SMALL INTESTINE

- Objectives:

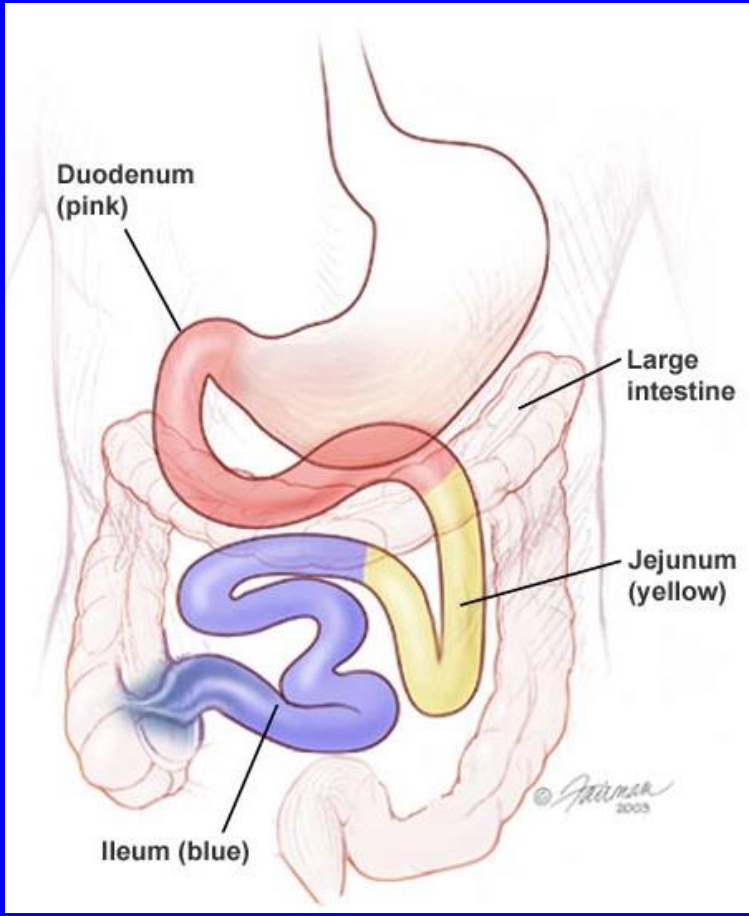
  By the end of this lecture,

  The student should describe the microscopic structure of the three regions of the small intestine:

  1- Duodenum.

  2- Jejunum.

  3- Ileum.

