**8MATRIC NO: 18/MHS01/160**

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**COURSE CODE: ANA 204**

**ASSIGNMENT;** Describe the microanatomy of the small and large intestines. You are expected to state the functions, segments, layers, general features and epithelial of each part of the small and large intestine.

The Gastrointestinal(GI) tract is a tube that goes from the mouth to the anus. The oesophagus carries food from the mouth and throat to the stomach. The stomach receives food from the oesophagus, starts the digestive process and empties partly digested food into the small intestine. The small intestine continues digestion and absorbs nutrients. The large intestine absorbs water from partly digested food, forms it into stool and stores it until it is passed out of the body with a bowel movement.

**MICROANATOMY OF THE SMALL INTESTINE**

The small intestine is a part of gastrointestinal tract where digestion and absorption takes place. The small intestine is a tubular structure within the abdominal cavity that carries the food in continuation with the stomach up to the colon from where the large intestine carries it to the rectum and out of the body via the anus. The main function of this organ is to aid in digestion.

**FUNCTIONS:**

1. **Final stages of food digestion:** The main functions of the small intestine are to break down, or digest, food and to absorb nutrients, such as [electrolytes](https://www.cancer.ca/en/cancer-information/cancer-type/small-intestine/small-intestine-cancer/the-small-intestine/?region=on), vitamins and minerals.
2. **Absorption of food and water:** The small intestine is the most important absorbing organ in the GI tract. About 90% of nutrient absorption takes place in the small intestine.

**SEGMENTS:** It extends from the pylorus of the stomach to the **ileocaecal junction**, where it meets the large intestine at the ileocaecal valve. Anatomically, the small bowel can be divided into three parts:

* 1. **Duodenum**: The most proximal portion of the small intestine is the duodenum. It runs from the pylorus of the stomach to the duodenojejunal junction. The duodenum can be divided into four parts; superior, inferior and ascending . Together these parts form a ‘C' shape, that is around 25cm long, which wraps around the head of the pancreas. It is a short section that receives secretions from the pancreas and liver via the **pancreatic and common bile ducts**. The duodenum functions to mix food with bile and pancreatic enzymes to continue the digestion of carbohydrates, fats, and proteins. The duodenum is supplied by the branches of the [**celiac trunk**](https://www.kenhub.com/en/library/anatomy/celiac-trunk) and [**superior mesenteric artery**](https://www.kenhub.com/en/library/anatomy/superior-mesenteric-artery) (SMA).
  2. **Jejunum:** considered to be roughly 40% of the small gut in man, but closer to 90% in animals. The jejunum constitutes about two fifths of the proximal small intestine and the ileum makes the distal three fifths. No clear demarcation is noted between the jejunum and ileum; however, there are some features which distinguish the jejunum from the ileum. The jejunum has a thicker wall and a wider lumen than the ileum and mainly occupies the left upper and central abdomen. Mesenteric fat is less abundant in the mesentery of the jejunum and vessels in the mesentery are, therefore, well seen. The jejunum functions to absorb most fats and also absorbs carbohydrates and proteins. The jejunum and ileum are supplied by 15-18 branches of the SMA called the jejunal and ileal arteries.
  3. **Ileum:** It is the longest part of the small intestine, measuring about 1.8 meters (6 feet) in length. It is thicker, more vascular, and has more developed mucosal folds than the jejunum. The ileum joins the cecum, the first portion of the large intestine, at the ileocaecal sphincter (or valve). The jejunum and ileum are tethered to the posterior abdominal wall by the mesentery. The superior mesenteric artery is its main arterial supply. The ileum function involves absorption of vitamin B12, bile salts and all digestion products which were not absorbed in duodenum and jejunum. The ileum is supplied by 15-18 branches of the SMA called the ileal arteries.
  4. **Mesentery:** The mesentery is a double fold of peritoneum attached to the posterior abdominal wall. It is fan-shaped with a root of about 15 cm extending obliquely from the left L2 transverse process level to the right sacroiliac joint and crossing the third part of the duodenum, aorta and inferior vena cava (IVC) and right ureter, and a 4- to 6-m periphery, which covers the entire length of the jejunum and ileum. Between the 2 leaves of the mesentery are the mesenteric vessels and lymph nodes.

**LAYERS:** The small intestine is made up of the same 4 layers that make up most of the Gastrointestinal tract.

1. **Mucosa:** The mucosa is a mucous membrane. It is the innermost lining of the small intestine. It contains the columnar epithelium, lamina propria and muscularis mucosae.

