Learning objectives

After you complete this module, you should be able to:

- Identify and describe the anatomy, morphology, and function of the gastrointestinal (GI) tract
- Discuss the epidemiology of colorectal cancer (CRC)
- Discuss the risk factors for CRC that you can modify and the ones you cannot
- Describe the mutations that drive oncogenic signaling in CRC
- Review the signs and symptoms of CRC and how to diagnose them
- Examine the classifications of colorectal tumors

Unit 1: Structure and function of the gastrointestinal tract

Gross anatomy of the GI tract

The GI tract is a long hollow tube made up of segments that perform specific tasks. One segment breaks down food into its component nutrients. The next segment absorbs these nutrients into the blood, while another excretes waste products.[1]

The GI tract contains the following parts (Figure 1):[1]

- Mouth, pharynx, and esophagus. These start the physical breakdown and chemical digestion of food and move food into the stomach.
- Stomach. Here, acid and enzymes break down food and promote a small amount of nutrient absorption.
- Small intestine (duodenum, jejunum, ileum). The final breakdown of food occurs here. It is the main site of nutrient absorption.
- Large intestine (colon, rectum). This site absorbs water and electrolytes. It also forms and regulates the removal of feces.

Overall, the GI tract is 9 m in length (30 feet) from the mouth to the anus.[1] The liver, gallbladder, and pancreas are accessory digestive organs. These organs release enzymes and other factors that aid the process of digestion.[1]

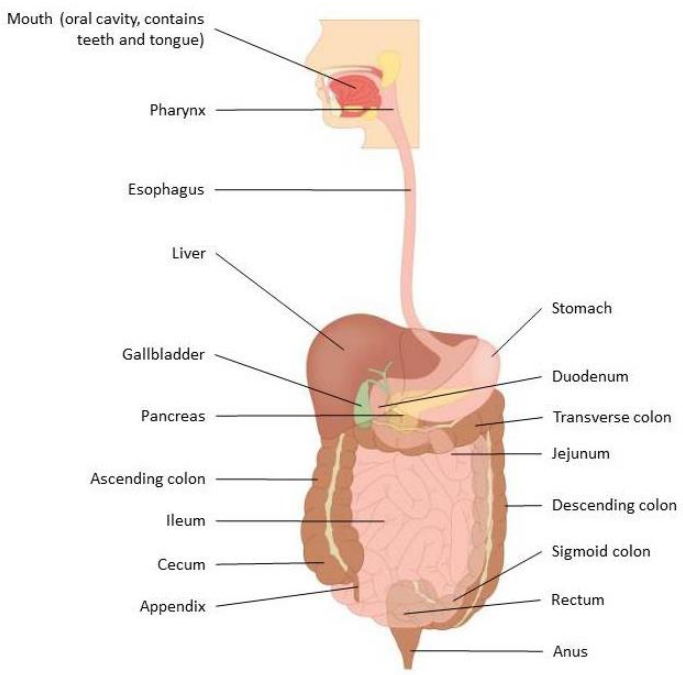

Figure 1: Major structures and organs of the GI tract

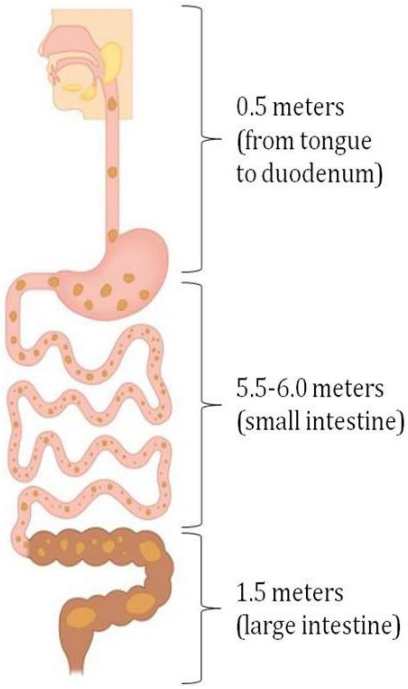

Figure 2: Segments of the GI tract

Take a closer look

Diet has been shown to influence the risk for developing CRC Studies show that when you eat foods high in fiber, like fruits and vegetables, and avoid foods high in fat, you may lower the risk of developing CRC.[2] Also, vitamins and minerals, like vitamin D, calcium, and magnesium, may help prevent CRC. These nutrients are co-factors that support digestion.[2]

