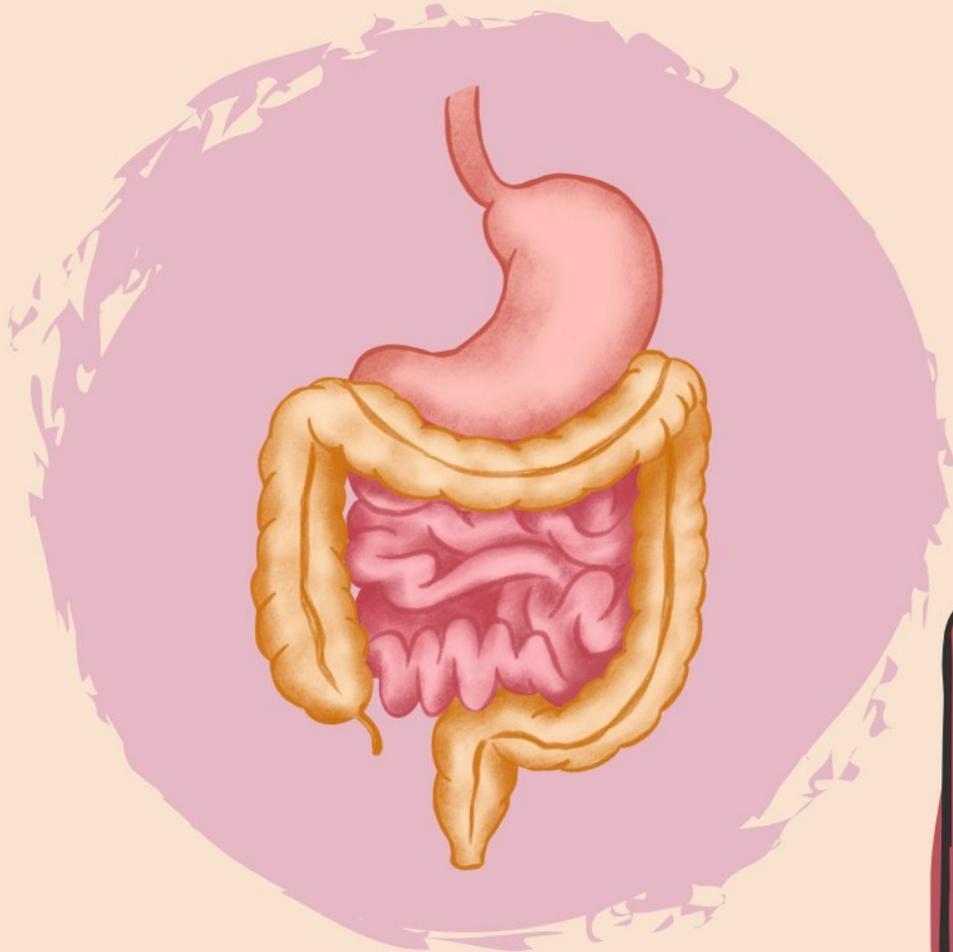


Level (3) - Semester (5)

# HISTOLOGY



**GIT - Lecture (2)**

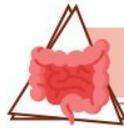
**Small & Large Intestine**

**DR M. YUSUF**

# SMALL & LARGE INTESTINE



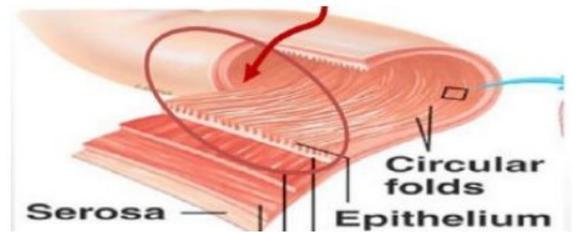
## (1) SMALL INTESTINE



### Structure

- ☑ **Shape:** It is a hollow tubular structure.
- ☑ **Length:** About 20 feet (6 meters).
- ☑ **Parts:** Duodenum – Jejunum - Ileum.
- ☑ **The wall is formed of four layers:**