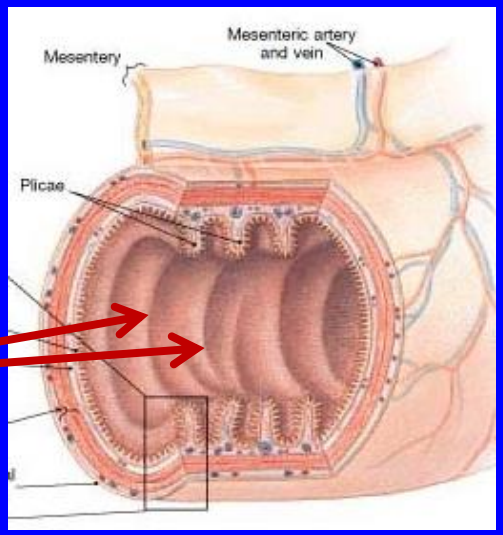


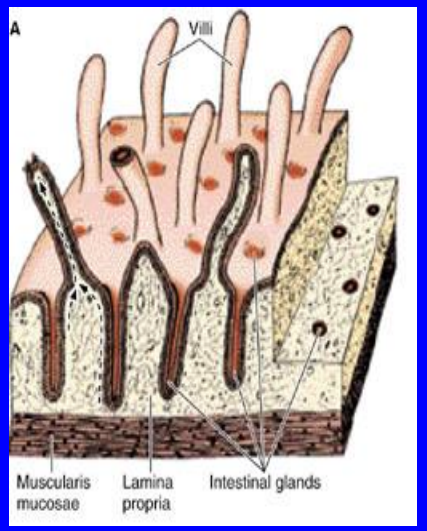
SMALL INTESTINE

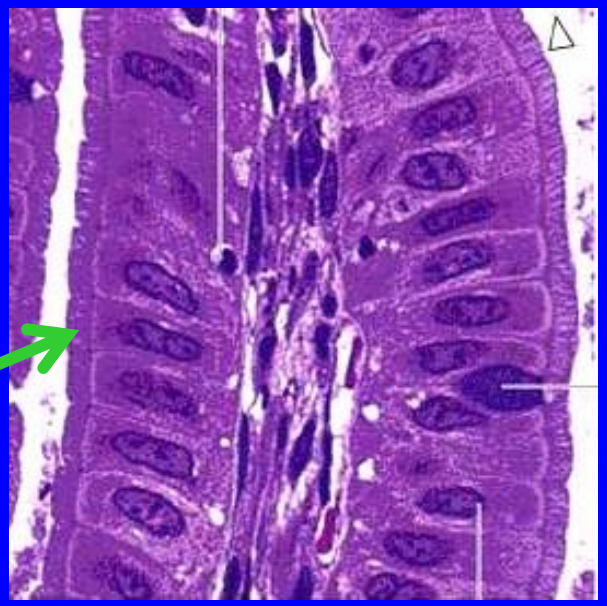
- To increase surface area the mucosa has:
  - Plicae circulares

    (circular folds):

    Permanent folds of the mucosa and submucosa.
  - Villi.
  - Intestinal crypts (crypts of **Lieberkühn**).
  - Microvilli (Brush border).







Duodenum

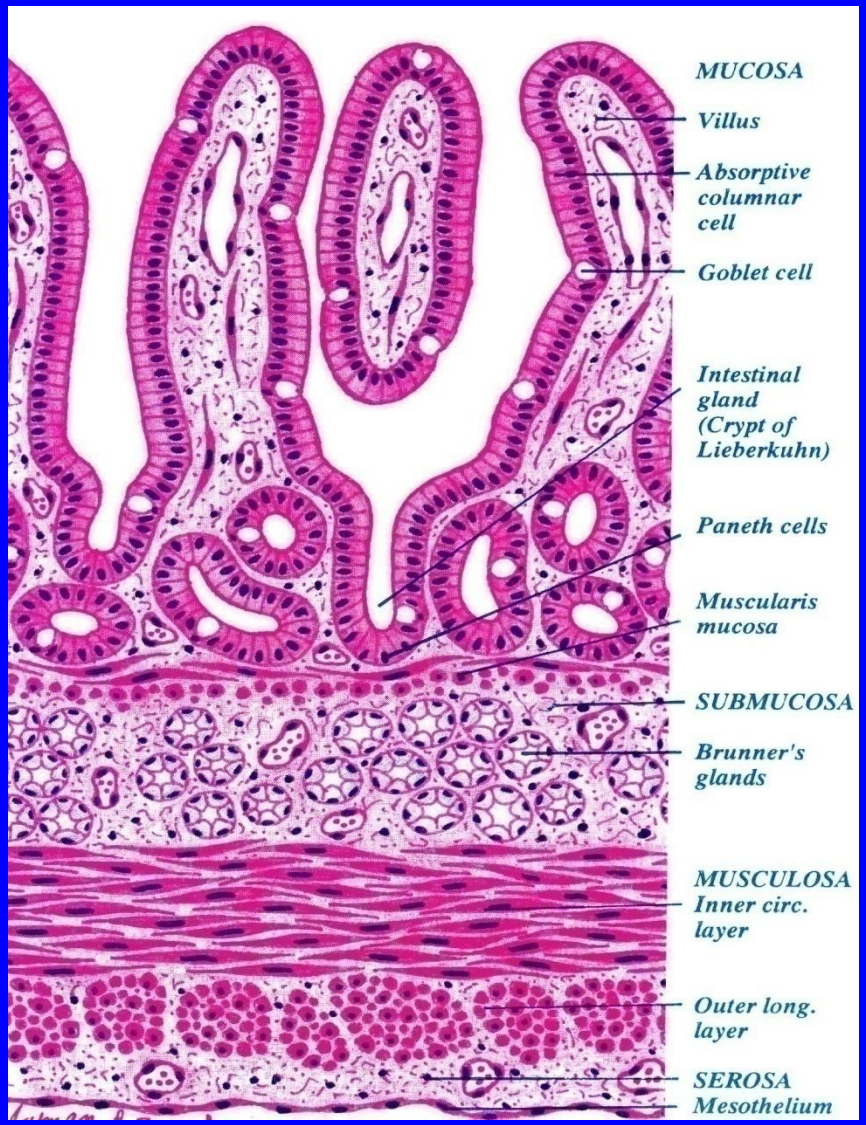
1. Mucosa:

