

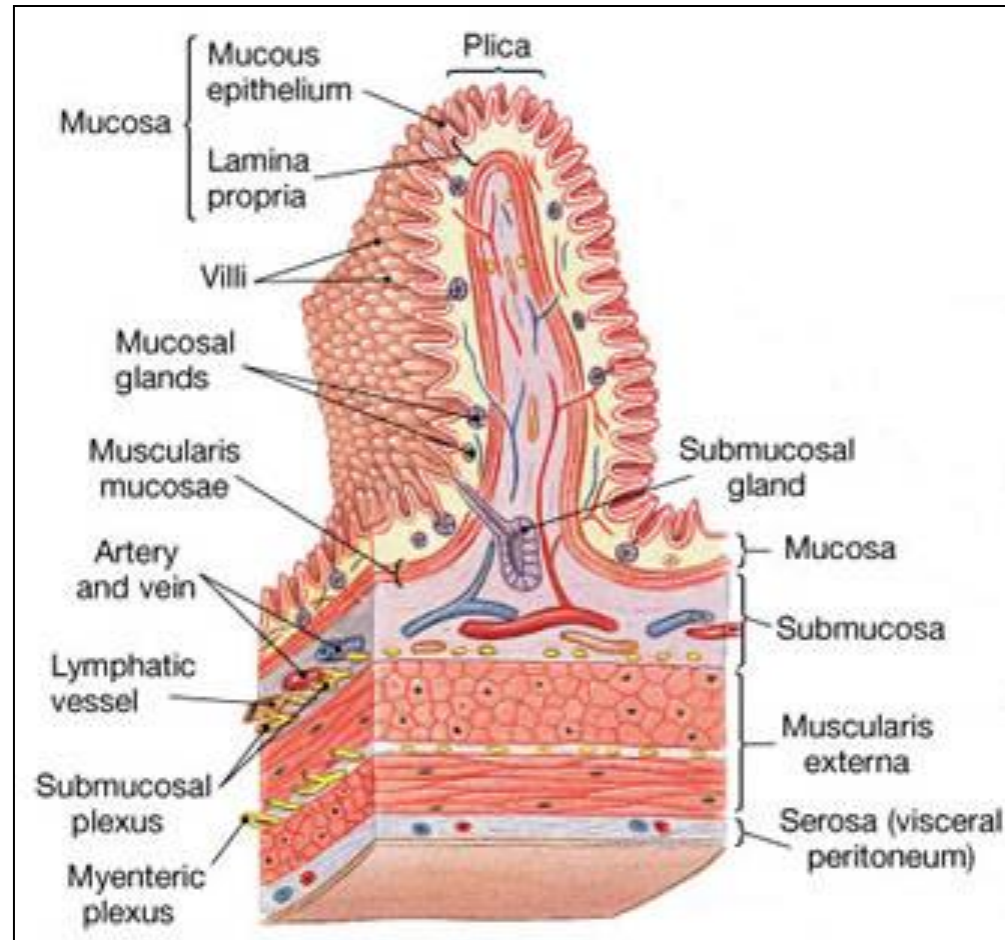


# HISTOLOGY OF THE SMALL INTESTINE

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# Histology of the Small Intestine

- Has the same general layout seen in the rest of the GIT
- The outermost layer, however, could be either serosa (formed of connective tissue and epithelium) or adventitia (formed of connective tissue only). This depends on whether that part of the small intestine is covered by peritoneum or not.



- Permanent circular folds of mucosa and submucosa are present in the wall of the small intestine; these are called *plicae circulares*. They start in the duodenum, are most numerous in the jejunum and are few/absent in the ileum.