1	Mucosa	MACROSCOPIC APPEARANCE	<ul style="list-style-type: none"> <li>☑ <b>Velvet appearance</b> of the surface                             <ul style="list-style-type: none"> <li>▪ Due to presence of intestinal villi.</li> </ul> </li> <li>☑ <b>Minute holes:</b> <ul style="list-style-type: none"> <li>▪ Represent openings of the <b>intestinal crypts</b></li> </ul> </li> </ul>
		MICROSCOPIC APPEARANCE	<ul style="list-style-type: none"> <li>① <b>Epithelium:</b> <ul style="list-style-type: none"> <li>▪ <b>Simple columnar type</b> which...                                     <ol style="list-style-type: none"> <li>1. Covers Intestinal villi</li> <li>2. Lines intestinal crypts</li> </ol> </li> </ul> </li> <li>② <b>Corium:</b> <ul style="list-style-type: none"> <li>▪ <b>Loose C.T</b> layer contains (<b>Blood vessels</b> – <b>Nerves</b> – <b>Lymphatics</b>).</li> <li>▪ <b>Surrounds the crypts &amp; extends</b> to form the <b>villous core</b>.</li> <li>▪ <b>Peyer's patches:</b> lymph follicles in the <b>ileum</b>.</li> </ul> </li> <li>③ <b>Muscularis mucosa:</b> <ul style="list-style-type: none"> <li>▪ 2 thin layers of smooth muscle fibers :IC &amp; OL</li> </ul> </li> </ul>





	<p style="text-align: center;"><b>Mucosa</b></p> <p style="text-align: center;"><b>MICROSCOPIC APPEARANCE</b></p> <p style="text-align: center;"><b>CONT...</b></p>	<p><b>Mucosa</b> Epithelium Lamina propria Muscularis mucosae</p> <p><b>Submucosa</b> Submucosal gland Blood vessel Submucosal nerve plexus</p> <p><b>Muscularis</b> Inner circular layer Myenteric nerve plexus Outer longitudinal layer</p> <p><b>Serosa</b></p> <p><b>a</b></p> <p><b>b</b> Section of small intestine</p> <p>Source: Mescher AL, Junqueira's Basic Histology: Text and Atlas, 12th Edition: <a href="http://www.accessmedicine.com">http://www.accessmedicine.com</a> Copyright © The McGraw-Hill Companies, Inc. All rights reserved.</p>				
<p style="text-align: center;"><b>2</b></p>	<p style="text-align: center;"><b>Submucosa</b></p>	<p><input checked="" type="checkbox"/> Loose C.T. contains (<b>Blood vessels</b> – <b>Nerves</b> – <b>Lymphatics</b>).</p> <table border="1" style="width: 100%;"> <thead> <tr> <th style="text-align: center;">① Brunner's glands</th> <th style="text-align: center;">② Peyer's patches</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <ul style="list-style-type: none"> <li>▪ Mucous secreting glands</li> <li>▪ In the proximal part of the duodenum</li> </ul> </td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> <li>▪ In the corium of the mucosa &amp; Extend piercing the muscularis mucosa to appear in submucosa</li> <li>▪ In the ilium</li> </ul> </td> </tr> </tbody> </table> <p>anization of the digestive tract</p>	① Brunner's glands	② Peyer's patches	<ul style="list-style-type: none"> <li>▪ Mucous secreting glands</li> <li>▪ In the proximal part of the duodenum</li> </ul>	<ul style="list-style-type: none"> <li>▪ In the corium of the mucosa &amp; Extend piercing the muscularis mucosa to appear in submucosa</li> <li>▪ In the ilium</li> </ul>
① Brunner's glands	② Peyer's patches					
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<p style="text-align: center;"><b>3</b></p>	<p style="text-align: center;"><b>Musculosa</b></p>	<p><input checked="" type="checkbox"/> 2 layers of smooth muscle fibers: <b>IC &amp; OL</b></p>				
<p style="text-align: center;"><b>4</b></p>	<p style="text-align: center;"><b>Serosa</b></p>	<p><input checked="" type="checkbox"/> It is a covering layer derived from the peritoneum.</p> <p><input checked="" type="checkbox"/> Formed of:</p> <ol style="list-style-type: none"> <li>1. Thin layer of simple squamous mesothelial cells.</li> <li>2. Submesothelial layer of loose C.T contains (<b>Blood vessels</b> – <b>Nerves</b> – <b>Lymphatics</b>).</li> </ol>				