Histology and morphology of the GI tract

The tissues of the GI tract and colon are made up of layers that surround a central opening.[1]

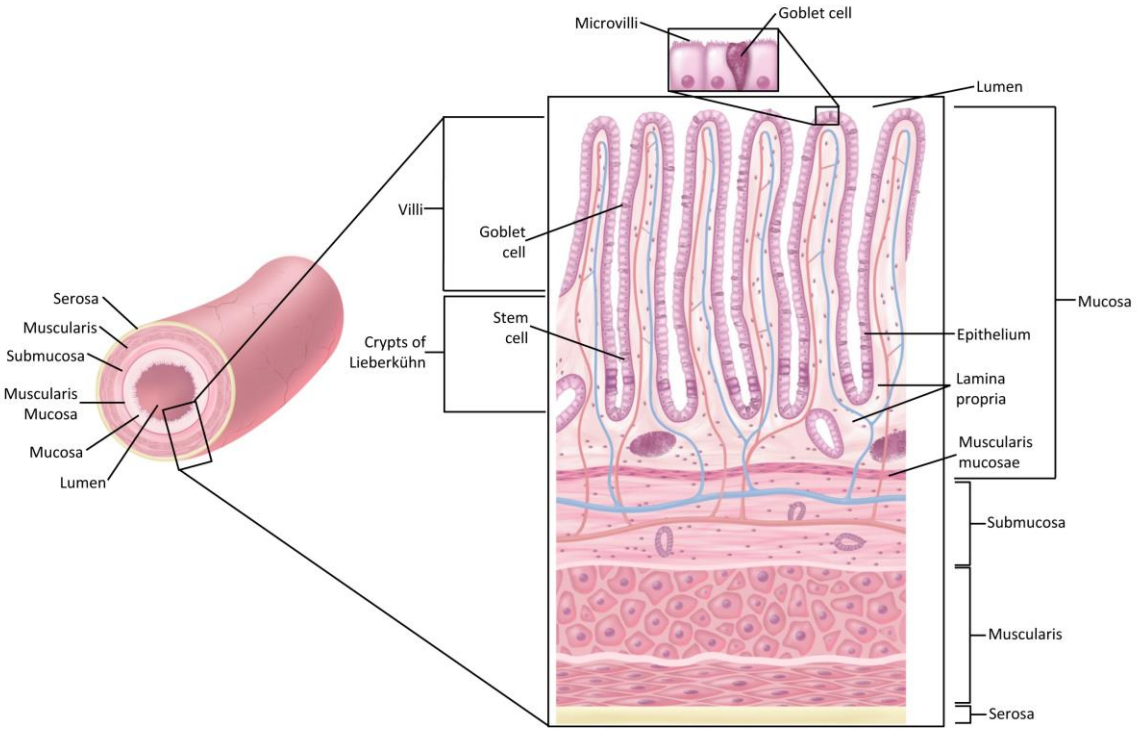

Figure 3: Histology and morphology of the GI tract[1]

- The lumen is the interior space of the hollow tube that forms the GI tract.[1]
  - Much of the inner wall of the GI tract is made up of villi that project into the lumen.[1] These projections increase the overall surface area of the epithelium; these sites absorb digested food.[1]
- The mucosa consists of three sublayers: the epithelium, lamina propria, and muscularis mucosae.[1]
  - Highly specialized epithelial cells line the villi of the GI tract wall. These cells come into direct contact with the contents of the intestines and absorb nutrients.[1] Sometimes microvilli cover the epithelial cells. These microvilli form a brush-like border and further increase the surface area.[1] Neighboring epithelial cells join tightly to stop substances in the GI tract from leaking.[1] Goblet cells that secrete mucous lay among these epithelial cells.[1]