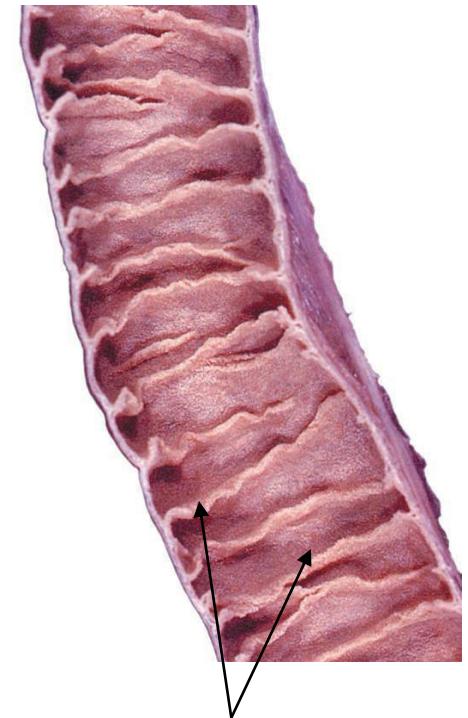
Proximal jejunum



Proximal Ileum



Terminal Ileum

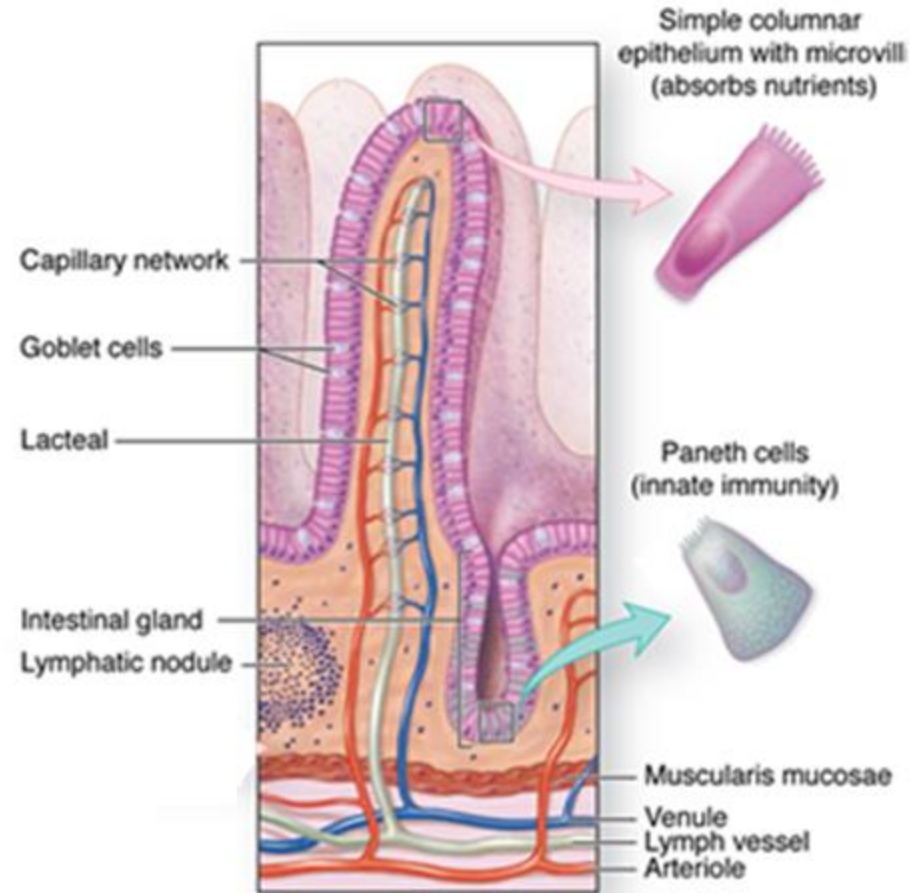


Plicae circulares

- These folds increase the surface area of absorption and slow the passage of food through the intestine allowing more time for the intestine to absorb nutrients.

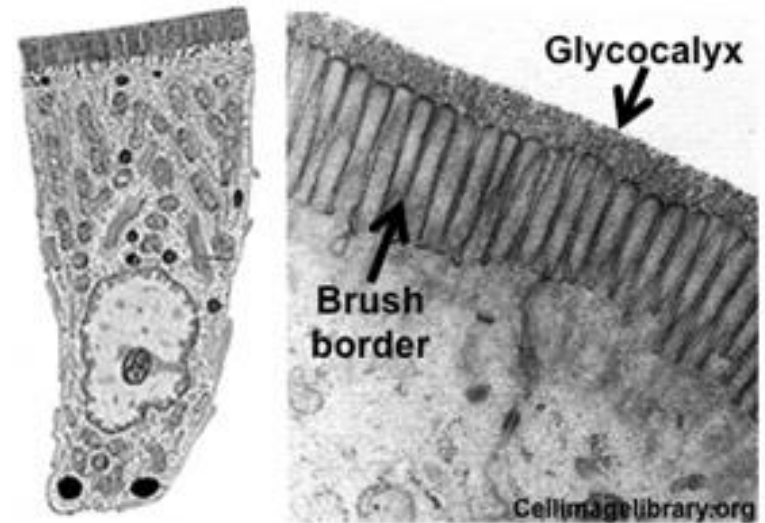
# Mucosa

- Formed of epithelium, lamina propria and muscularis mucosae.
- Epithelium and lamina propria project into the lumen forming ‘*Villi*’ which increase surface area of absorption.
- Simple tubular glands open between the villi. These are called: *Intestinal Crypts* (of Lieberkuhn).