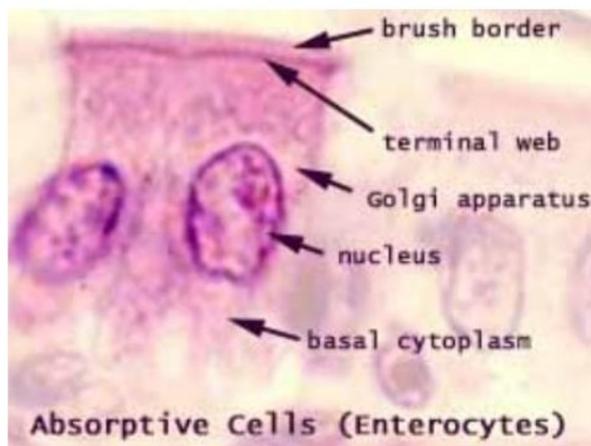


(A) Intestinal Villi

<p><b>DEFINITION</b></p>	<p>▪ Finger like projections of the mucosa extending from the wall into the lumen of the intestine.</p>	
<p><b>STRUCTURE</b></p>	<p>① <b>Villous epithelium:</b> formed of:</p> <ol style="list-style-type: none"> <li>1. Simple Columnar Absorbing Cells. (90%)</li> <li>2. Goblet Cells. (9.5%)</li> <li>3. Entero-Endocrine “EE” Cells. (0.5%)</li> </ol> <p>② <b>Villous core:</b> formed of CT</p>	

☒ Villous epithelium:

		<b>① Simple Columnar Absorbing Cells (Enterocytes)</b>
<b>SITE</b>		Cover the villi (90%) & upper part of the intestinal crypts
<b>LM</b>	<b>SHAPE</b>	Tall columnar cells
	<b>NUCLEUS</b>	Basal - Oval
	<b>CYTOPLASM</b>	Basophilic
	<b>FREE BORDER</b>	Acidophilic striated (brush border), due to microvilli
<b>FUNCTION</b>		<p>A. Secretion of lactase - sucrase - isomaltase enzymes.</p> <p>B. Essential for <b>absorption</b> of useful substances.</p>

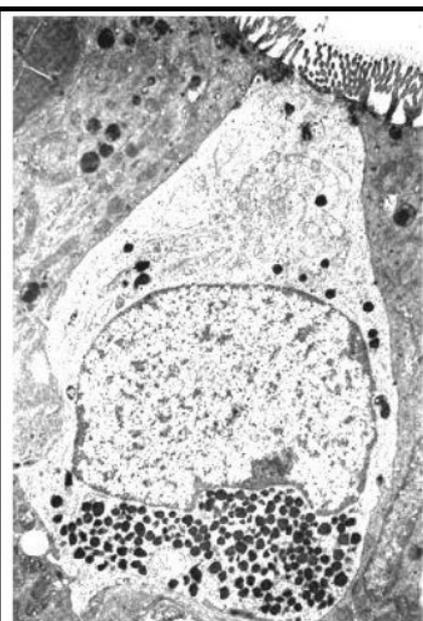




		② Goblet Cells	③ Entero-Endocrine cells
SITE		✓ <b>Cover:</b> A. Intestinal villi (9.5%) B. Upper part of intestinal crypts.	✓ <b>Cover intestinal villi (~ 0.5%)</b> ✓ <b>Line intestinal crypts (~ 1%).</b>
LM	Shape	Goblet-like cells	Columnar cells
	Nucleus	---	Basal - Open face
	Cytoplasm	---	Shows <b>basal granules</b> demonstrated by <b>silver stain</b>
	Apical part	Expanded & filled with <b>mucin granules</b>	Narrow
	Basal part	<b>Constricted</b> & contains <b>nucleus &amp; cell organelles</b>	---
	By Hx & E	Apical part appears as <b>clear, vacuolated or foamy</b> due to dissolved mucin granules	---
FUNCTION		A. <b>Secrete mucous</b> to lubricate the passage of intestinal content. B. <b>Secrete acid glycoprotein</b> to prevent bacterial invasion of intestinal mucosa.	<b>Secrete intestinal hormones</b>

☞ **Types of E.E cells lining small intestine & their functions: (KMoN SEED)**

Cells	Secretion
① <b>KCC cells</b>	<b>Choly-cystokinine</b>
② <b>Mo- cells</b>	<b>Motilin</b>
③ <b>N- cells</b>	<b>Neurotensin.</b>
④ <b>S-cells</b>	<b>Secretin hormone</b>
③ <b>E-cells</b>	<b>Endorphine</b>
⑥ <b>E-G cells</b>	<b>Glucagon-like substance</b>
⑦ <b>D-cells</b>	<b>Somatostatin hormone</b>





