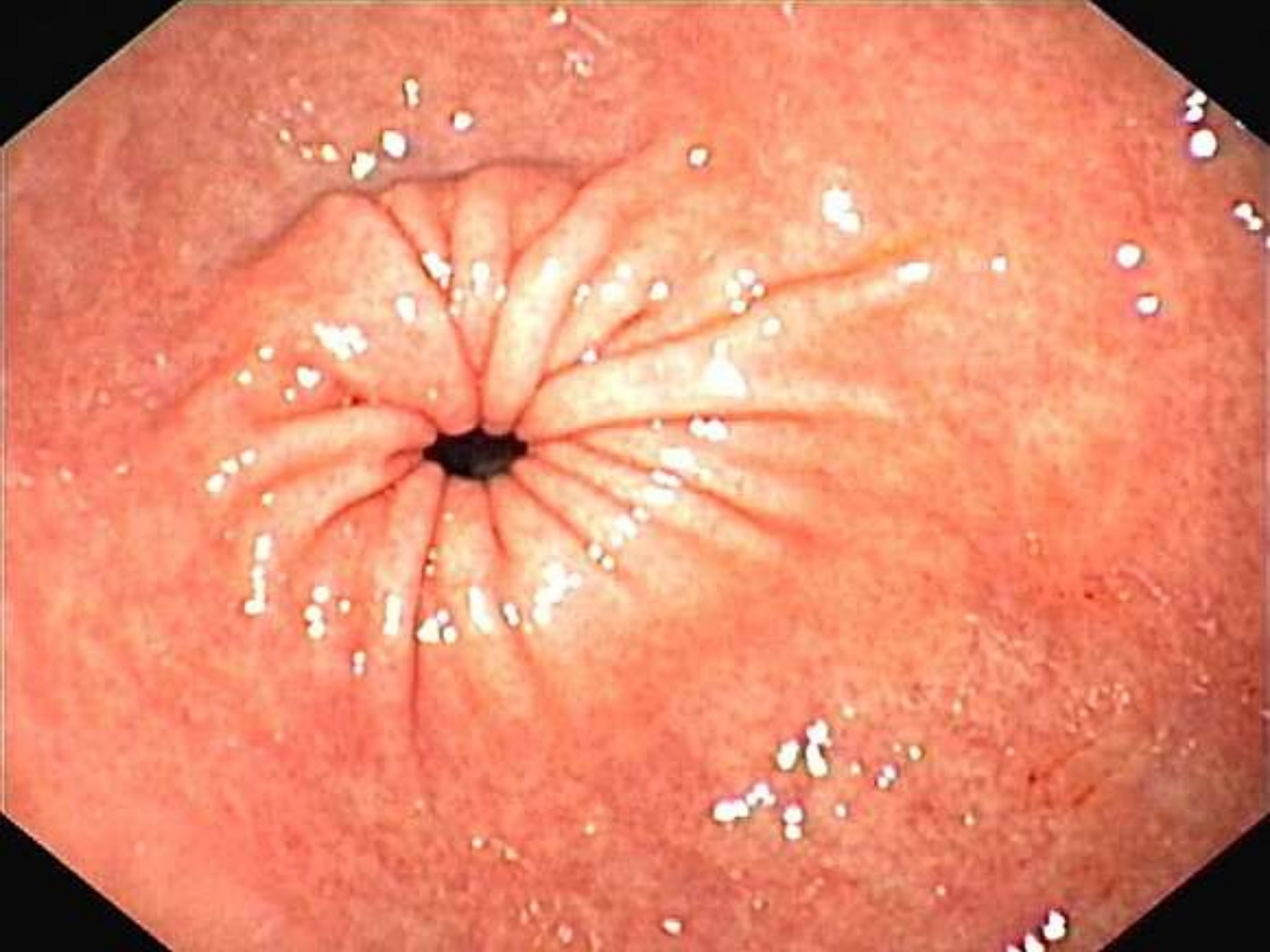












- **Chyme:** After food in the stomach has become thoroughly mixed with the stomach secretions, the resulting mixture that passes down the gut is called **Chyme.**
- The degree of fluidity of the chyme depends on the relative amounts of food, water, and stomach secretions and on the degree of digestion that has occurred.
- The appearance of chyme is that of a <sup>معكر</sup> **Murky Semifluid or Paste.**