Shows *villi* and *crypts*.

A- Epithelium: simple columnar epithelium with goblet cells.

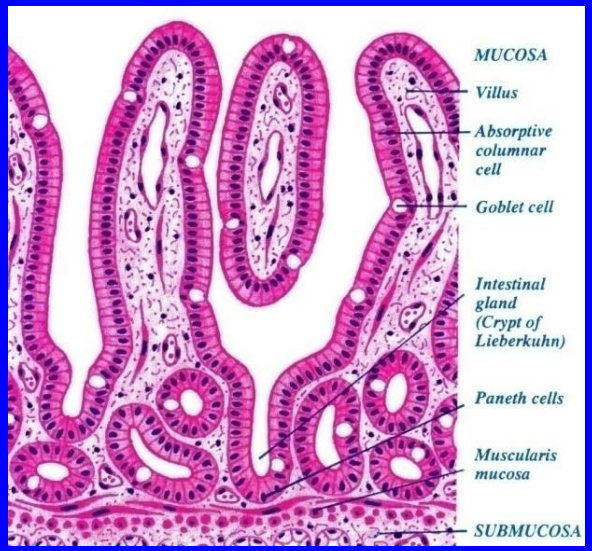
B- Lamina propria: Loose areolar C.T.

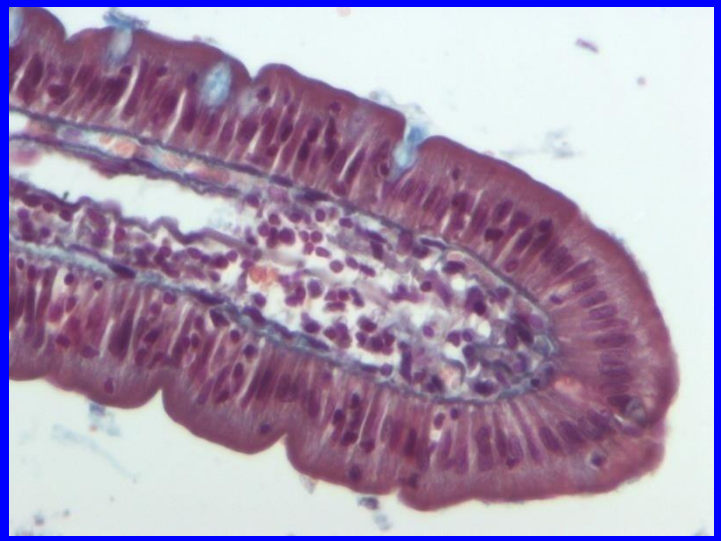
C- Muscularis mucosae: 2 layers of smooth muscle cells.



Intestinal villi

- Each Villus is a finger-like projection of small intestinal **mucosa** and it is formed of:
  - I- Central core of loose areolar C.T. containing:
    - » Lymphocytes.
    - » Plasma cells.
    - » Fibroblasts.
    - » Smooth muscle cells.
    - » Capillary loops.
    - » Lacteal (blindly ending lymphatic channels).
  - II- Villus-covering epithelium.