**(B) Intestinal Crypts**

DEFINITION	<ul style="list-style-type: none"> <li>Simple tubular glands extending from the base of the intestinal villi to the muscularis mucosa.</li> </ul>
LINING EPITHELIUM	<ul style="list-style-type: none"> <li>Intestinal crypts are lined with the following cells:                     <ol style="list-style-type: none"> <li>Columnar absorbing cells (DISCUSSED BEFORE).</li> <li>Goblet cells (DISCUSSED BEFORE).</li> <li>Entero-endocrine cells (DISCUSSED BEFORE).</li> <li>Paneth cells</li> <li>M-cells.</li> <li>Stem cells.</li> <li>Caveolate cells</li> </ol> </li> </ul>

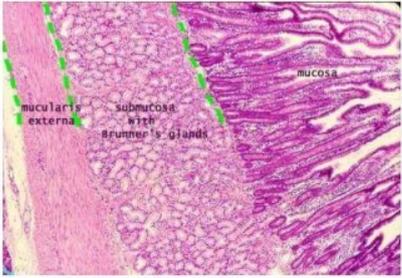
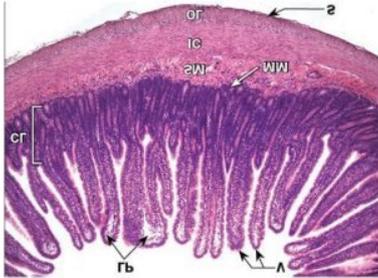
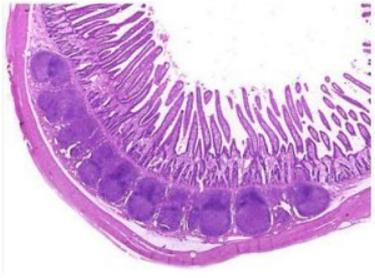
	④ Paneth cells	⑤ M-cells (Membrane like cells - Microfold cells)
SITE	<ul style="list-style-type: none"> <li>Grouped in the base of the crypts of the small intestine.</li> <li>Absent in crypts of large intestine.</li> </ul>	---
L/M	Shape	Columnar or triangular cells with narrow apex
	Nucleus	Basal - Rounded - Pale
	Cytoplasm	<ul style="list-style-type: none"> <li><b>Basal basophilia:</b> Due to numerous rER</li> <li><b>Apical acidophilia:</b> Due to presence of zymogen granules.</li> </ul>
FUNCTION	<ul style="list-style-type: none"> <li>Secrete lysozyme enzyme                     <ul style="list-style-type: none"> <li>Which has antibacterial effect as the enzymes digest the cell coat of the bacteria.</li> </ul> </li> </ul>	Antigen presenting cells
FIG.		<p>Copyright © 2006 Nature Publishing Group Nature Reviews   Immunology</p>

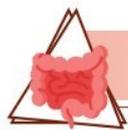




	⑥ Stem cells	⑦ Caveolated cells
SHAPE	Undifferentiated columnar cells	Large columnar cells with long microvilli.
SITE	At the base of the crypts between Paneth cells	---
FUNCTION	---	Act as receptors

☞ **Differences between the Duodenum, Jejunum and Ileum:**

	Duodenum	Jejunum	Ileum
Goblet cells	Few	Numerous	More numerous
Submucosa	Brunner's glands	Free	Peyer's patches
Figure			



**Function of Small Intestine**

- ① Complete the process of food **digestion**.
- ② **Absorption** of useful products of digestion by blood & lymph capillaries.

☞ **Factors increasing absorption from the intestinal lumen:**

- A. Plica circularis → ↑ Surface Area about 3 folds.
- B. Intestinal villi → ↑ Surface Area about 10 folds.
- C. Microvilli → ↑ Surface Area about 20 folds.

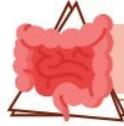
So, these factors ↑↑ the surface area by about **600 folds**.

- ③ Secretion of mucous which lubricate food and stool. ▀
- ④ Secretion of gastrointestinal hormones.





