

## Unit V – Problem 3 – Physiology: Swallowing and Esophageal Motility

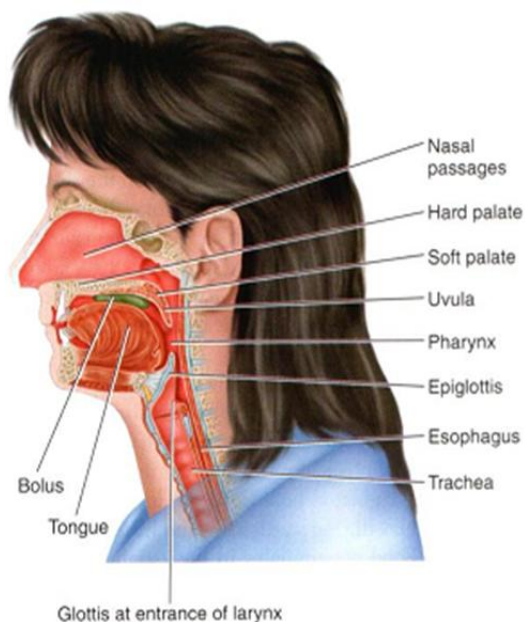


### - Phases of swallowing:

- Preparatory (mastication, chewing).
- Oral.
- Pharyngeal.
- Esophageal.

### - Stages of swallowing:

- Tactile areas in the mouth will sense the presence of the bolus of food. These areas are represented by:
  - ✓ Pharyngeal opening.
  - ✓ Tonsillar pillars.
- Tactile areas will send signals to excite neurons in swallowing center which is located in the reticular substance.
- Swallowing center will send excitatory signals through cranial nerves which are controlling the process of swallowing. These nerves are:
  - ✓ V: trigeminal nerve.
  - ✓ IX: glossopharyngeal nerve.
  - ✓ X: vagus nerve.
  - ✓ XII: hypoglossal nerve.

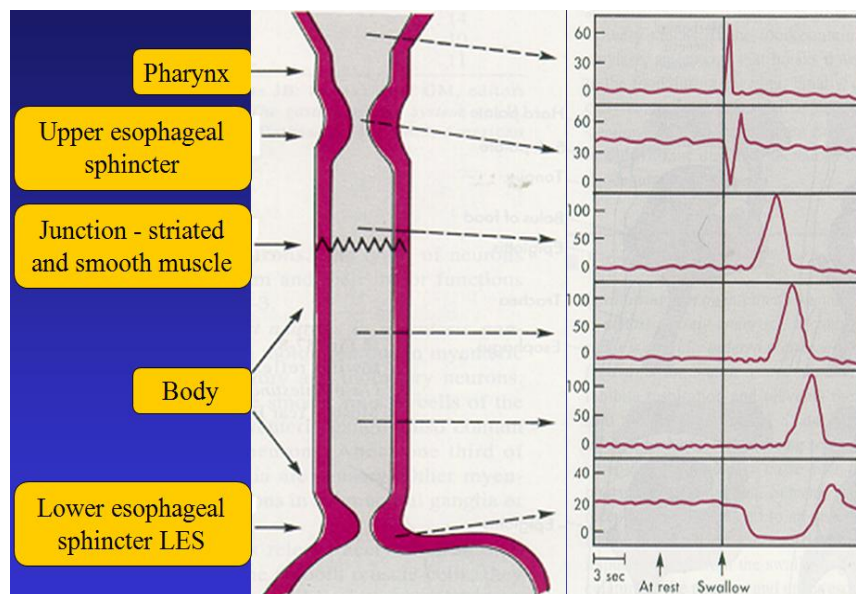


### - Biomechanics of swallowing:

- Swallowing center will inhibit the respiratory center which is located in the brainstem.
- Uvula will be elevated to prevent food from entering the nasal cavity.
- Pressing of the tongue to prevent food from re-entering the mouth.
- Epiglottis will be pressed down over the closed glottis and prevents food from entering airways (notice that there will be tight apposition of the vocal cords).

### - Esophageal stage:

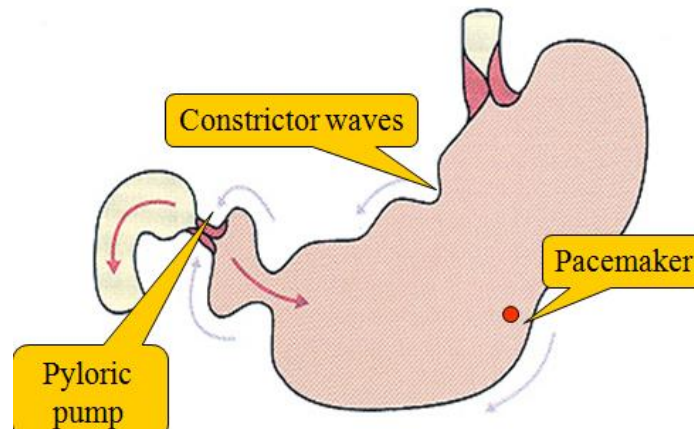
- In pharynx, upper esophageal sphincter and upper 1/3 of the esophagus → the action of swallowing is controlled by the glossopharyngeal and vagus nerves.
- In lower 2/3 of esophagus and lower esophageal sphincter → the action of swallowing is controlled by the vagus nerve acting on myenteric nervous plexus.