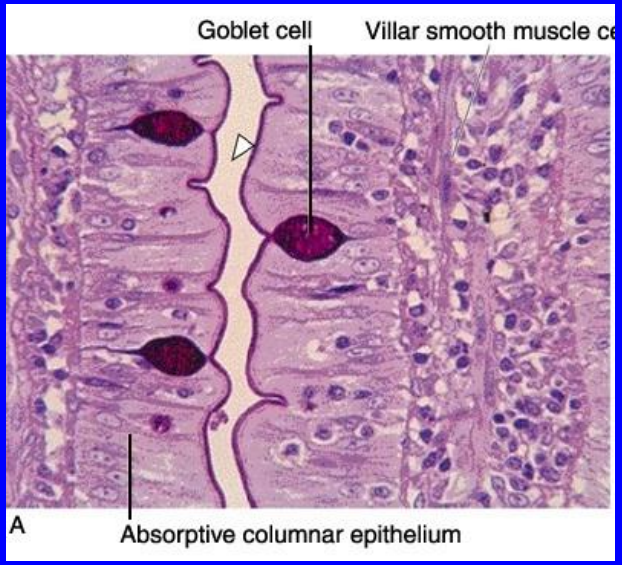


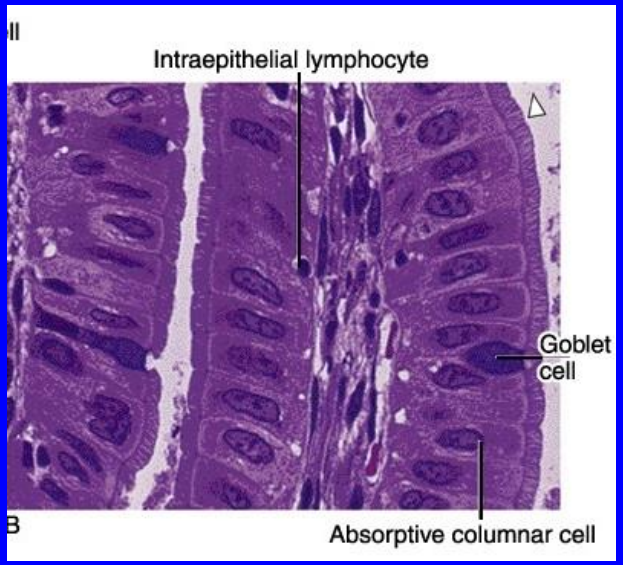
Cells Covering the Villi

1- **Surface columnar absorptive cells:** They have brush border (microvilli). They are covered with thick glycocalx that has digestive enzymes. They have Junction complex (tight, adhering and desmosome junctions).

2- **Goblet cells:** Increase toward the ileum.

