The Small Intestine

**Location:** Abdominal Cavity

**Physical description:**

- Your small intestine is approximately six metres long. (It is the longest section of your digestive tract.)
- Although it is longer than your large intestine, it has a smaller diameter. (This is why it's called the small intestine.)
- It has an average diameter of 2.5 cm.
- The absorptive surface area is roughly 250 square meters. (the size of a tennis court)

The primary functions of the **small intestine** are ...

The Small Intestine

**Mechanical Digestion:**

After food is churned up in your stomach, a sphincter muscle at the end of your stomach opens to squirt small amounts of food into the top of your small intestine. This first section of the small intestine is called the **duodenum**.
The Small Intestine

The small intestine is where most of the food you digest is absorbed into the bloodstream.

It contains many folds covered in tiny projections known as villi, which in turn are covered in even tinier projections known as microvilli. The microvilli contain blood vessels (capillaries) that absorb nutrients.

The Small Intestine

Food is absorbed (taken in) to the body in the small intestine. The wall of the small intestine has small holes in it. Only small particles can pass through it:

- Large particles (e.g., starch) are left in the gut.
- Small particles (e.g., glucose) go through into the blood.

**BUT** large particles can be broken down into small particles. This is called **DIGESTION**.
The Small Intestine

**Duodenum:**

- ...

**The Pancreas**
The Pancreas

The pancreas manufactures the following enzymes ...

<table>
<thead>
<tr>
<th>Digestive Chemical</th>
<th>Breaks down ... (reactant)</th>
<th>into ... (the product)</th>
<th>Chemical is manufactured in the</th>
</tr>
</thead>
<tbody>
<tr>
<td>pancreatic amylase</td>
<td>starch / glycogen</td>
<td>maltose / disaccharides</td>
<td>pancreas</td>
</tr>
<tr>
<td>pancreatic lipase</td>
<td>fats</td>
<td>Fatty Acids + Glycerol</td>
<td>pancreas</td>
</tr>
<tr>
<td>trypsin</td>
<td>peptides</td>
<td>simpler peptides</td>
<td>pancreas</td>
</tr>
<tr>
<td>chymotrypsin</td>
<td>peptides</td>
<td>simpler peptides</td>
<td>pancreas</td>
</tr>
<tr>
<td>carboxy-peptidase</td>
<td>peptides</td>
<td>simpler peptides</td>
<td>pancreas</td>
</tr>
<tr>
<td>ribonuclease</td>
<td>ribonucleic acid (RNA)</td>
<td>nucleotides</td>
<td>pancreas</td>
</tr>
<tr>
<td>deoxyribo-nuclease</td>
<td>deoxyribo-nucleic acid (DNA)</td>
<td>nucleotides</td>
<td>pancreas</td>
</tr>
</tbody>
</table>

The Liver

**Location:** Under your diaphragm, more to the right side of your body

**Physical description:**

* *

The Liver

![Liver Diagram with Gallbladder and Pancreas](image-url)
The Liver and Gall Bladder

Mechanical and Chemical digestion is NOT done in the liver.

The stalk of small lipid droplet
Mixing + bile salts + pancreatic lipase
   Micelles

The Liver and Gall Bladder

The gall bladder is a small sack located under the liver. The gall bladder is connected to the digestive tract through the bile duct. The gall bladder secretes the stored bile when fatty food is ingested. The gall bladder does NOT manufacture bile, it STORES bile for later use.
The Small Intestine

Jejunum:
- about 2.5 m long
- contains more folds than the duodenum
- breaks down the remaining proteins and carbohydrates so that they can be absorbed by the bloodstream

Ileum
- about 3 m long
- contains fewer and smaller villi than either the duodenum or the jejunum
- absorbs nutrients, as well as pushes the remaining undigested material into the large intestine

Chemical Digestion:

Chemical digestion in the small intestine involves various enzymes.

Proteins:
Fats:
Carbohydrates:

![Diagram of starch to glucose conversion](attachment:starch_to_glucose_conversion.png)
Pancreatic amylase

The Small Intestine

Pancreatic amylase

Digestion of Starch

Starch Molecule

The Small Intestine

Dietary lipids (fats and oils) do not dissolve in water, as a result they are not easily broken down by fat-digesting enzymes called lipase in the watery content of the gastrointestinal tract. Fats must first be physically broken down into small droplets by bile salts so that they may be chemically digested by the lipase enzymes. Bile salts are produced in the liver but stored in the gallbladder. They enter the duodenum via the bile duct. Lipase enters the duodenum from the pancreas and chops up lipid molecules into fatty acid molecules and glycerol molecules.
The Small Intestine

Absorption in the Small Intestine

**Monosaccharides**
- absorbed into the bloodstream
- are transported to the liver where monosaccharides (other than glucose) are converted to glucose
- glucose is carried to parts all over the body for energy.
- excess glucose is converted to glycogen.

**Amino Acids**
are absorbed into the bloodstream and carried:
- to the liver where they are converted to sugar for energy releasing reactions
- to other cells of the body where they are used to make enzymes and other protein such as keratin which forms skin and hair

**Glycerol and Fatty acids**
- are absorbed by the lacteal
- they are reassembled to form triglycerides
- triglycerides are coated with protein to make them water-soluble so they can be transferred into the bloodstream
- provide energy to the cells
In a 24 hour period, the small intestine it is capable of absorbing ...

* several kilograms of carbohydrate
* up to 1 kg of fat
* 500 g protein
* 20 litres of water

The small intestine is ...

* 
* 
* 

It normally takes about 90-120 minutes for the first part of a meal we have eaten to reach the large intestine, and the last portion of the meal may not reach the large intestine for five hours.