## (2) LARGE INTESTINE



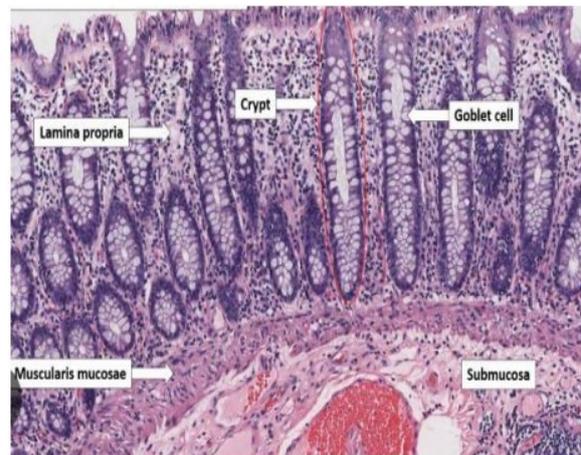
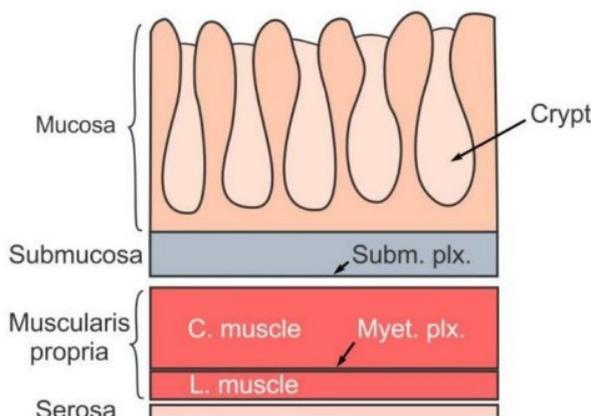
### Structure

☞ **The large intestine consists of:**

- ① Caecum.
- ② Appendix.
- ③ Ascending, transverse & descending colons.
- ④ Rectum.
- ⑤ Anal canal.

☞ **The wall is formed of four layers:**

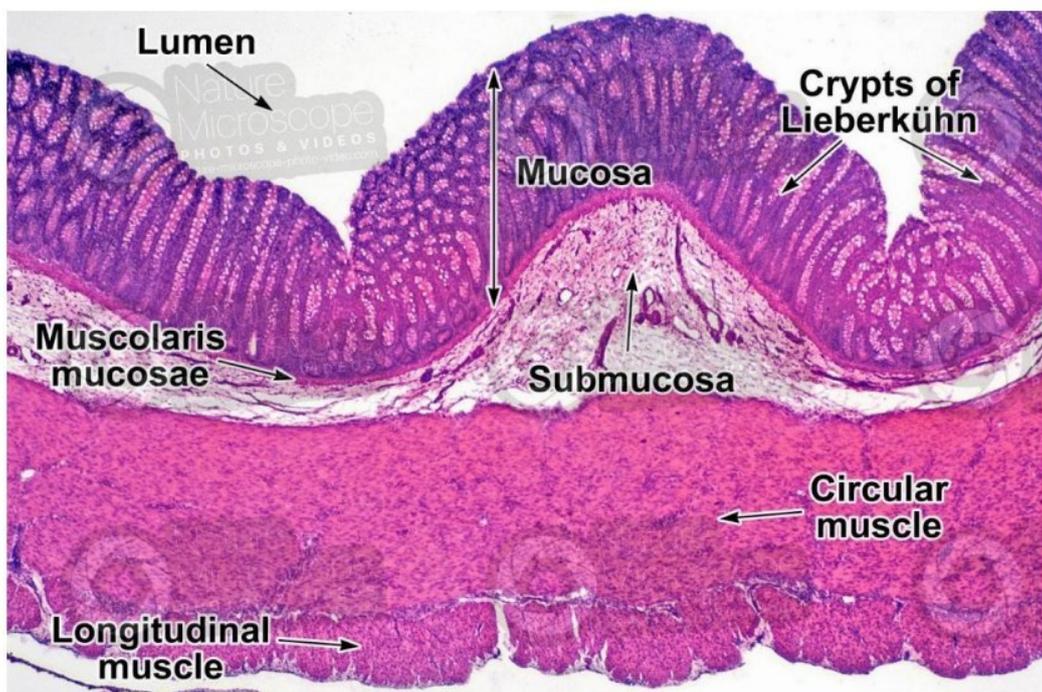
<b>1</b> Mucosa	<b>MACROSCOPIC APPEARANCE</b>	<ul style="list-style-type: none"> <li>☑ Smooth surface “No villi”.</li> <li>☑ Longitudinal folds                             <ul style="list-style-type: none"> <li>▪ More prominent in the rectum.</li> </ul> </li> <li>☑ Minutes holes on its surface which                             <ul style="list-style-type: none"> <li>▪ Represent the openings of the crypts.</li> </ul> </li> </ul>
	<b>MICROSCOPIC APPEARANCE</b>	<ul style="list-style-type: none"> <li>① <b>Epithelium:</b> The crypts are lined with:                             <ol style="list-style-type: none"> <li>1- Simple columnar absorbing cells.</li> <li>2- Goblet cells: more numerous.</li> <li>3- E.E. cells</li> <li>4- Stem cells: at the base of the crypts.</li> <li>5- Caveolate cells</li> <li>6- M-cells.</li> </ol> </li> <li>② <b>Corium:</b> <ul style="list-style-type: none"> <li>▪ Loose C.T layer contains (Blood vessels – Nerves – Lymphatics).</li> <li>▪ Greatly reduced by the numerous deep crypts.</li> <li>▪ Rich in solitary lymph nodules: May extend into the submucosa.</li> </ul> </li> <li>③ <b>Muscularis mucosa:</b> <ul style="list-style-type: none"> <li>▪ Well-developed</li> <li>▪ Formed of 2 thin layers of smooth muscle fibers :IC &amp; OL</li> </ul> </li> </ul>