3- **Enteroendocrine (EE) cells (DNES cells).**

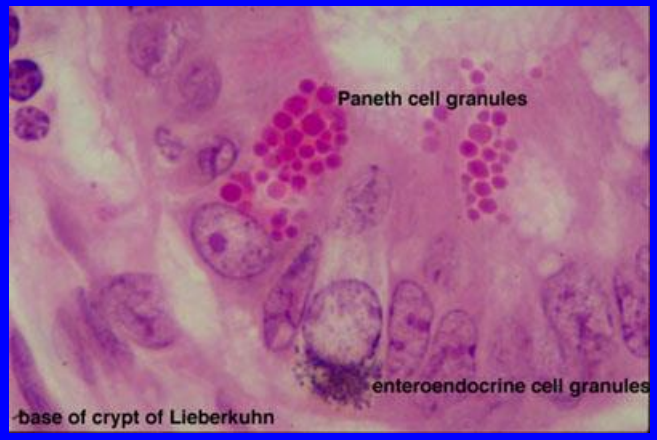


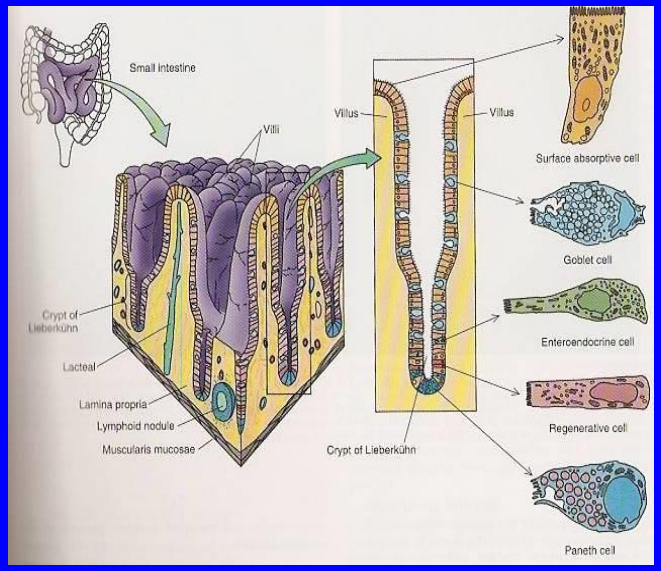


Intestinal Glands (Crypts)

- Simple tubular glands that open between villi.
- Composed of 5 cell types:

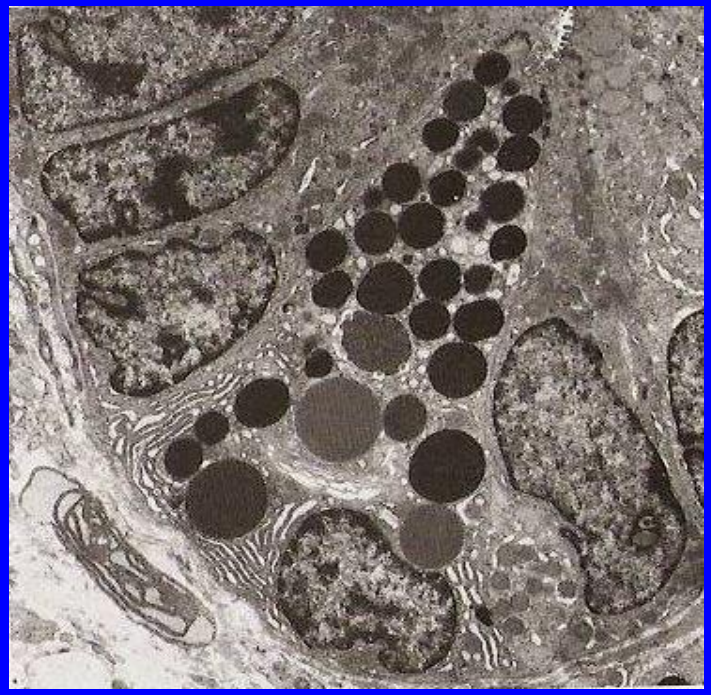
1. **Columnar absorptive cells**.
2. **Goblet cells:**
   secrete **mucus**.
3. **Enteroendocrine (EE) (DNES) cells:**
   secrete **hormones**.
4. **Paneth cells:**
   secrete **Lysozyme** (antibacterial).
   are found in the base of the crypts.
5. **Stem cells:**
   are regenerative cells.
   are found in the base of the crypts.