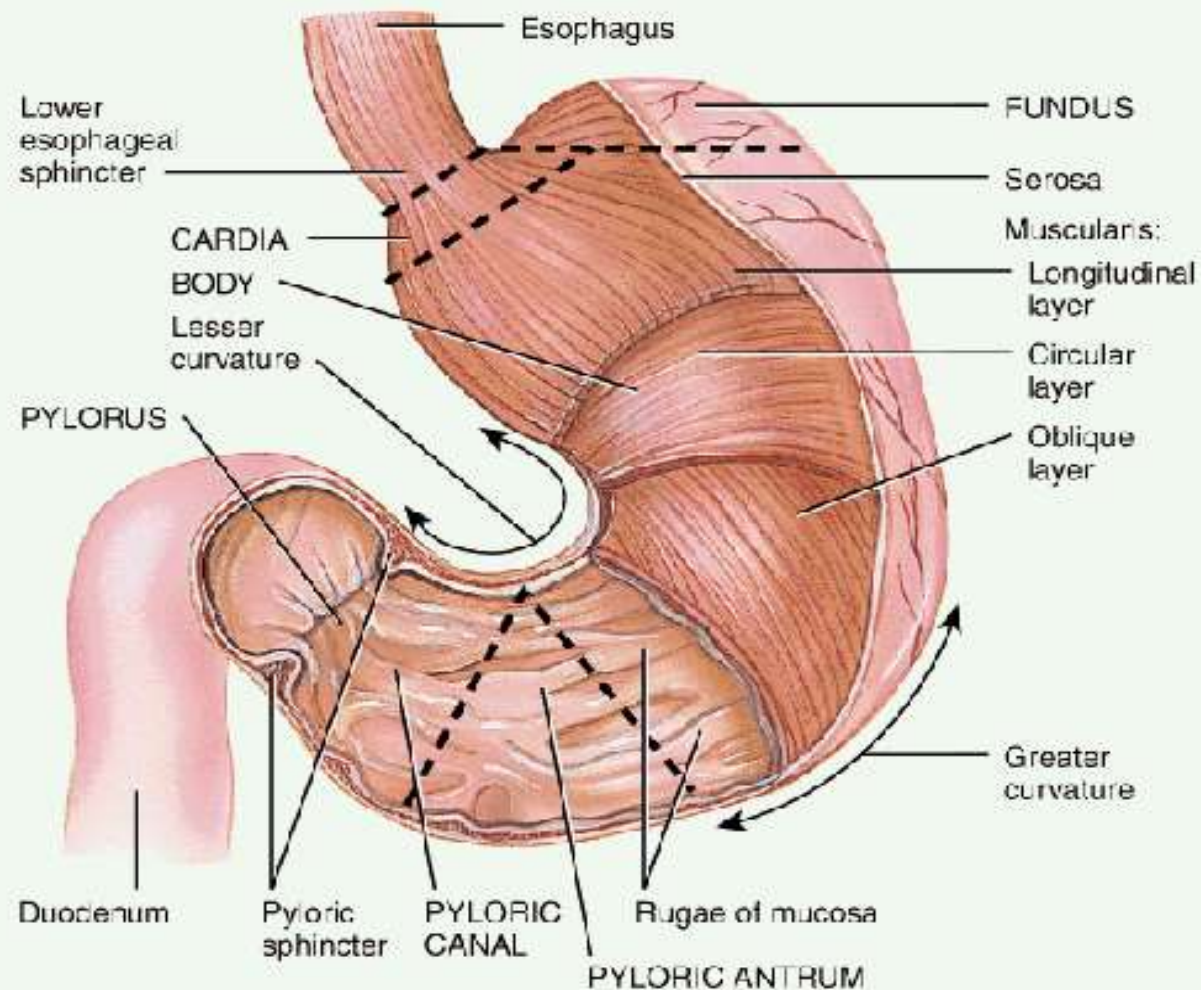
# Stomach Emptying is due to

- Intense Antral Peristaltic Contractions “Pyloric Pump.”
- Role of the Pylorus in Controlling Stomach Emptying
  - ⦿ Despite normal tonic contraction of the pyloric sphincter, the pylorus usually is open enough for water and other fluids to empty from the stomach into the duodenum with ease.
  - ⦿ Conversely, the constriction usually prevents passage of food particles until they have become mixed in the chyme to almost fluid consistency.