2	Submucosa	<ul style="list-style-type: none"> <li>☑ Loose C.T. contains (<b>Blood vessels</b> – <b>Nerves</b> – <b>Lymphatics</b>).</li> <li>☑ There is no gland</li> <li>☑ Lymphocytic infiltration was found due to abundant bacteria in the large intestine.</li> </ul>
3	Musculosa	<ul style="list-style-type: none"> <li>☑ 2 layers of smooth muscle fibers: <b>IC</b> &amp; <b>OL</b> (not continuous but breaks up into 3 bands called “<b>Taenia coli</b>”)</li> </ul> <div data-bbox="798 515 1228 884" style="text-align: center;"> </div>
4	Serosa	<ul style="list-style-type: none"> <li>☑ Formed of loose C.T containing <b>blood vessels</b> &amp; <b>nerves</b>.</li> <li>☑ Covered with simple squamous mesothelial cells with flat nuclei.</li> <li>☑ <b>In the rectum:</b> The serosa is partially replaced by <b>adventitia</b>.</li> </ul>

**NB:** Adipose C.T accumulates in pedunculated masses which hang out from the serosa into the peritoneal cavity & called “Appendices epiploicae”.





☞ Differences between the parts of the large intestine:

	A) Appendix	B) Colon	C) Rectum
LUMEN	<b>Small &amp; Narrow,</b> Obliterated in old age	Wide lumen	
MUCOSA			
Goblet cells	<b>Few (+)</b>	<b>Numerous (++)</b>	<b>More Numerous (+++)</b>
Crypts:	<b>Few &amp; Short</b>	<b>Numerous &amp; long</b>	<b>Numerous &amp; longer</b>
Corium	<b>Full of lymphoid follicles</b> all over the circumference	<b>Few (solitary) lymphoid follicles</b>	
Muscularis mucosa	<b>Ill defined &amp; may be absent</b> in some areas	<b>Defined</b>	
MUSCULOSA (Outer longitudinal layer)	<ul style="list-style-type: none"> <li>▪ Continuous</li> <li>▪ <b>No Taenia coli</b></li> </ul>	<ul style="list-style-type: none"> <li>▪ Divided into 3 bands</li> <li>▪ <b>Taenia coli</b></li> </ul>	<ul style="list-style-type: none"> <li>▪ Continuous layer</li> <li>▪ <b>No Taenia coli</b></li> </ul>



**Clinical hint**

☞ Appendicitis:

**MECHANISM**

Because appendix is **Closed sac** & Its contents are **relatively static**

⇓⇓

It can **easily become a site of inflammation**

⇓⇓

With the **small lumen** & relatively **thin wall** of the appendix

⇓⇓

**inflammation** & the growth of **lymphoid follicles** in the wall can produce **swelling** that can lead to **bursting** of the appendix.

⇓⇓

**Severe** appendicitis is a **medical emergency** since a **burst appendix** will produce infection of the **peritoneal cavity**.