Columnar Absorptive cells

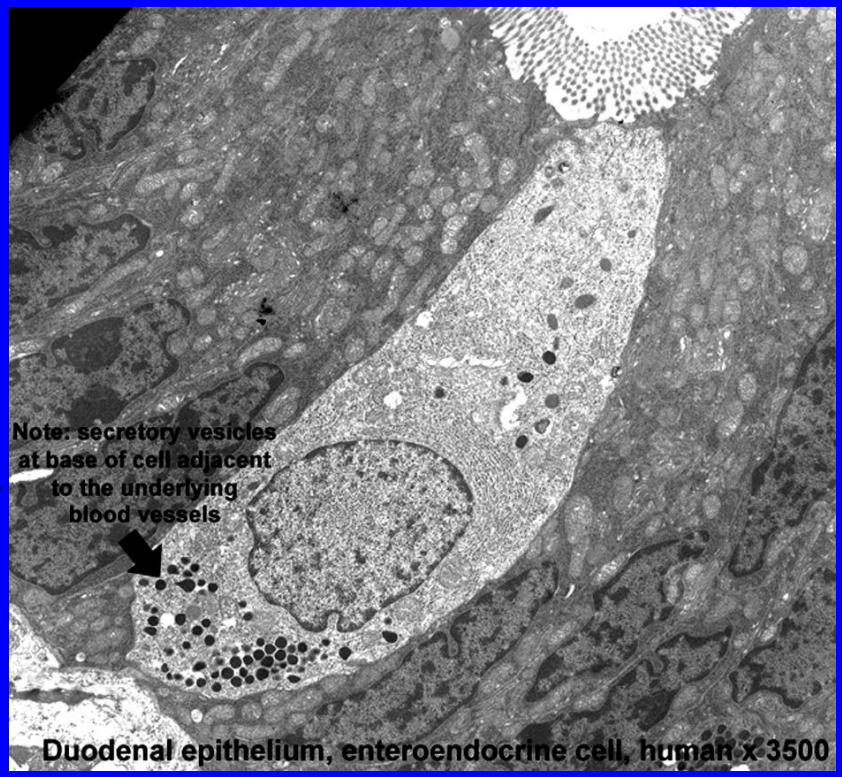
Paneth cell



EE (DNES) cells

EE cells:

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

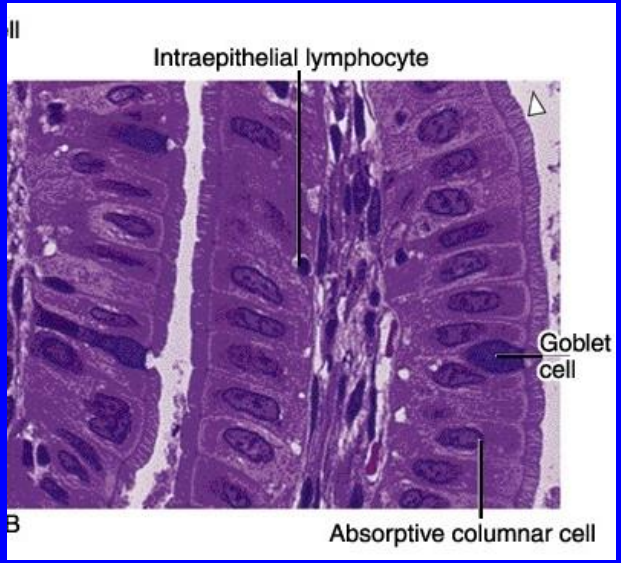


M Cells (Microfold cells)

They are mainly found within the intestinal epithelium overlying lymphatic nodules of lamina propria.

Each is a dome-shaped cell (or specialized squamous cell) with a basal concavity that contains intraepithelial lymphocytes and macrophages.

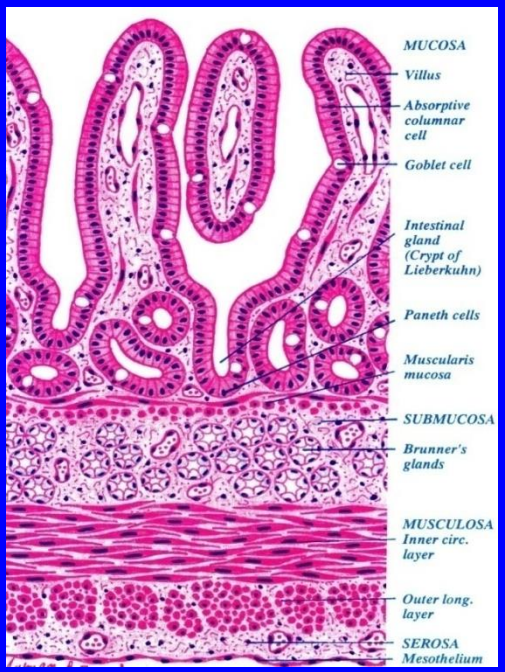
They phagocytose and transport antigens present in the intestinal lumen to the underlying lymphoid tissue cells to initiate the immune response to these antigens leading to the secretion of IgA.