# Cells of the Villi

1) **Enterocytes**: are tall columnar cells with an oval nucleus in the basal half of the cell. The apical surface of the cell has a *brush border* formed of numerous microvilli that contain the digestive enzymes. These enzymes form a layer called the *glycocalyx*.

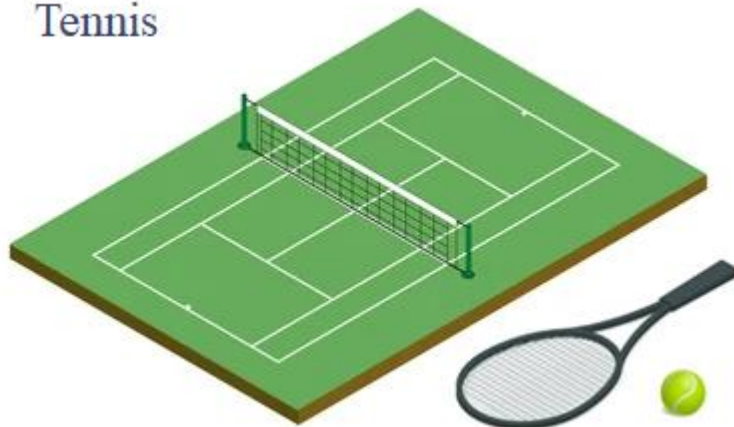


- The microvilli increase the surface area of **absorption**.

## Surface Area of Absorption:

- Plicae circulares, villi, and microvilli all participate in increasing the surface area of absorption.
- Research have estimated the total surface area of absorption to be about 250m<sup>2</sup> (area of a tennis court!!!). Recently, however, with advanced methodology, this number has been adjusted to just 32m<sup>2</sup> (half a badminton court!!).
- *Which has the largest surface area of absorption: jejunum or ileum?*