Mucosa is much thicker in the jejunum than in the ileum and is arranged in spiral folds called plicae circulares, which appear as valvulae conniventes on plain abdominal radiographs

1. **Submucosa:** The submucosa is a layer of connective tissue that surrounds the mucosa. It contains the blood vessels, lymphatics and the Meissner nerve plexus. The submucosa of the duodenum is the only site of the complex mucus-secreting **duodenal glands** (Brunner’s glands).
2. **Muscularis propria:** The muscularis propria lies outside the submucosa. It is a band of smooth muscle that helps move food through the small intestine.The muscularis propria contains inner circular and outer longitudinal muscles and myenteric (Auerbach) nerve plexus which lies between them.
3. **Serosa:** The serosa is the outermost layer that covers the small intestine. It comprises of loosely arranged fibroblasts and collagen, with the vessels and nerves passing through it. The majority of small intestine serosa is covered by mesothelium. It is formed by the visceral layer of the peritoneum (layers of tissue that cover the outer surface of most organs in the abdomen). The mesentery is attached to the serosa. The serosa covering the organs of the peritoneal cavity is called the visceral peritoneum.

**GENERAL FEATURES:**

1. **Circular folds:** (valves of Kerckring, plicae circulares) are the transverse folds of mucosa found predominantly in the distal duodenum and proximal jejunum. These folds facilitate absorption. Their shape causes the chyme to spiral, rather than move in a straight line, through the small intestine. Spiraling slows the movement of chyme and provides the time needed for nutrients to be fully absorbed.
2. **Intestinal villi** are fingerlike extensions of intestinal mucosa which project into the lumen of the small intestine. Between the villi are intestinal glands (crypts of Lieberkuhn) which secrete intestinal juice rich in digestive enzyme.

Each villus contains a capillary bed composed of one arteriole and one venule, as well as a lymphatic capillary called a **lacteal**. The breakdown products of carbohydrates and proteins (sugars and amino acids) can enter the bloodstream directly, but lipid breakdown products are absorbed by the lacteals and transported to the bloodstream via the lymphatic system.

1. **Microvilli**are projections found on the apical surface of each intestinal cell (enterocyte). There are an estimated 200 million microvilli per square millimeter of small intestine, greatly expanding the surface area of the plasma membrane and thus greatly enhancing absorption.
2. **Peyer's patches**are part of gastrointestinal associated lymphoid tissue (GALT). They are found in ileum and they serve to keep bacteria from entering the bloodstream. Peyer’s patches are most prominent in young people and become less distinct as you age, which coincides with the general activity of our immune system.
3. **Brunner glands** are found in the submucosa of the duodenum. They produce mucus rich in alkaline which protects the duodenum from the corrosive effects of gastric acid.

**EPITHELIUM:**

1. **Duodenum:** It is lined by the simple columnar epithelium(lamina epithelialis), a connective tissue layer (lamina propria) and a smooth muscle layer (lamina muscularis).
2. **Jejunum:**

* Mucosa- lined by simple columnar epithelium, contains crypts of Lieberkuhn and intestinal villi.
* Tunica serosa- lined by simple squamous epithelium and a connective tissue layer underneath(lamina propria serosae).

1. **Ileum:** Its mucosa is lined by simple columnar epithelium, also contains Peyer’s patches.

**CLINICAL RELEVANCE**

* Coeliac disease: It is a condition which causes inflammation of the small intestine.
* Abdominal distention in children.

**MICROANATOMY OF LARGE INTESTINE**

The large intestine is that part of the digestive tube between the terminal ileum and anus.

The large intestine, which is the terminal part of gastrointestinal (GI) tract, is so called because its lumen (diameter) is larger, not because its length is greater, than that of the [small intestine](http://emedicine.medscape.com/article/1948951-overview) (duodenum, jejunum, ileum); in fact, small intestine is longer than the large intestine. The large intestine develops partly from the midgut (from cecum to distal transverse colon), the hindgut (from distal transverse colon to dentate line in anorectum), and proctodeum (below the dentate line).

**FUNCTIONS**

* 1. reabsorption of water and mineral ions such as sodium and chloride.
  2. formation and temporary storage of faeces
  3. maintaining a resident population of over 500 species of bacteria
  4. bacterial fermentation of indigestible materials
  5. Chemical digestion by gut microbes

**SEGMENTS:**

1. **Caecum(*intestinum cæcum*)**: It is the proximal blind end (pouch) of the ascending (right) colon, is a blind cul-de-sac below the level of the ileocecal junction that lies in the right iliac fossa. The terminal ileum opens into the cecum at its medial wall, and the opening is guarded by an ileocecal valve.