    - The crypts of Lieberkühn are also called intestinal crypts. They form tube-like notches around the villi.[1,3] The crypts have a lining of younger epithelial cells; these cells secrete digestive enzymes.[1,3] The base of the crypts has stem cells that form new epithelial cells.[3] The new cells multiply, then migrate up the side of the crypt as they develop.[3]
  - The lamina propria is a layer of connective tissue. It contains many blood and lymphatic vessels.[1] The nutrients that you absorb release into these vessels.[1]
  - The muscularis mucosae is a layer of smooth muscle within the mucosa.[1] The muscle in the mucosa allows the epithelial cells to stretch and fold. This maximizes the area that is available to absorb nutrients.[1]
- The submucosa surrounds the mucosa. This region contains the major blood and lymphatic vessels of the GI tract. It also contains the nerves that control the contraction of the muscles of the GI tract.[1]
- The muscularis is a thick layer of smooth muscle that surrounds the submucosa.[1] The contractions of the muscularis propria enable **peristalsis** to take place. Its movements break down food and propel it along the length of the GI tract.[1]
- The serosa is the outermost layer of the GI tract. It is made of **connective tissue** and is continuous with the peritoneum. The peritoneum holds the structures of the GI tract in place in the abdomen.[1]

Take a closer look
The inner lining of the GI tract is the mucosa, which is made up of epithelial cells.[1]

Focus on the colon

The colon is part of the large intestine. The four sections of the colon are the ascending, transverse, descending, and sigmoid colons.[1] The morphology of the colon and rectum is slightly different from the rest of the GI tract.[1]

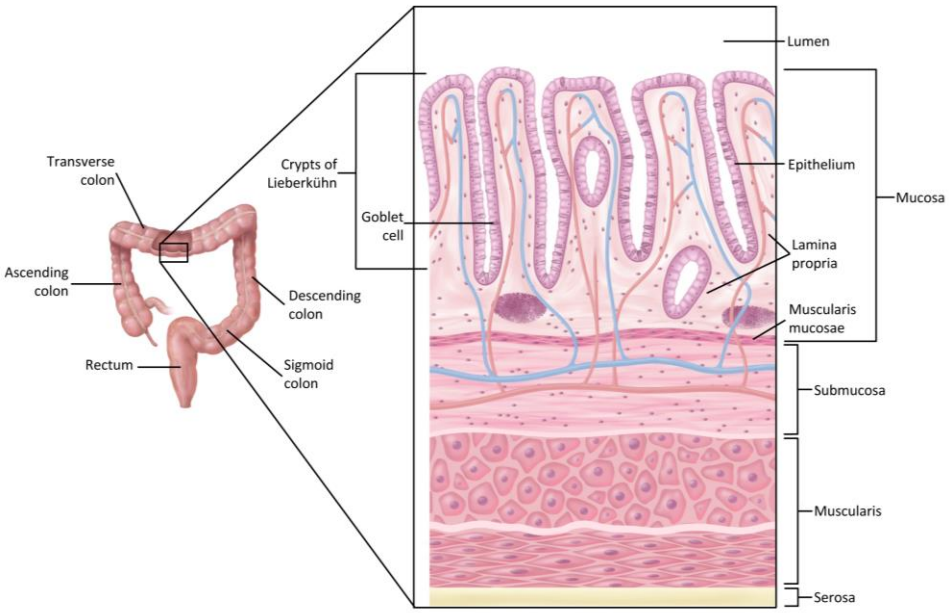

Figure 4: Anatomy and morphology of the colon[1]

The mucosa of the colon is largely formed by specialized epithelial cells. Some absorb (to reabsorb water), and others secrete (to produce mucus that lubricates the lumen). Unlike the small intestine, the mucosa does not form villi. But it has crypts of Lieberkühn and goblet cells.[1] Like the small intestine, the cells that absorb contain microvilli.[1]

The **muscularis** of the large intestine is thicker than that of the small intestine. It consists of an external layer of smooth muscle and an internal layer of circular smooth muscle.[1] This enables the large intestine to push large volumes along using peristalsis.[1]

The rectum forms the final 20 cm (8 inches) of the GI tract.[1] This structure is a muscular bag that holds feces until they are pushed out of the body.[1] The anal canal makes up the last 2-3 cm (1 inch) of the rectum.[1] No digestion or absorption occurs in the rectum. However, it contains the same muscular layers as the colon to push out waste.[1]

Take a closer look

The mucosa of the colon contains epithelium that absorb and secrete. The epithelium has microvilli that extend into the lumen.

The highest incidence of colorectal tumors is in the sigmoid colon and the rectum.[4]