I. **Introduction**

II. Learning Objectives

III. Slides and Micrographs

   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   
   C. Esophagogastric Junction

IV. Summary

Fig 15-1, Junqueira, 13th ed.
### I. Introduction

### II. Learning Objectives

### III. Slides and Micrographs

#### A. Oral Cavity
- Lip
- Tooth
- Tongue

#### B. Esophagus
- General structure
- Mucosa
- Submucosa
- Muscularis
- Adventitia

#### C. Esophagogastric Junction

### IV. Summary

---

### Layers of the Gastrointestinal Tract

<table>
<thead>
<tr>
<th>General Layer</th>
<th>Specific Layer</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mucosa</td>
<td>Epithelium</td>
<td>stratified squamous epithelium (for protection) is found in the oral cavity, pharynx, esophagus, and anal canal; simple columnar epithelium (for absorption/secretion) is found in the stomach, small and large intestine</td>
</tr>
<tr>
<td></td>
<td>Lamina propria</td>
<td>thin layer of loose CT underneath epithelium; supports epithelium and contains a diffuse population of cells (e.g., fibroblasts and leukocytes)</td>
</tr>
<tr>
<td></td>
<td>Muscularis mucosae</td>
<td>Lt. “muscle of the mucosa”; thin smooth muscle layer of mucosa; allows localized movement/agitation of the mucosa</td>
</tr>
<tr>
<td>Submucosa (w/ Meissner’s plexus)</td>
<td></td>
<td>dense CT with larger blood and lymph vessels; Meissner’s (submucosal) plexus of autonomic (parasympathetic) nerves controls the mucosal glands and the muscularis mucosae; glands and lymphoid tissue may also be present</td>
</tr>
<tr>
<td>Muscularis (w/ Auerbach’s plexus)</td>
<td>Innermost oblique</td>
<td>thick layer of smooth muscle with generally two specific layers based upon orientation of muscle fibers [exceptions: (1) the upper 1/3 of the esophagus contains skeletal muscle instead of smooth muscle; (2) the stomach has three layers of smooth muscle, with the addition of an innermost oblique layer]; contraction of the muscles mixes and propels luminal contents forward; Auerbach’s (myenteric) plexus of autonomic (parasympathetic) nerves is found in the thin layer of CT between the muscle layers (along with blood and lymph vessels); it controls contraction of the muscularis (peristalsis)</td>
</tr>
<tr>
<td></td>
<td>Inner circular</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outer longitudinal</td>
<td></td>
</tr>
<tr>
<td>Serosa/Adventitia</td>
<td></td>
<td>adventitia is a layer of thick CT that merges into the surrounding tissue and lacks mesothelium – it covers structures outside of the abdominal cavity; most of esophagus, rectum, and anal canal; serosa is a thin layer of loose CT with vessels and adipose and covered by simple squamous epithelium (mesothelium) – it covers the gastrointestinal tract within the abdominal cavity</td>
</tr>
</tbody>
</table>

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Learning Objectives

1. Recognize and understand the general structural characteristics of the gastrointestinal tract: mucosa, submucosa, muscularis, and serosa.

2. Understand the regions and parts of a tooth and how these structures are formed.

3. Understand the functional significance of structures associated with the tongue.

4. Recognize and understand the function of the different glands associated with the gastrointestinal tract.

5. Recognize the various regions of the gastrointestinal tract (esophagus, stomach, small and large bowels), the major specific cell types specific to each region and how they contribute to digestive function.
I. Introduction

II. Learning Objectives

III. Slides and Micrographs

A. Oral Cavity
   1. Lip
   2. Tooth
   3. Tongue

B. Esophagus
   1. General structure
   2. Mucosa
   3. Submucosa
   4. Muscularis
   5. Adventitia

C. Esophagogastric Junction

IV. Summary

Slide 67: Lip, H&E

**oral mucosa**

nonkeratinized stratified squamous epithelium

**skin**

keratinized stratified squamous epithelium (w/ hair follicles)
I. Introduction
II. Learning Objectives
III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction
IV. Summary

