While it may look like a narrow tube, its absorptive surface area is actually about 250 square meters (almost 2,700 square feet). That’s the size of a tennis court! Let’s take a look at the segments of the small intestine, their roles in digestions, and the tiny structures that maximize not only the small intestine’s surface area but also its absorption capability!
OVERVIEW OF THE SMALL INTESTINE

The small intestine is a portion of the alimentary canal, about seven meters long, within the abdominal cavity. The mucosa that lines the inside of the small intestine is covered with numerous villi (sing. villus) that maximize the surface area for absorption.

The small intestine’s role in chemical digestion and nutrient absorption cannot be overstated. Within the small intestine, nutrients, water, and ions from the food we eat pass into the bloodstream. Secretions from the pancreas and liver help break down larger molecules.

The small intestine consists of three segments: the duodenum, the jejunum, and the ileum.
WHAT IS A VILLUS?

A villus is a small, fingerlike projection of the epithelial lining of the intestinal wall. Its role is to increase surface area and aid in the absorption of nutrients and fluids. The walls of the small intestine are covered in villi and microvilli (villi found in the cell membrane).

Intestinal villi absorb nutrients from chyme (a mix of gastric juices and partially-digested food from the stomach, as well as digestive enzymes from the liver and pancreas) through columnar epithelial cells of the mucosa (innermost layer of the small intestine where chyme passes through the villus), called enterocytes.

In the core of each villus, amino acids and sugars enter the bloodstream via a dense capillary network, whereas digested lipids enter the lymphatic system via a lymphatic capillary called a lacteal.

Intestinal villi are largest in the duodenum, ranging from .5 to 1.6 mm in length.
**SECTIONS OF THE SMALL INTESTINE:**

**DUODENUM**

The *duodenum* is the first segment of the small intestine, where the absorption of nutrients begins. It is short and wide — only 25cm long! Its role is to receive chyme.

Chyme passes from the stomach into the duodenum through the pyloric sphincter. Bile from the liver and pancreatic juices from the pancreas mix where the pancreatic duct and common bile duct converge, then pass into the duodenal papilla when the sphincter of Oddi is relaxed to aid in chemical digestion and to reduce acidity of the gastric juices.
SECTIONS OF THE SMALL INTESTINE:

**JEJUNUM**

The next stop is the **jejunum**, the middle portion of the small intestine. It is approximately 2.5 m long with a diameter of about 4 cm, and is defined as the upper two-fifths of the remaining small intestine. The jejunum is thicker, darker in color, and more vascular than the ileum (the third segment of the small intestine), with large circular folds of submucosa called **plicae circulares**. Its villi are larger than the ileum’s, as well.

The jejunum is attached to the posterior abdominal wall by the **mesentery**, an extensive fold of the peritoneum that allows free motion. This means each coil can adapt to changes in form and position.


**SECTIONS OF THE SMALL INTESTINE:**

**ILEUM**

The ileum is the longest segment of the small intestine at about 3.5 m long, and is defined as the lower three-fifths of the remaining small intestine. The walls of the ileum are thinner and less vascular than those of the jejunum. Its few plicae circulares are small and disappear gradually.

The terminal part of the ileum usually lies in the pelvis and comes to an end at the ileocecal sphincter, which acts as a valve to prevent backflow of material from the cecum. The cecum is located at the beginning of the large intestine, the site of the final steps of nutrient absorption and the first stages of turning liquid waste into solid waste.

The mesentery anchors the ileum to the posterior abdominal wall while allowing the coils of the ileum to move freely, as it does for the jejunum.
As we stated before, the mesentery is attached to the small intestine. It is an extensive fold of peritoneum that supplies the small intestine with blood vessels, lymphatic vessels, and nerves and allows free motion so that each intestinal coil can adapt to changes in form and position.

The outermost layer of the small intestine is the serosa, which is continuous with the mesentery. It contains blood vessels and nerves, and it secretes fluid to lubricate the small intestine, protecting it from damage due to friction.
1&2. Under the serosa is the **longitudinal muscle layer**. This muscle, in conjunction with the **circular muscle**, contracts in peristaltic waves, moving food through the intestines. The longitudinal muscle shortens the tract to facilitate the movement of chyme, while the circular muscle prevents chyme from traveling backwards.

3. The **submucosa** is composed of dense connective tissue to support the mucosa and connect it to the muscular layers. It also contains blood vessels, lymphatic vessels, and nerves to supply the mucosa.

4. Next is the **muscularis mucosae**, which comprises several thin layers of smooth muscle. It gently stimulates the mucosa and intestinal glands, helping to expel chyme and enhancing contact between mucosa and chyme in the lumen.

5. The **mucosa** is the innermost layer; it surrounds the lumen through which the chyme passes. It has three principal functions: protection of the inner environment, secretion, and absorption. The mucosa contains many circular folds and is covered in millions of villi.
The peritoneum is a serous membrane composed of mesothelium and connective tissues that lines the abdominal and pelvic cavities and surrounds the abdominal organs.

It has two layers: the parietal peritoneum, which is attached to the walls of the abdomen and pelvis, and the visceral peritoneum, which covers the internal organs.

The peritoneal cavity is the fluid-filled space between the parietal and visceral peritoneum. This fluid allows the organs of the abdominal and pelvic cavities to move past one another smoothly.

**FUN FACT:** The peritoneal cavity differs in male and female bodies. The male peritoneal cavity is a completely enclosed space, while the female cavity has openings for the uterine tubes, uterus, and vagina.
OVERVIEW OF THE
FAST EXAM

The FAST (Focused Assessment with Sonography in Trauma) exam is a specific ultrasound examination used by medical professionals to look for hemorrhage or abnormal fluid in the pericardium, pleural cavity, and peritoneal cavity after traumatic injury.

The eFAST (extended FAST) exam is a regular FAST with additional views to examine the lungs.

It’s a bedside ultrasound, which means the imaging equipment can be brought to where the patient is.

When a FAST/eFAST exam is being conducted, there are typically a few key views that focus on a number of important structures, such as particular organs and regions of the peritoneum.
FAST EXAM LANDMARKS:

RIGHT PERITONEUM

The Right Upper Quadrant (RUQ) view is used to look for fluid in the right subhepatic space (Morison’s pouch). The right subphrenic space, which lies between the liver and diaphragm, is another place fluid can accumulate. In addition, moving the ultrasound probe towards the head (cephalad) provides a view of the right pleural space and caudal movement provides a view of the right paracolic gutter.
The Left Upper Quadrant (LUQ) view uses the spleen to look at the **left subphrenic space** (the space between the spleen and the diaphragm) and the **splenorenal recess** (the space between the spleen and left kidney). The left pleural space and **left paracolic gutter** can also be examined via movement of the probe.
The Pelvic view is used to examine the *rectovesical recess* or rectouterine recess. The rectovesical recess is the space between the rectum and the bladder in the male pelvis. While the *rectouterine recess* is the space between the rectum and the posterior uterine wall in the female pelvis.
A pericardial (subxiphoid, subcostal) view is used to assess fluid buildup in the pericardium. It uses the liver's left lobe as its ultrasound window. If the ultrasound probe is angled in a particular way, the inferior vena cava and hepatic veins can also be examined.
An anterior thoracic view (part of eFAST) can be used to look at the pleural spaces. The pleural spaces can be examined from various points on each side of the chest, and such examination is important for diagnosing pneumothorax.
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