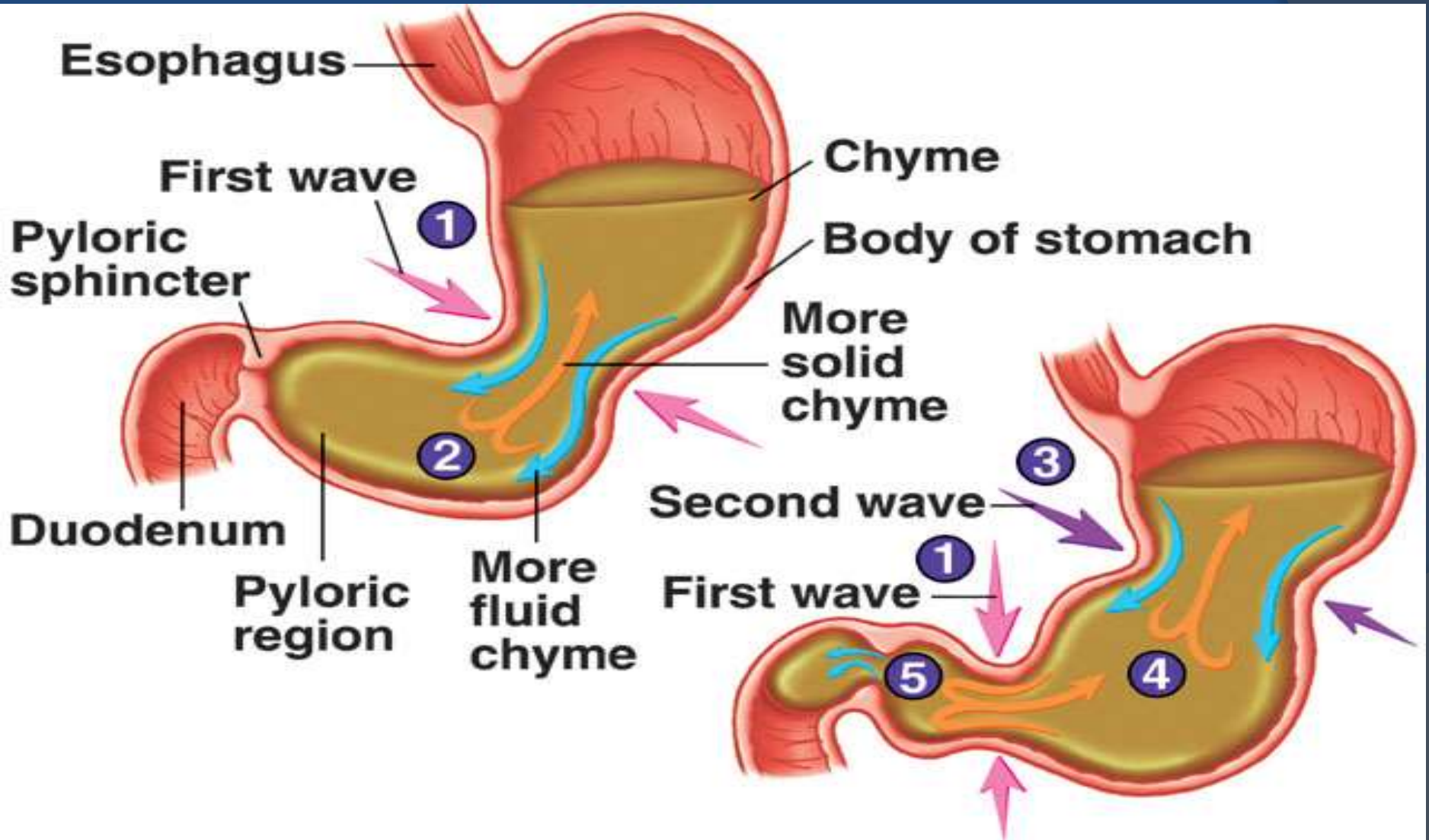
- في حاجة في الأطفال بسموها infatle hypertrophic pyloric stenosis، يعني ال pylorus sphincter مش راضي يرخي، فال Baby بياكل بلاقي الأكل مش راضي ينزل فبصير ينتق الحليب الي اكله، بنعمله عملية وبنرخي الصمام