- What are the motor functions of the stomach?

- Storage.
  - Grinding and mixing of food.
  - Chyme formation.
  - Propulsion.
- During peristaltic waves in the stomach, a reflex known as vagovagal reflex will occur. The vagovagal reflex is active during the receptive relaxation of the stomach in response to swallowing of food (prior to it reaching the stomach). When food enters the stomach a "vagovagal" reflex goes from the stomach to the brain, and then back again to the stomach causing active relaxation of the smooth muscle in the stomach wall. If vagal innervation is interrupted then intra-gastric pressure increases. This is a potential cause of vomiting due to the inability of the proximal stomach smooth muscle to undergo receptive relaxation.



- Emptying of the stomach depends on:

- Food volume.
- Gastrin (which is secreted by G-cells in antral mucosa and enhances the secretion of hydrochloric acid from parietal cells of the stomach).

- Inhibition of emptying of the stomach:

- **Enterogastric nervous reflexes:**
  - ✓ Duodenogastric reflex (MNP).
  - ✓ Extrinsic pathway.
  - ✓ Vagovagal pathway.
- **Upregulation of enterogastric reflexes:**
  - ✓ Duodenal distention.
  - ✓ Irritants and acids (pH of chyme = 3-4).
  - ✓ Protein products.
  - ✓ Osmolality of the chyme.
- **Hormones (VERY IMPORTANT TO MEMORIZE!):**
  - ✓ Cholecystokinin (CCK).
  - ✓ Secretin (from duodenum).
  - ✓ Gastric inhibitory peptide.

- Motility of small intestine is represented by the following:

- **Migrating myoelectric complex:** waves of electrical activity that sweep through the intestines in a regular cycle during fasting. These motor complexes trigger peristaltic waves, which facilitate transportation of indigestible substances such as bone, fiber, and foreign bodies from the stomach, through the small intestine, past the ileocecal sphincter, and into the colon. The MMC occurs every 90–120 minutes during the interdigestive phase (between meals), and is responsible for the rumbling experienced when hungry. It also serves to transport bacteria from the small intestine to the large intestine, and to inhibit the migration of colonic bacteria into the terminal ileum.

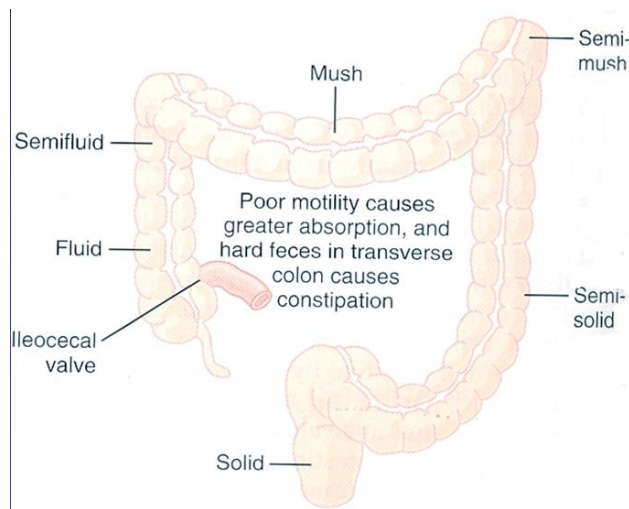


- **Segmentation:** while peristalsis involves one-way motion in the caudal direction, segmentation contractions move chyme in both directions, which allows greater mixing with the secretions of the intestines. Segmentation involves contractions of the circular muscles in the digestive tract, while peristalsis involves rhythmic contractions of the longitudinal muscles in the GI tract. Unlike peristalsis, segmentation actually can slow progression of chyme through the system.
- **Peristaltic wave (mentioned above).**
- **Peristaltic rush (??).**

- **Control of motility of small intestine:**

<b>Nervous mechanisms</b>	<ul style="list-style-type: none"><li>• Distention of the duodenum.</li><li>• Gastroenteric reflux.</li></ul>
<b>Hormonal up-regulation</b>	<ul style="list-style-type: none"><li>• CCK, motilin, gastrin, insulin and serotonin.</li></ul>
<b>Hormonal down-regulation</b>	<ul style="list-style-type: none"><li>• Secretin and glucagon.</li></ul>

- **Process of feces formation:**



- **Control of function of ileocecal valve:**

- Fluidity of contents promotes emptying.
- Pressure and chemical irritation relax sphincter and promotes peristalsis.
- Pressure or chemical irritation in the cecum inhibits peristalsis in the ileum and excites ileocecal valve.