Tennis



Or

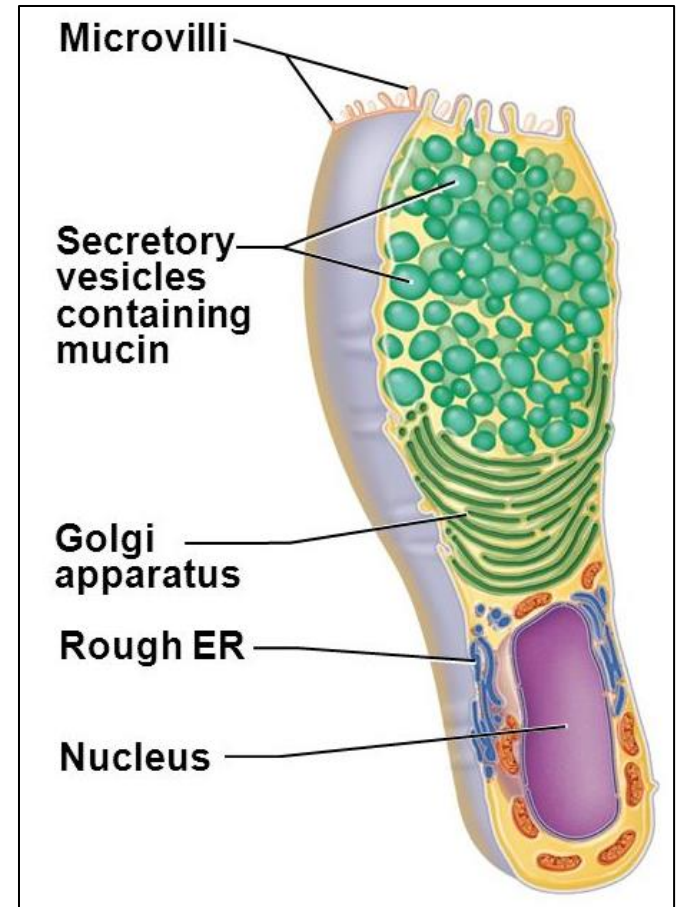
1/2

Badminton



## 2) Goblet cells:

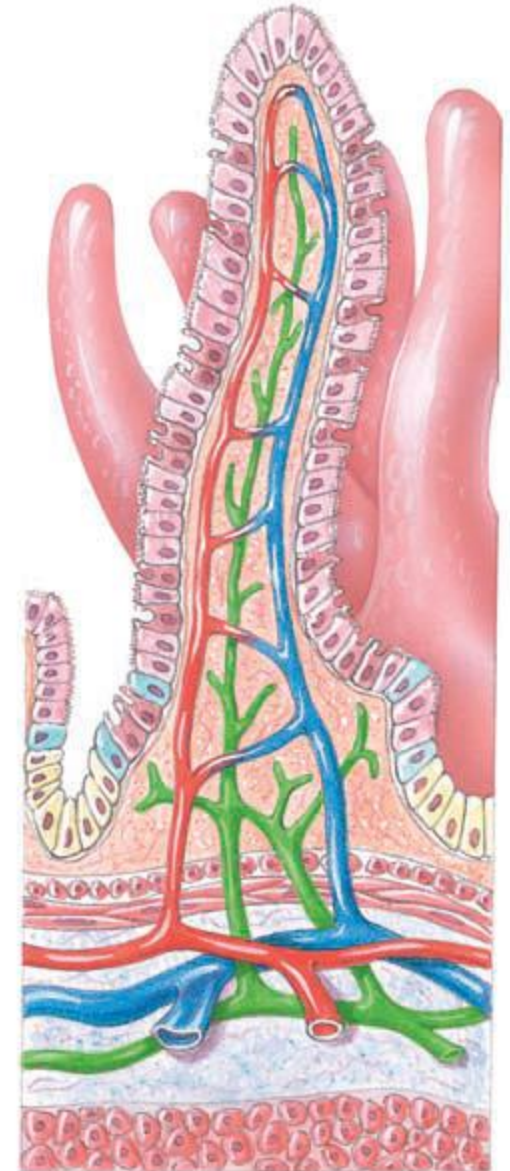
- **Mucus secreting cells.**
- Found between the epithelial cell.
- Less in duodenum, more in ileum.
- Apical part is distended with mucinogen granules.
- Golgi apparatus forms a wide cup just below the granules.



- The stem shaped basal part contains the nucleus, numerous rough endoplasmic reticula, and mitochondria.
- Microvilli are restricted to a thin rim of cytoplasm that surrounds the apical part.

# Core of the Villi

- The core of the villus is formed of:
  1. The connective tissue of the lamina propria.
  2. An arteriole, a venule and a lymphatic vessel (lacteal) that are connected to submucosal plexuses.
  3. Smooth muscle fibers derived from the muscularis mucosae that pass into the villus and play an important role in its rhythmic movement.