# EMPTYING OF THE STOMACH (PYLORIC PUMP)

**Peristalsis  
+  
relaxation  
of pyloric  
sphincter**



(a) Anterior view of regions of the stomach



# Regulation of Stomach Emptying

## Gastric Factors That Promote ↑ Emptying:

- Effect of Gastric Food Volume on Rate of Emptying. كل ما يزيد الأكل يزيد ال stretch in the wall

(Stretching of stomach produce local axon reflex which stimulate contraction of wall and inhibition of pyloric sphincter)

- Effect of the Hormone Gastrin ↑ Stomach Emptying by increase contractility of antrum muscle relaxation to the pyloric sphincter وبعمل

# Powerful Duodenal Factors That Inhibit Stomach Emptying

منها short reflexes بنسبيهم local reflexes  
بتوصل لل brain stem وبترجع وبنسبيها long reflexes

## A-Inhibitory Effect of Entero Gastric Nervous Reflexes from the Duodenum

- Multiple nervous reflexes are initiated from the duodenal wall:
  - Directly from the D1 to the stomach through ENS in the gut wall.
  - Through Extrinsic Nerves that go to the prevertebral sympathetic ganglia and then back through inhibitory sympathetic nerve.

All these parallel reflexes have two effects on stomach emptying:

- First, they strongly Inhibit the "pyloric pump" propulsive contractions.
- Second, they increase the tone of the pyloric sphincter.

# Factors that initiate Entero Gastric Inhibitory Reflexes include the following:

- ◆ The degree of Distention of the duodenum .
- ◆ The presence of any degree of Irritation of the duodenal mucosa.
- ◆ The degree of Acidity of the duodenal chyme.  
يعني لو كان فيه protein و fat  
مثير في ال duodenum
- ◆ The degree of Osmolality of the chyme.
- ◆ The presence of certain breakdown products in the chyme, especially breakdown products of Proteins and, perhaps to a lesser extent, of fats.

*These factors become strongly activated within as little as **30** seconds.*

بقول أخذناهم مش عارف وقتيش 🥰💔، شكله الدكتور معتبر تقليبة الصورة الي صارت في آخر المحاضرة الأولى شرح 🥰

## B-Hormonal Feedback from the Duodenum Inhibits Gastric Emptying-Role of Fats and the Hormone Cholecystikinin.

C-Other possible inhibitors of stomach emptying are the hormones <sup>أهمهم</sup> Secretin and Gastric inhibitory peptide (GIP).

- These feedback inhibitory mechanisms work together to slow the rate of emptying when
- (1) Too much chyme is already in the small intestine or
- (2) the chyme is Excessively Acidic, contains too much unprocessed protein or fat, is hypotonic or hypertonic, or is irritating.

# Stomach emptying

## Gastric factors

**VE + + + + +**

1- volume of gastric contents

2- gastrin hormone.

## Duodenal factors

**Ve - - - - -**

1 Entero gastric reflex

2 hormones :

CCK ,GIP, Secretin  
somatostatin

## Others

1 chemicals

2 autonomic

Sympathetic  
and parasymp.

3-emotions

4-consistency

&type of food

# Hunger contraction

In empty stomach

Strong peristalsis in the body  
after 12-24 h of last meal

Reach its max. 3-4 days بعدين بتروح

Due to hypoglycemia

If very Strong □ Fuse □ Tetanic contraction

“Hunger pain”