General Feature of Intestine

1. Plicae (circular folds) - valves of Kerckring are permanent
   i. Submucosal connective tissue core
   ii. Slow movement of chyme and increase surface area

2. Villi
   i. Fingerlike projections of mucosa on plicae
   ii. Crypts of Lieberkuhn below
      1) Lumen appears in middle of crypts
      2) Invaginates into underlying lamina propria
   iii. Cells have brush border
   iv. Core is made of lamina propria full of WBCs
   v. Simple columnar epithelium
   vi. Fibers of smooth muscle from muscularis mucosa run in core to contract villi (propels blood, lymph from core)
   vii. In cross section, lumen is outside

3. Microvill
   i. Composed of actin
   ii. Glycocalyx holds digestive enzymes

4. Enteric Nervous System
   i. Huge nervous cells: large, oval cells in small ganglia (<5 cells)
   ii. Meissner's plexus (submucosal)
      1) Controls blood vessels, muscularis mucosa tone, secretion
      2) Located between circular muscle and submucosa
   iii. Auerbach's plexus (myenteric)
      1) Located between longitudinal and circular layers of muscularis externa
      2) Controls muscularis externa

5. Epithelial Cell Types
   i. Enterocytes: absorption; majority of cells
   ii. Goblet cells
      1) Increase as distal
      2) Produce acid glycoproteins (mucins)
      3) Stained by alcian blue or PAS
      4) Clear cytoplasm, just like goblet cells seen earlier
   iii. Enteroendocrine cells
      1) Affect secretory and contractile activities by secreting hormones
      2) Clear cytoplasm, round nucleus, granules are basal
   iv. Paneth cells
      1) Located at base of crypts
      2) Exocrine secretion of lysozyme --> antibacterial
      3) Nucleus towards base, granules apical
   v. Stem cells also visible in lower quadrant of crypts
      1) Each stem cells gives rise to 4 cells lineages
      2) Cells differentiate as they migrate out of crypts and up the villi
      3) Cells at apex slough off into lumen
      4) Entire epithelium turns over every 3-4 days
      5) Each crypt contributes to a small stripe on the villus (multiple crypts/villus)

A. Small Intestine
   1. Duodenum
Ducts open penetrate into muscularis mucosae and open into crypts
1) Secret alkaline mucous to neutralize stomach acid
2) Secret alkaline mucous to neutralize stomach acid
3) Brush border b/c of glycocalyx

1. Submucosal glands (Brunner's glands)
   i. Muscularis mucosae
   ii. Muscularis mucosae
   iii. Muscularis mucosae
   iv. Muscularis mucosae
   v. Muscularis mucosae
   vi. Muscularis mucosae

2. Jejunum and Ileum
   i. Mucosa clearly demarcated from submucosa by prominent muscularis mucosae
   ii. Heavy lymphatic infiltration of lamina propria
   iii. Submucosa appears as irregular connective tissue
   iv. Mitotic figures in crypts
   v. Gut Associated Lymphoid Tissue
      1) 1/4 of mucosa
      2) Plasma cells, Mphages, lymphocytes in lamina propria and submucosa
      3) Intraepithelial lymphocytes - specialized T cells
      4) Lymph nodule in lamina propria
         a) Activated leukocytes go to nearby lymph nodes, activating T + B cells that go to GI mucosa
         b) Plasma cells develop from activated B lymphocytes in follicles and migrate to lamina propria to secrete antibodies
      5) Peyer's Patches: large aggregates of nodules; only in ileum, technically
         a) Covered by M cells specialized for uptake and presentation of antigen to underlying Mphages and lymphocytes
         b) Found in appendix as well
         c) M cell surface surrounds macrophages and other cells in Peyer's patch

B. Large Intestine
1. Colon
   i. No villi
   ii. Thick muscularis mucosae
   iii. Thick inner circular muscle
   iv. Longitudinal muscle is variably present b/c teniae coli do not surround the entire colon
   v. Rich in goblet cells
   vi. Tightly packed crypts
2. Appendix
   i. Mucosa similar to colon
   ii. Muscularis externa has 2 layers like small intestine
   iii. Lymphoid nodules all over submucosa, extend into mucosa
3. Recto-Anal Junction
   i. Narrow zone of transition from columnar epithelium to stratified squamous epithelium
   ii. Non-keratinized proximal, keratinized distally
   iii. Internal sphincter is smooth muscle, external sphincter is skeletal muscle
   iv. Dermal sebaceous glands and adipose tissue in wall of anal canal
   v. Dilated submucosal vessels = "internal" rectal hemorrhoids

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