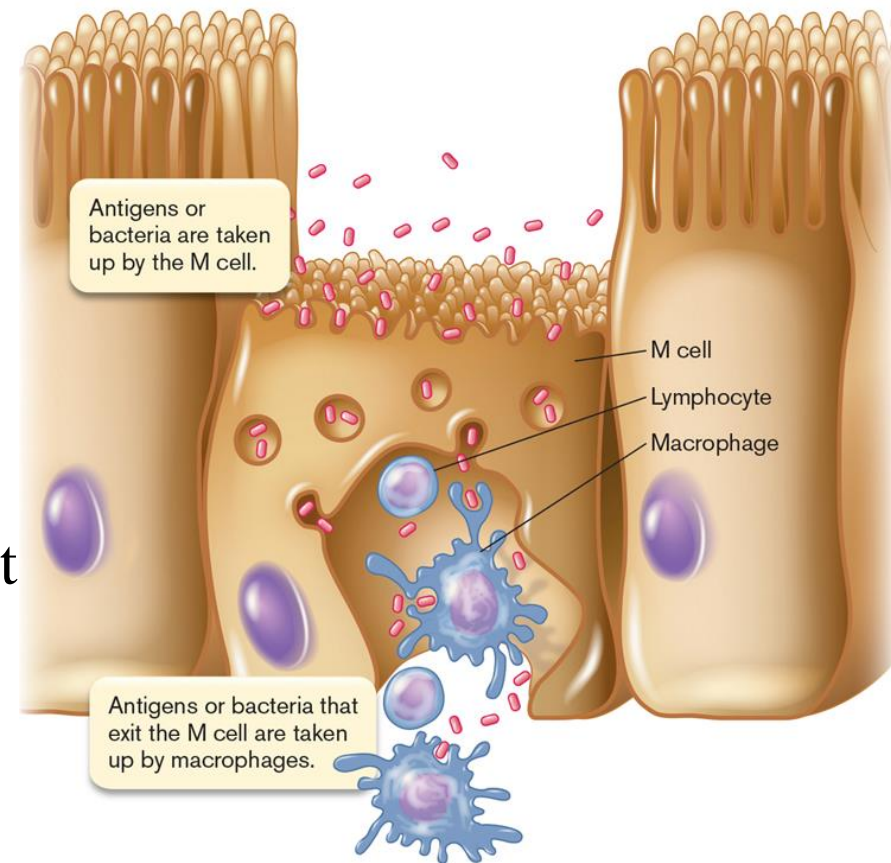


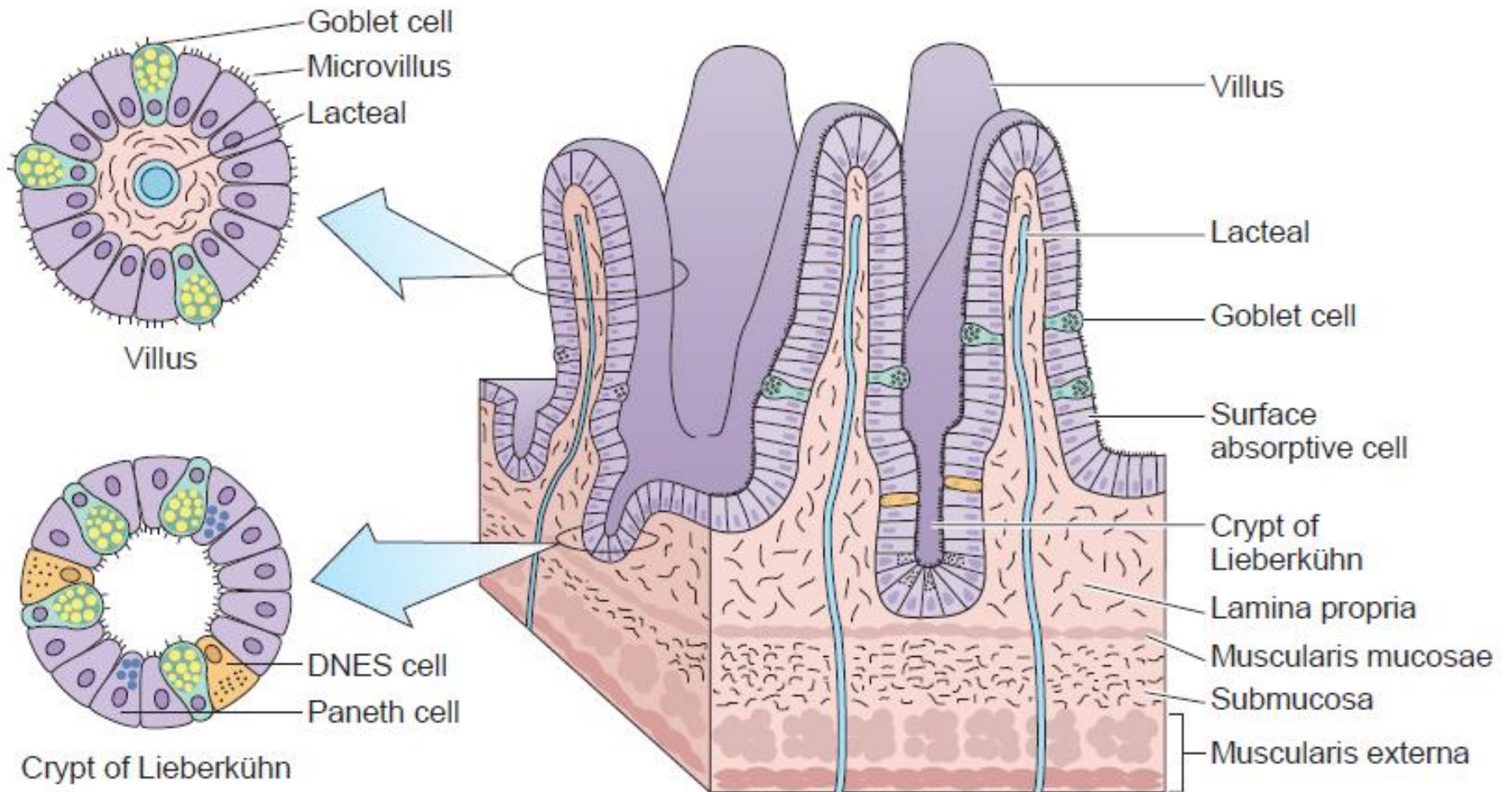
## Cells of the Crypts

- 1) Enterocytes
- 2) Goblet cells
- 3) Enteroendocrine cells (these release cholecystokinin, secretin, motilin and others)
- 4) **Stem cells**: replace all the other cells. Enterocyte produced thus migrate from the crypt to the tip of the villus where they die. This process (cell turnover) takes about 5 days.
- 5) **Paneth cells**: produce various substances into the lumen of the intestine for the non-specific resistance against organisms.

## 6) M (Microfold) cells

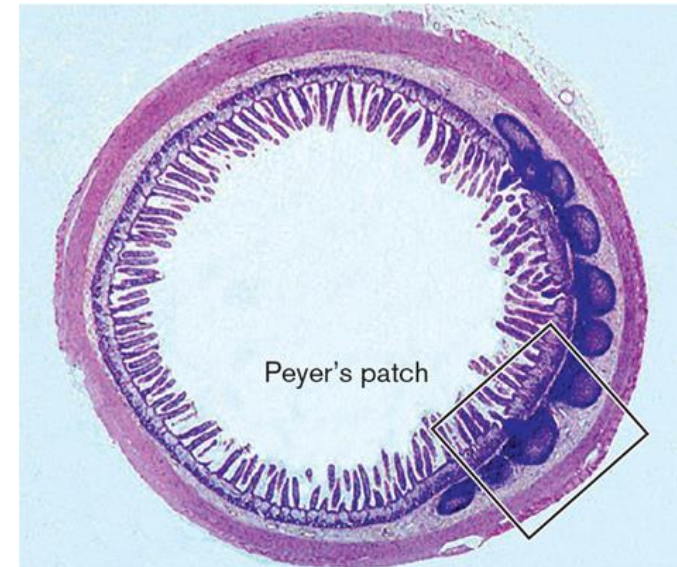
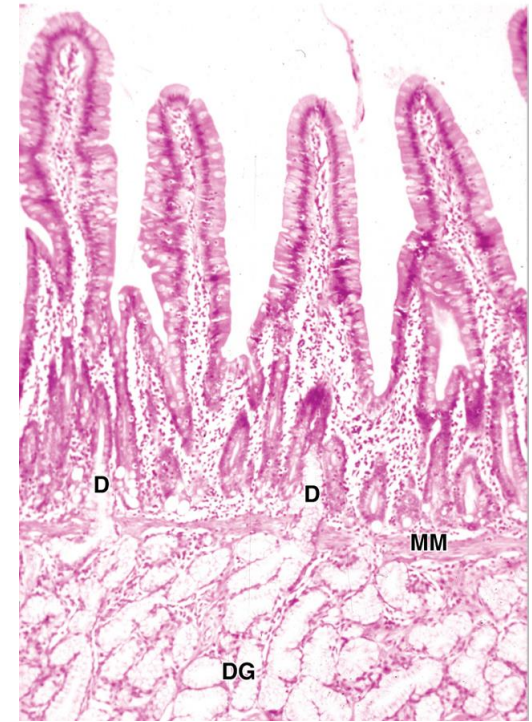
- Present in the ileum overlying Peyer's Patches.
- Apical surface has microfolds.
- Basal surface has a membrane invagination that produces a pocket which contains lymphocytes and macrophages.
- Their function is the **non-specific uptake of antigens from the intestinal lumen**. These antigens are, then, transported to the macrophages and lymphocytes present in the subcellular pockets where they are processed to activate the immune system.





## Other layers

- Submucosa of the duodenum has duodenal (Brunner) glands. These secrete mucus which lubricates intestinal wall, neutralizes gastric acid, and provides optimal pH for the action of the enzymes.
- Submucosa of the ileum has a collection of lymphoid tissue called *Peyer's Patches*. These play an important immune role.
- The submucosa has the submucosal plexus.



- The muscularis externa is formed of two layers. Outer longitudinal and inner circular between which we have the myenteric plexus.
- Serosa is continuous with the mesentery. The parts of the small intestine not covered by peritoneum (parts of the duodenum) are covered only by connective tissue adventitia.