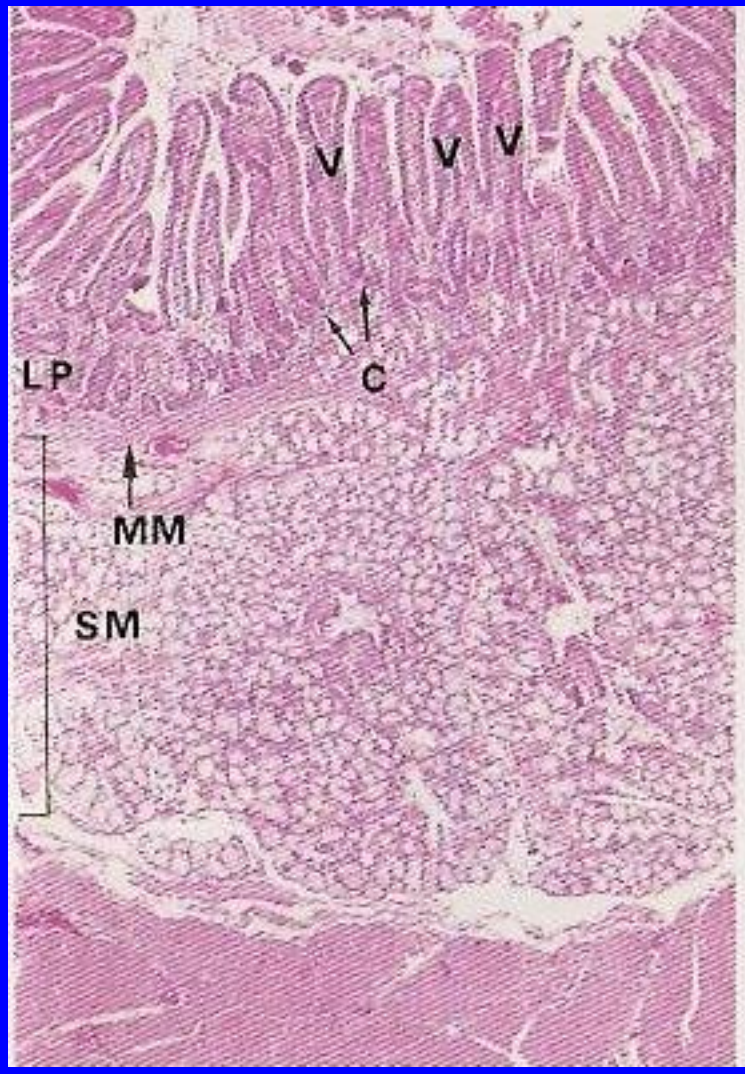
Duodenum

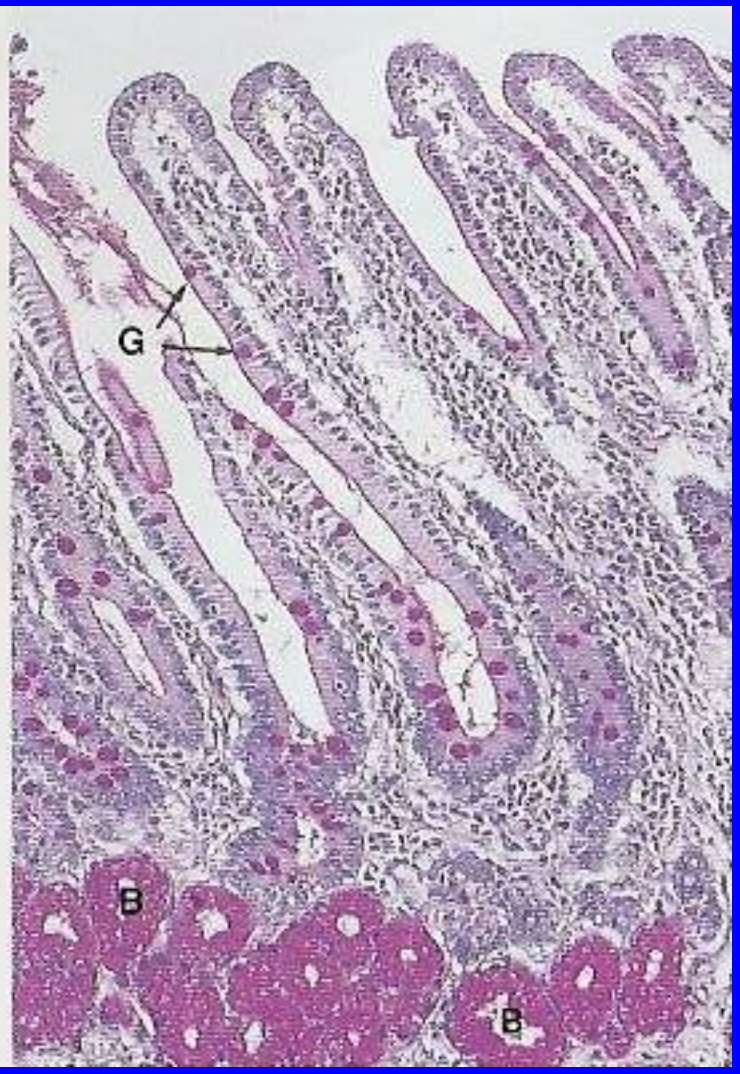
2. **Submucosa:**
   - Connective tissue containing blood vessels & nerves.
   - Contains **Brunner's glands** (secrete mucus).
3. **Muscularis Externa:**
   - 2 smooth muscle layers:
     - » Inner circular layer.
     - » Outer longitudinal layer.
4. **Serosa or Adventitia:**

   Duodenum is invested by a serosa or adventitia.



Duodenum





