



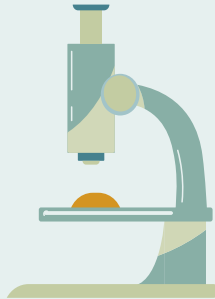
MED439
KING SAUD UNIVERSITY

Revised & Approved



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Histology Team
439

Small Intestine

Color index:

Slides



Important



Doctors notes



Extra



[Editing file](#)

► Objectives:

- By the end of this lecture, The student should describe the microscopic structure of the three regions of the small intestine:
 - 1- Duodenum.
 - 2- Jejunum.
 - 3- Ileum.

► Small Intestine

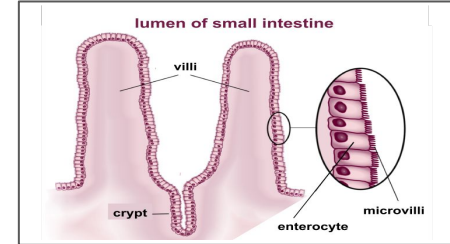
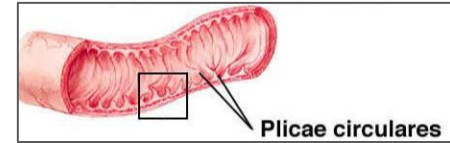
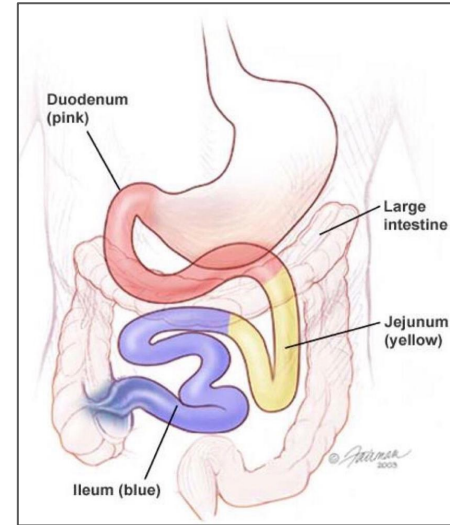
It is divided into the duodenum, the jejunum, and the ileum.
the main functions of the small intestine are digestion, absorption of food and production of gastrointestinal hormones. The small intestine is 4-6 metres long in humans.

Small intestine (عندھا حیز ضیق وربنا عایزنا نستفید من کل حاجة بناکلھا) so there are structures to increase the surface area more for more absorptions .

The role of small intestine in the absorption is similar to the plants that take the nutrients from the soil by roots.

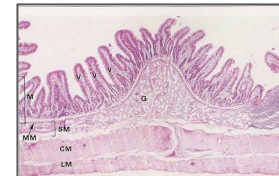
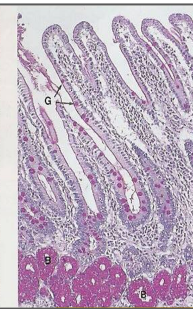
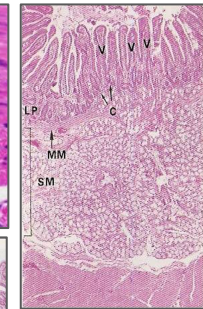
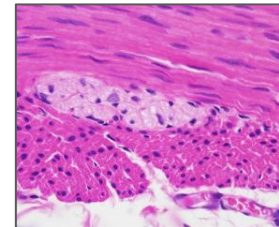
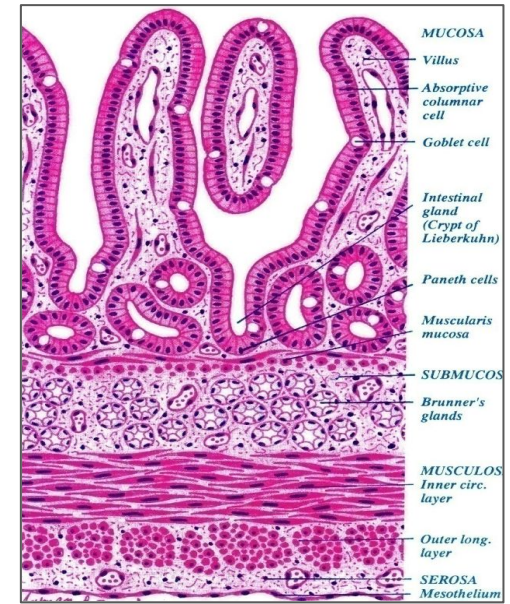
To increase surface area the mucosa has:

- **Plicae circulares (circular folds):** Permanent folds of the mucosa and submucosa.
(Stomach has rugae to increase the capacity for storage while small intestine has folds to increase the surface area for absorption).
- **Villi like roots**
- **Intestinal crypts lined by absorptive cells (crypts of Lieberkühn).**
- **Microvilli (Brush border)** well arranged , developed mini villi present only in the small intestine and the proximal tubules of the kidney



▶ Duodenum

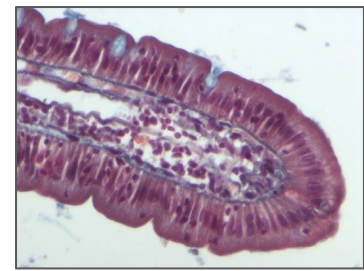
<p>Mucosa</p>	<p>Shows villi and crypts A- Epithelium: <u>simple columnar epithelium</u> <u>absorptive cell with brush border</u> with goblet cells. B- Lamina propria: Loose areolar C.T. C- Muscularis mucosae: 2 layers of smooth muscle cells.</p>
<p>Submucosa</p>	<ul style="list-style-type: none"> • Connective tissue containing blood vessels & nerves. • Contains Brunner's glands (secrete mucus) <u>present in the base of crypt to secrete alkaline mucus rich with bicarbonate immediately to the lumen</u>
<p>Muscularis Externa</p>	<p>2 smooth muscle layers:</p> <ul style="list-style-type: none"> • Inner circular layer. • Outer longitudinal layer.
<p>Serosa / Adventitia</p>	<p>Duodenum is invested by a serosa or adventitia (<u>because the transverse colon pass in front of it</u>)</p>



Mucosa of Duodenum

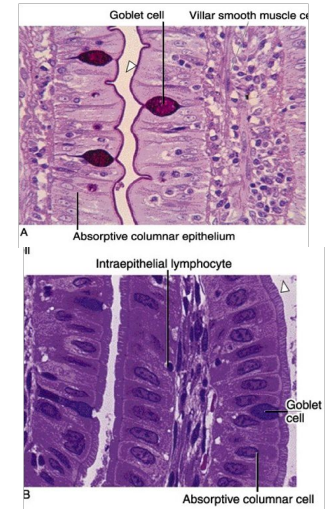
Intestinal villi

- Each Villus is a finger-like projection of small intestinal mucosa and it is formed of:
 - 1- Central core of loose areolar C.T. containing:
 - Lymphocytes (if it got activated it becomes plasma cells).
 - Plasma cells.
 - Fibroblasts.
 - Smooth muscle cells.
 - Capillary loops.
 - Lacteal (blindly ending lymphatic channels) the majority of fat goes through it
 - 2- Villus-covering epithelium. covered by simple columnar epithelium



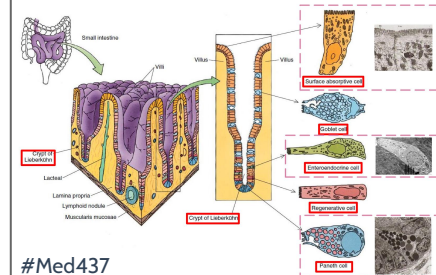
Cells Covering the Villi

- Surface columnar absorptive cells:
 - They have brush border (microvilli).
 - They are covered with thick glyocalx (it's glycolipid + glycoprotein and thick due to the enzymes) that has digestive enzymes.
 - They have Junction complex 'more than one' (tight, adhering and desmosome junctions) (because in between the cells the food material cross them to pass and that's lead to leakage of enzymes so the junctions needed to prevent that).
- Goblet cells: Increase toward the ileum.
- Enteroendocrine (EE) cells (DNES cells).



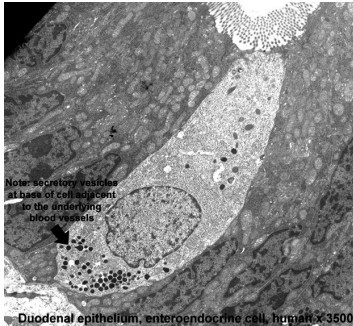
Intestinal Glands (Crypts)

- Simple tubular glands that open between villi.
- Composed of 5 cell types:
 1. Columnar absorptive cells.
 2. Goblet cells: secrete mucus.
 3. Enteroendocrine (EE) (DNES) cells: secrete hormones. cholecystokinin
 4. Paneth cells: secrete Lysozyme (antibacterial) that's why the small intestine sterile are found in the base of the crypts.
 5. Stem cells: are regenerative cells. are found in the base of the crypts.



EE (DNES) cells

- **EC cells:** secrete endorphin and serotonin.
- **S cells:** secrete secretin.
- **D (delta) cells:** secrete somatostatin.
- **A (alpha) cells:** secrete glucagon.
- **Mo cells:** secrete motilin.
- **CCK-PZ cells:** secrete cholecystokinin (pancreozymin)

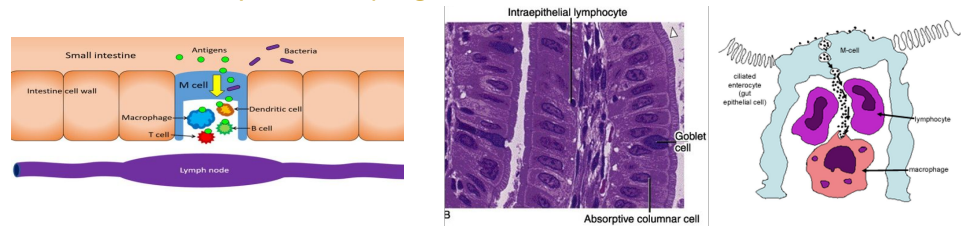


M Cells (Microfold cells)


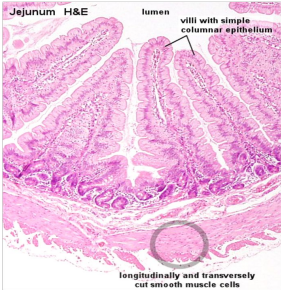
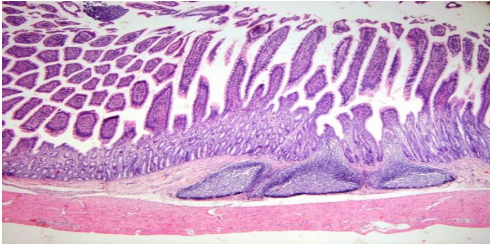
- They are mainly found within the intestinal epithelium overlying lymphatic nodules of lamina propria. It allow a specific matrix to enter intestinal lumen for endocytosis of antigens
- Each is a dome-shaped cell (or specialized squamous cell) with a basal concavity that contains intraepithelial lymphocytes and macrophages.
- They phagocytose and transport antigens present in the intestinal lumen to the underlying lymphoid tissue cells to initiate the immune response to these antigens leading to the **secretion of IgA**.

Small intestine lamina propria contain lymphatic nodules which a collection of lymphocytes and macrophages .

The M cells was خلية عادية but due to the cells in the lymphatic nodules حفرت in the basal part of the cell near the lumen , has non microvilli and modified to present the Auto immune Cells mainly the macrophages.



► Regional differences of small intestine

Duodenum	Jejunum	Ileum
<ul style="list-style-type: none"> - Its submucosa has Brunner's glands. - It is invested by serosa or adventitia <p>Located at the level of upper abdomen at the level of L1-L3</p>	<ul style="list-style-type: none"> - Has neither Brunner's glands nor Peyer's patches. -It is invested by serosa. <p>It lies between ileum and duodenum</p>	<ul style="list-style-type: none"> - Its lamina propria, opposite the attachment of the mesentery - Has lymphoid nodules (Peyer's patches with Mucosal origin) that extend to the submucosa (the presence of peyer's patches is due to no more absorption and it's present for ileum and caecum protection from the colon bacteria) - Ileum is invested by serosa.
 <p>A histological section of the duodenum stained with H&E. It shows the mucosal layer with numerous Brunner's glands (labeled 'G') and villi. The layers are labeled: M (mucosa), SM (submucosa), MM (muscularis mucosae), CM (circular muscle), and LM (longitudinal muscle).</p>	 <p>A histological section of the jejunum stained with H&E. It shows the lumen, villi with simple columnar epithelium, and a circular muscle layer. Labels include: Jejunum H&E, lumen, villi with simple columnar epithelium, and longitudinally and transversely cut smooth muscle cells.</p>	 <p>A histological section of the ileum stained with H&E, showing Peyer's patches (lymphoid nodules) in the submucosa.</p>

Extra from Kaplan
 Special thanks to Sarah Alobaid for sharing ♥

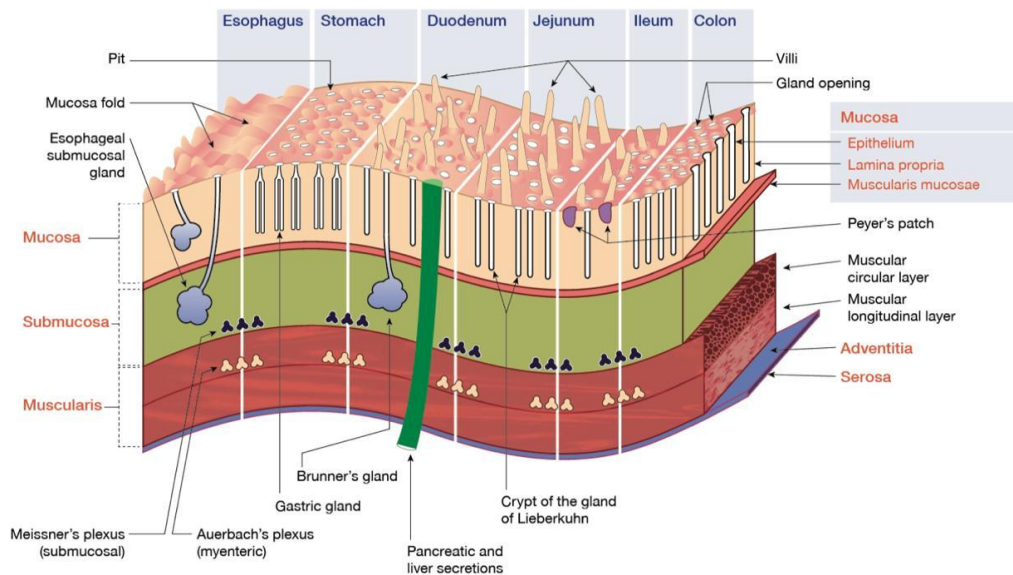


Figure II-3-15. Histologic Organization of the Digestive Tube

Table II-3-4. Histology of Specific Regions

Region	Major Characteristics	Mucosal Cell Types at Surface	Function of Surface Mucosal Cells
Esophagus	<ul style="list-style-type: none"> Nonkeratinized stratified squamous epithelium Skeletal muscle in muscularis externa (upper 1/3) Smooth muscle (lower 1/3) 	—	—
Stomach (body and fundus)	<i>Rugae</i> : shallow pits; deep glands	Mucous cells Chief cells Parietal cells Enteroendocrine (EE) cells	Secrete mucous; form protective layer against acid; tight junctions between these cells probably contribute to the acid barrier of the epithelium. Secrete pepsinogen and lipase precursor Secrete HCl and intrinsic factor Secrete a variety of peptide hormones
Pylorus	Deep pits; shallow, branched glands	Mucous cells Parietal cells EE cells	Same as above Same as above High concentration of gastrin
Small intestine	Villi, plicae, and crypts	Columnar absorptive cells	Contain numerous microvilli that greatly increase the luminal surface area, facilitating absorption
Duodenum	Brunner glands, which discharge alkaline secretion	Goblet cells Paneth cells EE cells	Secrete acid glycoproteins that protect mucosal linings Contains granules that contain lysozyme. May play a role in regulating intestinal flora High concentration of cells that secrete cholecystokinin and secretin
Jejunum	Villi, well developed plicae, crypts	Same cell types as found in the duodenal epithelium	Same as above
Ileum	Aggregations of lymph nodules called Peyer's patches	M cells found over lymphatic nodules and Peyer's patches	Endocytose and transport antigen from the lumen to lymphoid cells
Large intestine	Lacks villi, crypts	Mainly mucous-secreting and absorptive cells	Transports Na ⁺ (actively) and water (passively) out of lumen

MCQs

Q1) To increase surface area the mucosa has?

- A- Permanent folds of the mucosa & submucosa
- B- Intestinal crypts (crypts of Lieberkühn)
- C- Villi & Microvilli (Brush border)
- D- All of them

Q2) Which of the following layers have Brunner's glands?

- A- Mucosa
- B- Submucosa
- C- Muscularis Externa
- D- Serosa

Q3) Which of the following cells found in the base of the crypt?

- A- Columnar absorptive cells
- B- Stem cells
- C- Paneth cells
- D- B & C

Q4) Which of the following cells secrete glucagon?

- A- EC cells
- B- S cells
- C- D cells
- D- A cells

Q5) D cells are responsible for secretion?

- A- Endorphin and serotonin
- B- Somatostatin
- C- Secretin
- D- Motilin

Q6) Which region of small intestine neither has Brunner's glands nor Peyer's patches?

- A- Duodenum
- B- Jejunum
- C- ileum
- D- Colon

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