Swallowing & the Esophagus

Swallowing

Normal adults swallow:

When a swallow is triggered, the first step in swallowing (or ________________) occurs, which is the only voluntary stage. The following three stages in swallowing are________________________:

1) Oral Phase: __________________________________________________________

2) Pharyngeal Phase: ____________________________________________________

3) Esophageal Phase: ____________________________________________________

The entire process of swallowing takes ________________

Steps in Swallowing
Esophageal Anatomy

The main purpose of the esophagus is ________________

The typical dimensions of the esophagus in adults are: ______ long, _______ diameter

The length of the esophagus is ______________________________________________________

Movement of material in the esophagus is controlled by two sphincters, or “______” at the top and bottom. Both of these sphincters (__________________) are normally ________

  - Upper esophageal sphincter: between the __________________________
  - Lower esophageal sphincter: between the __________________________

Esophageal Motility

Once a bolus passes through the UES, _________________ propels the bolus through the esophagus ____________________________.

The primary peristaltic wave first______________________________, then ____________________________.

The peristaltic wave creates a wave of ___________________________ and moves through the esophagus at ____________________________.

After a swallow, _________________ is a peristaltic wave that is initiated in the esophagus and are ___________________________ \( \rightarrow \) Typically _________________

____________________________________________________________________________
**Gastric Anatomy and Basic Function**

The stomach is a __________________________ organ where ___________________________

that connects the ____________________ to the _________________________________

The main functions of the stomach are to:

1) Serve as a __________________________

2) Control the __________________________

3) Continue __________________________

4) Enzymatic hydrolysis of __________________________

5) Decrease in the amount of __________________________

<table>
<thead>
<tr>
<th>Gastric Component</th>
<th>Key Attributes &amp; Function</th>
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</thead>
<tbody>
<tr>
<td>Lower Esophageal Sphincter</td>
<td></td>
</tr>
<tr>
<td>Cardia</td>
<td></td>
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<tr>
<td>Fundus</td>
<td></td>
</tr>
<tr>
<td>Body</td>
<td></td>
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<tr>
<td>Antrum</td>
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<tr>
<td>Pylorus</td>
<td></td>
</tr>
<tr>
<td>Pyloric Sphincter</td>
<td></td>
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<tr>
<td>Greater Curvature</td>
<td></td>
</tr>
<tr>
<td>Lesser Curvature</td>
<td></td>
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<tr>
<td>Rugae</td>
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</table>
In many anatomical descriptions, the terms proximal and distal are utilized to describe relative location within the body, where: proximal refers to ________________________________

Conversely, distal refers to ________________________________

If we look at our overall gastric anatomy, we can identify the proximal vs. distal gastric regions as:

*Example image of porcine gastric rugae*

*Example image of porcine gastric pylorus*
**Gastric Secretions**

Gastric secretions are important in:

<table>
<thead>
<tr>
<th>Gastric Secretory Product</th>
<th>Source (Cells where Secreted)</th>
<th>Function</th>
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</thead>
<tbody>
<tr>
<td>Hydrochloric acid (HCl)</td>
<td></td>
<td></td>
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<tr>
<td>Intrinsic factor</td>
<td></td>
<td></td>
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<tr>
<td>Pepsinogen</td>
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<td>Mucus</td>
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<tr>
<td>Bicarbonate</td>
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<tr>
<td>Trefoil factors</td>
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<tr>
<td>Histamine</td>
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<tr>
<td>Gastrin</td>
<td></td>
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<tr>
<td>Gastric-releasing peptide, Acetycholine (Ach)</td>
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<td></td>
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<tr>
<td>Somatostatin</td>
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</tbody>
</table>

**Functional Regions of the Stomach & Gastric Secretory Products**
**Gastric Secretory Glands**

Gastric glands are located in the ____________ and ______________ of the stomach and contain ____________________________________________

Sometimes these glands are referred to as ________________ glands

In the gastric antrum, secretory glands do not contain ___________ or ___________ cells, but rather contain ________________ and ________________

Enteroendocrine cells these include several types of cells such as ________________

that secrete various compounds that act to ____________________________________________

**Gastric Gland Structure in the Fundus & Body**
Regulation of Gastric Secretions

The component of gastric secretions that has been researched in the most detail is ____________, by the ___________________________.

Since _______________ secretion by _______________ is influenced by similar regulatory factors, the secretion of _________ and ____________ typically rise simultaneously.

Basal Gastric Secretions

Between meals, the stomach secretes basal (baseline) acidic secretions.

Acid output in the basal secretions is ________________, with a pH of ________________

Postprandial Gastric Secretions

Postprandial means ________________________________

Maximum gastric secretory output: ________________, or ________________

There are 3 phases of postprandial gastric secretions based on the what impacts secretion rate:

1. Cephalic
2. Gastric
3. Intestinal

Cephalic Phase: gastric secretions initiated by ______________________________, even ______________________________

→ Why? ______________________________

Accounts for ______________ of maximum gastric secretory response

Response varies with meal: ______________________________

Can test to determine the gastric secretions in the cephalic phase by:
How secretions are modified:
- _______________ stimulated
- _______________ inhibited

**Gastric Phase:** initiated by __________________________________________________________________________

Accounts for _______________ of maximum secretory response

How secretions are modified:
- __________________________________________________________________________ increases regulation initiated in cephalic phase
  
  - __________________________________________________________________________ in the antrum also stimulate gastric secretions

**Intestinal Phase:** starts as the meal __________________________________________________________________

as gastric pH decreases to _______________

How secretions are modified:
- _______________ stimulated to release _______________ which inhibits secretions
  
  - Inhibited by presence of _______________ in small intestine

![Graph showing acid output (mmol/hr) over time (min)](chart.png)
Postprandial Gastric pH Distribution

Due to gastric secretions of __________, the pH of the ingested meal will drop as the meal

_____________________________

Average gastric pH after a meal

But…although this shows a single profile, is the pH uniform throughout the stomach?

In humans, there has been evidence of an “acid pocket” or layer of gastric acid on top of the meal

Why would this make sense with what we know about gastric secretions?

Why might this be important?
Also, the pH drop (and distribution) of a meal during gastric digestion may vary due to:

1) Variations in ____________________________ Buffering capacity:

2) Variations in ____________________________

3) Variations in ____________________________

4) Variations in ____________________________

Why might the gastric pH be important in food digestion?

Let’s take a look at some intragastric pH profiles after different meals to see how these factors may impact the biochemical environment in the stomach: