

Small intestine

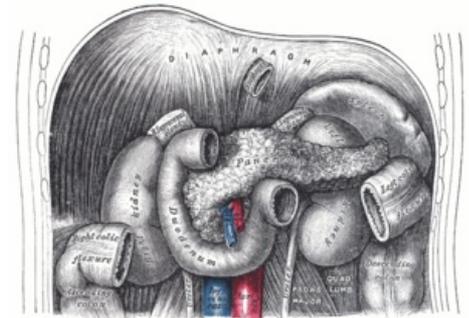
It is the continuation of the stomach, a tube about **3-4 cm** in diameter, **3-5 m** long when alive and just after death. The actual length of the intestine cannot be determined because it depends on the degree of contraction or relaxation of the wall musculature, and in relation to the time since death and the technique of measurement. After death (after relaxation of the muscular tension), the small intestine may extend up to 7 m, with the stretching of the intestine during removal during the autopsy playing a role. The main and final stage of enzymatic digestion of food into absorbable components and absorption of the resulting components takes place here.

Duodenum

The **duodenum** is horseshoe-shaped, the initial part of the **small intestine** is connected to the stomach. The length of the duodenum is between 20 and 28 cm and its diameter is 3.5 to 4.5 cm. With the exception of its initial part, the duodenum is connected to the posterior abdominal wall and secondarily covered by the peritoneum parietale.

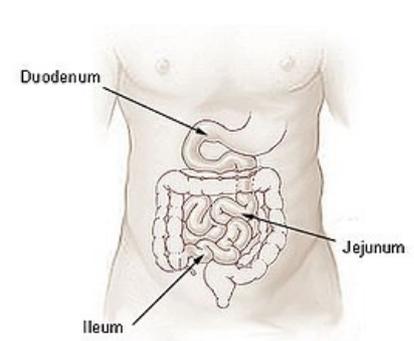
The segments of duodenum include:

1. **pars superior** - starts from the pylorus as the ampulla (bulbus) of the duodenum, at the level of the L1 vertebra, touching the liver (often also the gallbladder) from below, behind it the v. portae, the *flexura duodeni superior* - the bend between the pars superior and the pars descendens.
2. **pars descendens** - is descending along the right side of the L2 and L3 vertebrae, in front of the hilum of the right kidney, behind the pars descendens is the ductus choledochus, *flexura duodeni inferior* - bends at the right side of L3, through which the pars descendens passes into the pars horizontalis.
3. **pars horizontalis** (inferior) - passes from right to left in front of the body of L3.
4. **pars ascendens** - along the left flank of the L2 vertebra obliquely upwards to the left, *flexura duodenojejunalis* - the duodenum passes anteriorly into jejunum.



Duodenal syntax

The pancreas is inserted into the tail of the duodenum. Through the pars horizontalis of the duodenum pass the *a. et v. mesenterica superior*. Horizontally the *mesocolon transversum* passes through the duodenum. Anteriorly the duodenum is covered by the margin of the liver, the colon transversum and the villi of **the jejunum**.



Parts of the small intestine: duodenum, jejunum, ileum

Jejunum and ileum

These two parts flow into each other without a clear boundary. The differences between them are listed in the attached table below.

The ostium ileocaecale is the outlet of the ileum into the appendix located in the right iliac fossa. On the mucosal side of the caecum, a valve is formed, which allows the direction of passage from the ileum in one direction only.

Differences in the structure of the jejunum and ileum

	jejunum	ileum
thickness	wider (3 cm)	narrower (2,5 cm)
length	shorter (2/5 length)	longer (3/5) length
villi	numerous, dense	they decrease until they disappear
lymf. follicles	solitary	solitary + aggregated
vascular supply	richer (pinker when alive), 1-2 rows of arcades, long aa. rectae (5 cm)	2-3 rows of arcades, short aa. rectae (2 cm)
content	empty during dissection	
mesenterium		richer in fat infiltration

Small intestine wall

- It consists of four basic layers.

The mucosa layer

The light pink mucosa is covered by a **single-layered cylindrical epithelium** capable of resorption. Between the epithelial cells are **goblet cells**, which form a protective layer of mucus. The surface is formed by *plicae intestinales* - transverse cilia 6-8 mm high. They are mostly found in duodenum and they decrease distally.

The entire mucosal surface is covered with slender finger-like projections called *villi intestinales* or **intestinal villi**. They are 0.3-1 mm high (gradually decreasing in height), with 10-40 villi per 1 mm². Due to the villi, the mucosal surface is enlarged to 7 m² (more surface area for nutrient absorption). The villi are formed by the epithelium and *lamina propria* of the mucosa.

Glandulae intestinales (Lieberkühn's crypts) are present in all parts of the small intestine. They descend as simple, slender tubular glands to the *lamina muscularis mucosae*.

The mucosal ligament is sparse and extends into the villi. In some places it contains lymphatic tissue, which increases distally. It can be found in two forms:

- **folliculi lymphatici solitarii** - tiny nodules everywhere in the mucosa;
- **folliculi lymphatici aggregati** - clusters of nodules that form plaques (called Peyer's plaques);

- they most often occur at the sites of the mesentery ;

- only in the ileum and distally they are more frequent

The lamina muscularis mucosae separates the mucosal connective tissue from the submucosal connective tissue.

Epithelium

A single-layer cylindrical epithelium is composed of several cell types:

enterocytes - most of the cells;

- slender, cylindrical with numerous microtubules on the surface;
- constantly renewed, detached at the apex of the villi;
- in the light microscope the microvilli form a so-called **brindle rim**;
- **main functions** - absorption of substances from the contents of the small intestine;

goblet cells - individually among enterocytes;

- **their contents consist of mucin** droplets which push the nucleus and other organelles towards the basal part;
- secreted mucin forms a protective layer on the surface of the intestine;
- the mucus layer is a layer of mucins;

M-cells - in places where there is lymphatic tissue under the epithelium;

- mediate communication between lymphocytes and the small intestine environment;
- are actively involved in mucosal **defence mechanisms**;

tuft cells - sporadically among enterocytes;

- thicker tufts of microtubules on the surface;
- the function is unknown.

Submucosal connective tissue

Sparse connective tissue rich in blood and lymphatic vessels and nerve plexuses. **Plexus submucosus Meissneri** is a nerve plexus in this connective tissue.

Muscle

A layer composed of smooth muscle. It forms two basic layers:

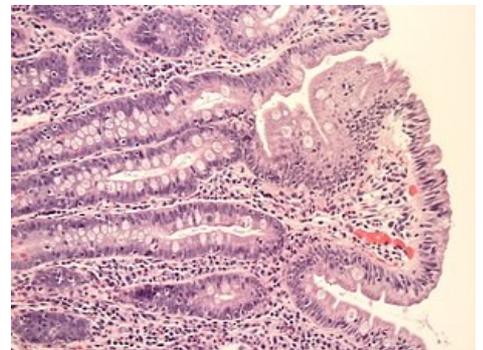
- *stratum circulare* - the inner circular layer;
- *stratum longitudinale* - the outer longitudinal layer.

Tunica serosa

A peritoneal translucent covering formed by the mesothelium (single-layered of flat epithelium), under which is a thin layer of subserosal connective tissue.

Links

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Microscopic image of the duodenal epithelium

- Digestive system
- Small and large intestine
- Colon

Source

- PASTOR, Jan. *Langenbeck's medical web page* [online]. [feeling. 2009]. < <http://langenbeck.webs.com> >.
 - ČIHÁK, Radomír and Miloš GRIM. *Anatomy. 2nd* edition. Prague: Grada Publishing, 2002. ISBN 80-247-0143-X^[1].
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1. PASTOR, Jan. *Langenbeck's medical web page* [online]. [feeling. 2009]. < <http://langenbeck.webs.com> >.
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