Slide 67: Lip, H&E

- salivary glands
- skeletal muscle
I. Introduction

II. Learning Objectives

III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction

IV. Summary

Slide 134: Lip, H&E

- sebaceous gland around hair follicle
- salivary glands (labial glands)
- skeletal muscle (orbicularis oris m.)
- skin
- mucosa
Slide 129: Tooth, H&E

gingiva (or gums): mucosa that lies over mandible and maxilla

dental pulp: loose CT, fibroblasts, mesenchymal stem cells, and odontoblasts on periphery

bone

crown: portion of tooth above the gingiva
enamel covers the dentin of the tooth crown, but has been dissolved away in this slide

root: portion of tooth below the gingiva and covered in cementum
Dentin is hard, calcified tissue (70% hydroxyapatite) with Type I collagen that surrounds the dental pulp; it is formed by odontoblasts (neural crest-derived cells) that line the pulp cavity (periphery of dental pulp); the roots are covered by cementum (bone-like tissue; the crown is covered by enamel instead); the periodontal ligament/membrane is fibrous CT with bundles of collagen anchoring the cementum of the tooth into the alveolar bone (Lt. “basin or bowl” – tooth sockets)
I. Introduction

II. Learning Objectives

III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction

IV. Summary

Slide 129: Tooth, H&E

predentin: organic fibrillar matrix of the dentin before it is calcified

odontoblasts
I. Introduction
II. Learning Objectives
III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction
IV. Summary

Slide 130: Fetal Head

look here for developing teeth
I. Introduction

II. Learning Objectives

III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. **Tooth**
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction

IV. Summary

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**Slide 130: Fetal Head**

- **ameloblasts**: tall cells part of the specialized epithelium of the tooth bud; form the enamel of the crown
- **enamel**
- **dentin**
- **predentin**
- **odontoblasts**
- **dental pulp**
III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction

IV. Summary

Filiform papillae (Lt. “thread-shaped”) are the most numerous papillae of the tongue; they are elongated and heavily keratinized; they provide friction to move food along; they do not contain taste buds; fungiform papillae (Lt. “mushroom-shaped”) are less numerous, larger, less-keratinized, and contain taste buds; circumvallate papillae (Lt. “surrounded with walls”) are 8-12 very large papillae located on posterior of tongue (near terminal sulcus) surrounded by moat-like grooves into which serous von Ebner's glands empty, providing fluid movement over numerous taste buds (~250) on each side of papilla.
I. Introduction

II. Learning Objectives

III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction

IV. Summary

Slide 70: Tongue, H&E

- Look here for taste buds
- Cirumvallate papilla
- Von Ebner's glands
I. Introduction
II. Learning Objectives
III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction
IV. Summary

Slide 77: Tongue, H&E
### Slides and Micrographs

#### A. Oral Cavity
- Lip
- Tooth
- Tongue

#### B. Esophagus
1. **General structure**
2. Mucosa
3. Submucosa
4. Muscularis
5. Adventitia

#### C. Esophagogastric Junction

### I. Introduction

### II. Learning Objectives

### III. Slides and Micrographs

<table>
<thead>
<tr>
<th>General Layer</th>
<th>Specific Layer</th>
<th>Esophagus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mucosa</strong></td>
<td>Epithelium</td>
<td>nonkeratinized stratified squamous epithelium</td>
</tr>
<tr>
<td></td>
<td>Lamina propia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Muscularis mucosae</td>
<td>prominent (depending on location)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Submucosa (w/ Meissner’s plexus)</th>
<th>Esophageal (submucosal) glands</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Muscularis (w/ Auerbach’s plexus)</th>
<th>Inner circular</th>
<th>thick; skeletal in upper 1/3 of esophagus, smooth in lower 2/3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outer longitudinal</td>
<td>thick; skeletal in upper 1/3 of esophagus, smooth in lower 2/3</td>
</tr>
</tbody>
</table>

**Serosa/Adventitia**

Adventitia (serosa at lower end)
I. Introduction

II. Learning Objectives

III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction

IV. Summary
I. Introduction

II. Learning Objectives

III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction

IV. Summary
I. Introduction
II. Learning Objectives
III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction
IV. Summary

Slide 66: Esophagus, H&E

- submucosa
- muscularis (inner circle layer)
- muscularis mucosae
- lumen
I. Introduction

II. Learning Objectives

III. Slides and Micrographs

A. Oral Cavity
   1. Lip
   2. Tooth
   3. Tongue

B. Esophagus
   1. General structure
   2. Mucosa
   3. Submucosa
   4. Muscularis
   5. Adventitia

C. Esophagogastric Junction

IV. Summary
I. Introduction
II. Learning Objectives
III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction
IV. Summary

Slide 66: Esophagus, H&E

- Auerbach’s (myenteric) plexus
- Outer longitudinal layer
- Inner circular layer
- Adventitia
- Muscularis
- Lumen
I. Introduction

II. Learning Objectives

III. Slides and Micrographs

A. Oral Cavity
   1. Lip
   2. Tooth
   3. Tongue

B. Esophagus
   1. General structure
   2. Mucosa
   3. Submucosa
   4. Muscularis
   5. Adventitia

C. Esophagogastric Junction

IV. Summary

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Slide 66: Esophagus, H&E

---

some *skeletal muscle* can be seen in the muscularis layer of the upper esophagus as it transitions into only smooth muscle
I. Introduction

II. Learning Objectives

III. Slides and Micrographs

A. Oral Cavity
   1. Lip
   2. Tooth
   3. Tongue

B. Esophagus
   1. General structure
   2. Mucosa
   3. Submucosa
   4. Muscularis
   5. Adventitia

C. Esophagogastric Junction

IV. Summary

Slide 142: Gastroesophageal Junction, H&E

**Esophagus**
- lymph nodule
- muscularis

**Stomach**
- nonkeratinized stratified squamous epithelium
- simple columnar epithelium
- cardiac glands
- gastric glands
I. Introduction
II. Learning Objectives
III. Slides and Micrographs
   A. Oral Cavity
      1. Lip
      2. Tooth
      3. Tongue
   B. Esophagus
      1. General structure
      2. Mucosa
      3. Submucosa
      4. Muscularis
      5. Adventitia
   C. Esophagogastric Junction
IV. Summary

<table>
<thead>
<tr>
<th>General Layer</th>
<th>Specific Layer</th>
<th>Esophagus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mucosa</td>
<td>Epithelium</td>
<td>nonkeratinized stratified</td>
</tr>
<tr>
<td></td>
<td></td>
<td>squamous epithelium</td>
</tr>
<tr>
<td></td>
<td>Lamina propria</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Muscularis mucosa</td>
<td>prominent (depending on location)</td>
</tr>
<tr>
<td>Submucosa</td>
<td></td>
<td>esophageal (submucosal)</td>
</tr>
<tr>
<td>(w/ Meissner’s plexus)</td>
<td></td>
<td>glands</td>
</tr>
<tr>
<td>Muscularis</td>
<td>Inner circular</td>
<td>thick; skeletal in upper 1/3</td>
</tr>
<tr>
<td>(w/ Auerbach’s plexus)</td>
<td></td>
<td>of esophagus, smooth in lower 2/3</td>
</tr>
<tr>
<td></td>
<td>Outer longitudinal</td>
<td>thick; skeletal in upper 1/3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of esophagus, smooth in lower 2/3</td>
</tr>
<tr>
<td>Serosa/Adventitia</td>
<td></td>
<td>Adventitia (serosa at lower end)</td>
</tr>
</tbody>
</table>
# Characteristics of Segments of the Gastrointestinal Tract

<table>
<thead>
<tr>
<th>General Layer</th>
<th>Specific Layer</th>
<th>Esophagus</th>
<th>Stomach</th>
<th>Duodenum</th>
<th>Jejunum</th>
<th>Ileum</th>
<th>Large Intestine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mucosa</td>
<td>Epithelium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lamina propria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Muscularis mucosae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submucosa</td>
<td>(w/ Meissner’s plexus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscularis</td>
<td>(w/ Auerbach’s plexus)</td>
<td>Innermost oblique</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner circular</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer longitudinal</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Serosa/Adventitia</td>
<td></td>
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</tr>
</tbody>
</table>