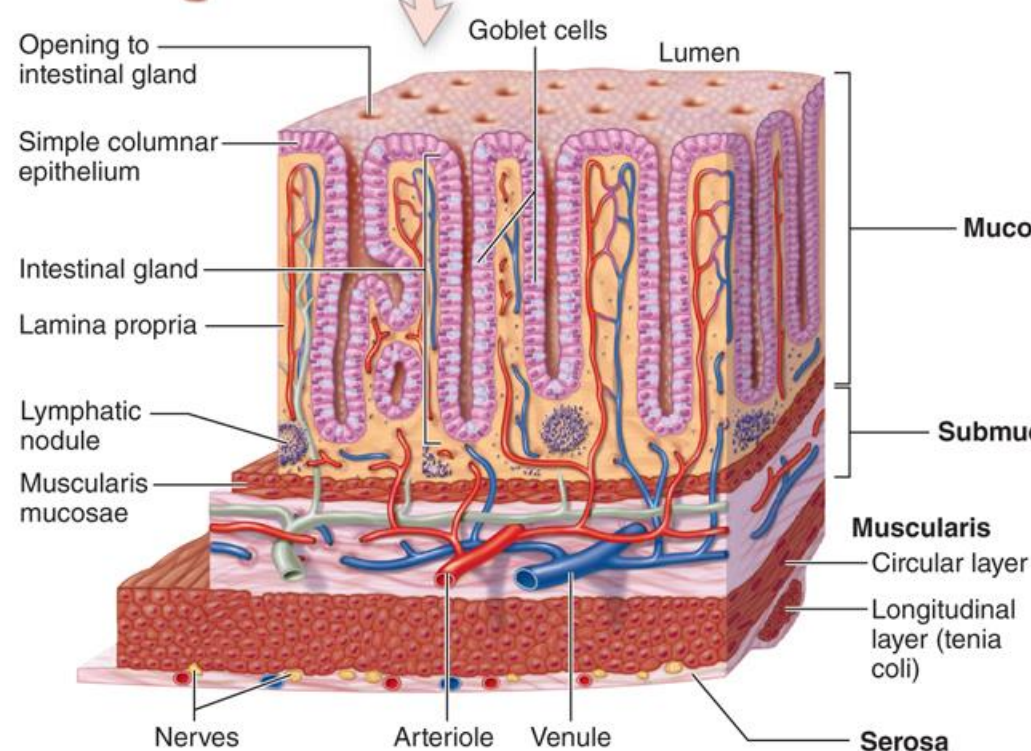
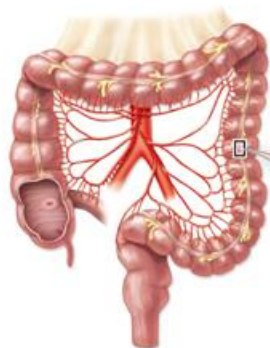


# HISTOLOGY OF THE LARGE INTESTINE

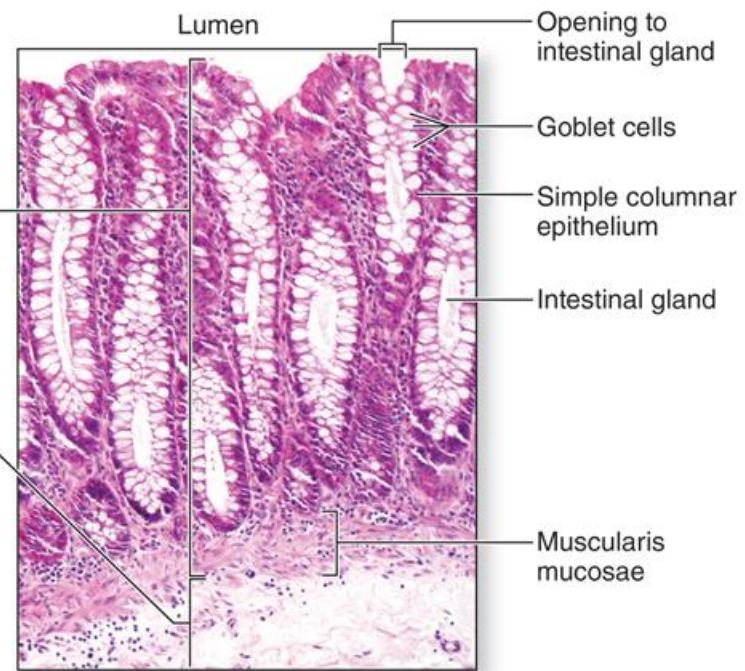
# The Colon

## Mucosa

- The colon is lined by a simple columnar epithelium which passes into the lamina propria to form tubular intestinal glands.
  
- This epithelium is formed of:
  1. *Colonocytes*
  2. *Goblet cells*: these become more numerous as we go distally along this organ (Why?)
  3. *Stem cells*: which are located in the bottom third of each gland.



**(a) Large intestine tunics**



**(b) Large intestine mucosa and submucosa**



## **Colonocytes**

- Columnar cells with oval nuclei.
- Short microvilli at the apical surface.
- Large intercellular spaces between the cells.
- Function: Absorption of water.