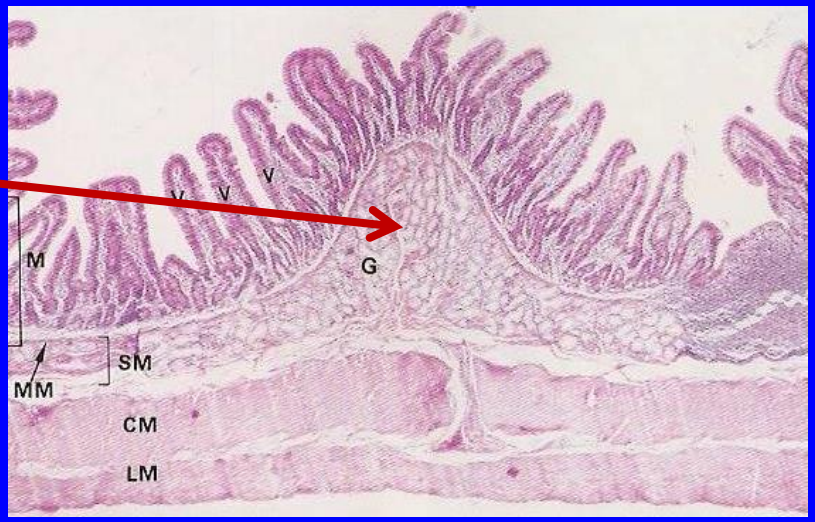
Regional differences of small intestine

- **Duodenum:** Its submucosa has **Brunner's glands**.

  It is invested by serosa or adventitia
- **Jejunum:** has neither Brunner's glands nor Peyer's patches.

  Jejunum is invested by serosa.
- **Ileum:** Its lamina propria, opposite the attachment of the mesentery, has lymphoid nodules (**Peyer's patches**) that extend to the submucosa.

  Ileum is invested by serosa.



GOOD
LUCK