**The appendix( an appendage of the caecum):** also called vermiform process or vermiform appendix, is a tubular structure with a blind end attached to the cecum. The base of the appendix lies on the posteromedial wall of the cecum 1-2 cm below the ileocecal junction. The tip of the appendix, however, floats in the peritoneal cavity and may be pelvic, preileal, postileal, or even retrocecal in position

### **Colon:** The cecum blends seamlessly withthe colon. Upon entering the colon, the food residue first travels up the ascending colon on the right side of the abdomen.

The colon consists of four parts:

* Ascending colon: Using muscle contractions, this part of the colon pushes any undigested debris up from the cecum to a location just under the right lower end of the liver.
* Transverse colon: Food moves through this second portion of the colon, across your front (or anterior) abdominal wall, traveling from left to right just under your stomach.
* Descending colon: The third portion of colon pushes its contents from just near the [**spleen**](https://www.chp.edu/our-services/transplant/liver/education/organs/spleen-information), down to the lower left side of your abdomen.
* Sigmoid colon: The final S-shaped length of the colon, curves inward among the coils of your small intestine, then empties into the rectum.

1. **Rectum**: It lies in the concavity of the sacrococcygeal hollow and changes to the anal canal at the anorectal angle created by the puborectal sling formed by the innermost fibers of the levator ani muscle.
2. **Anal Canal**: The anal canal is related to the perineal body in front and the anococcygeal body behind. This 3.8–5 cm (1.5–2 in) long structure opens to the exterior of the body at the anus. The anal canal includes two sphincters. The internal anal sphincter is made of smooth muscle, and its contractions are involuntary. The external anal sphincter is made of skeletal muscle, which is under voluntary control. Except when defecating, both usually remain closed.

**LAYERS**

1. **Mucosa**: Includes a columnar epithelium with large number of mucus-secreting goblet cells (villi; present in small intestine; absent in colon), lamina propria, and muscularis mucosa; the appendix is rich in mucosa-associated lymphoid tissue (MALT)
2. **Submucosa**: mixture of irregular connective and adipose tissue, numerous blood vessels, and several excellent examples of ganglion cells and nerves. Also Contains the blood vessels and Meissner nerve plexus.
3. **Muscularis propria**: Contains continuous inner circular and outer longitudinal muscles arranged in bands and myenteric (Auerbach) nerve plexus; tenia coli are formed by bands of the outer longitudinal muscles (tenia are present in the colon only and are not present in the rectum, where the outer longitudinal muscle is continuous)
4. **Serosa**: Visceral peritoneum

**GENERAL FEATURES**

1. **Omental** **or** **epiploic appendages**are fat filled pouches of [peritoneum](https://www.kenhub.com/en/library/anatomy/the-peritoneum) that are attached externally to the walls of the large intestine.
2. **Teniae coli**are three longitudinal bands of [smooth muscle](https://www.kenhub.com/en/library/anatomy/smooth-muscle) located underneath the peritoneum that extend along certain sections of the large intestine. Their contractions facilitate the peristaltic action of the large intestine, propelling the fecal matter and forming the haustra.
3. **Haustra**are sacculations that occur along the large intestine, providing it with its characteristic ‘baggy’ aspect. They are created by **semilunar folds** on the internal surface of the large intestine.
4. **The ileocaecal valve** controls the entry of material from the last part of the small intestine called the ileum.

**EPITHELIUM**

1. **Colon:** The **mucosa** of the colon is lined by a simple columnar epithelium with a thin brush border and numerous **goblet cells**
2. **Caecum: Simple columnar epithelium**
3. **Appendix:** It is lined by the simple columnar epithelium.
4. **Anal canal:** It is lined by non-keratinised stratified squamous **epithelium** (known as the **anal** pecten).
5. **Recto-Anal Junction:**

* Transitional epithelium: The anal canal is the site where there is a transition from the simple columnar epithelium of the colon to the stratified squamous epithelium of skin (the pectinate line).

The mucosa of the small intestine is lined by a simple **columnar epithelium** which consists primarily of absorptive **cells** (**enterocytes**), with scattered goblet **cells** and occasional enteroendocrine **cells**. In crypts, the epithelium also includes Paneth **cells** and stem **cells**.

**CLINICAL RELEVANCE**

* Spastic colon; also called irritable bowel syndrome, is more than just a colon problem. It is the spontaneous contractions or loss of movement of the muscles in the small and large intestine
* Colon dysplasia is when a spot of cells on the lining of the colon look abnormal under a microscope.

Polyps are an abnormal growth of tissue on the inner lining of the colon or rectum that are benign.