## **Lamina propria**

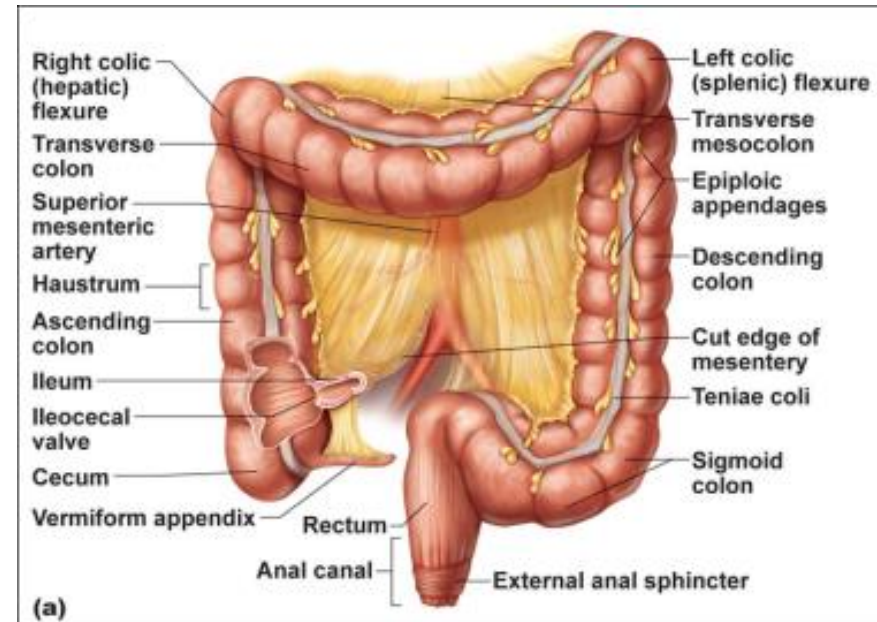
- Rich in lymphatic nodules that extend into the submucosa. This is due to the large bacterial content of the large bowel. This is most prominently seen in the appendix.

## **Mucularis mucosae**

- A layer of smooth muscle cells

## Muscularis externa

- Formed of two layers
  1. Inner circular
  2. Outer longitudinal: in the colon, the muscle cells of this layer aggregate in three bundles called *taenia coli*.
- Taenia coli are shorter than the large intestine. This results in puckering of the colon into large sacs called haustra.

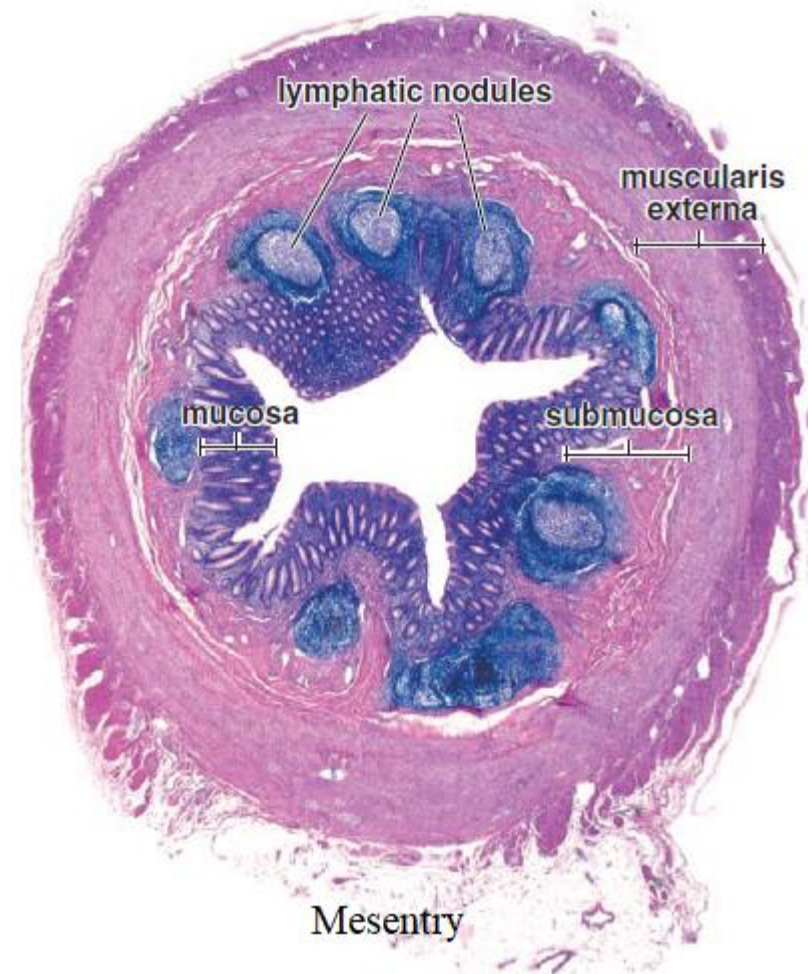


## Serosa/Adventitia

- The intraperitoneal parts of the large intestine are covered by serosa.
- The serosa of the colon forms several pendulous fat-filled sacs called *appendices epiploicae* (omental appendices).

# The Appendix

- Has the same general layout of the large intestine.
- The mucosa and submucosa are filled with a large number of lymphatic nodules with distinct germinal centers.
- The outer longitudinal layer of the muscularis externa is continuous (not divided into bundles).
- The outer serosa is continuous with the mesentery of the appendix.



Thank You