Lesson Description

In this lesson, we:

- Examine and understand absorption
- Define absorption and describe where it occurs
- Study the structure of a villus
- Define assimilation and describe where it occurs
- Understand the structure of the hepatic portal system and define its function
- Examine and understand assimilation

Summary

Absorption

- Absorption is defined as the process where the products of digestion (small molecules) move through the wall of the small intestine into the blood vessels.
- Absorption can occur in the mouth, stomach and large intestine but the majority of the absorption occurs in the small intestine. Water is absorbed mainly in the large intestine.
- For absorption to occur properly, there are a few criteria that the small intestine must meet:
  - There must be a large surface area so that a lot of nutrients can be absorbed.
  - The surface of the intestine must be thin so that the smaller molecules can be absorbed.
  - There must be a good blood supply so that the absorbed molecules can be moved throughout the body.
  - The molecules inside the intestine must be in close contact with the surface – the molecules must be small.

Structure of a Villus

- A villus is a finger-like projection which increases the surface area.
- There are many tiny blood vessels (capillaries) to carry away amino acids, monosaccharadies, mineral salts and vitamins which pass through the villus.
- Water is reabsorbed because the amino acids, minerals etc are in solution to be absorbed.
- In the centre of the villus is a lacteal which carries lipids to the lymph vessels.
- The epithelium of each villus has folds in the membrane forming microvilli known as a brush border.
- There is only one layer of columnar epithelium so that it is easy for the small molecules to move from the lumen of the small intestine into the villus. The Goblet cells found interspersed amongst the columnar epithelium secrete mucuous.
- Between each villus is found a krypt of Lieberkuhn. The krypts produce new cells to replace any cells that need to be replaced.
- The Brunner’s glands produce an alkaline solution which contains bicarbonate.
Assimilation

The process where nutrients are taken from the blood and into the cells is called **assimilation**.

Absorbed nutrients are transported from the liver to the heart by the hepatic vein. From the heart the nutrients move to all parts of the body.

<table>
<thead>
<tr>
<th>Nutrient / Chemical</th>
<th>Process</th>
</tr>
</thead>
</table>
| Amino acids         | • Excess amino acids go through a process of de-amination.  
                      | • De-amination is when the nitrogen is removed and ammonia is formed with it  
                      | • The ammonia is moved to the kidneys which convert it into urea.  
                      | • The urea is excreted in the urine. |
| Glucose             | • Excess glucose is converted into glycogen.  
                      | • The liver stores the glycogen which can be converted back into glucose when needed. |
| Alcohol and drugs   | • The detoxification process changes alcohol and drugs from harmful substances into harmless substances  
                      | • Excess alcohol over time causes the liver to work too hard and this leads to some parts of the liver not working. |
| Hormones            | • Once hormones have fulfilled their functions in the body, the liver breaks them down.  
                      | • Examples are insulin, testosterone and oestrogen. |

Hepatic Portal System

- The capillaries join to form venules. The venules join with venules from the stomach to become the hepatic portal vein. This system is known as the hepatic portal system.
- The hepatic portal vein transports amino acids and glucose molecules to the liver.
- The hepatic portal vein is unusual because it is formed by a series of capillaries that join together outside the liver and then split up into capillaries again inside the liver.
Test Yourself

Question 1
Brunners glands are found in
A. stomach
B. ileum
C. duodenum
D. rumen

Question 2
Which one of the following statements is not correct about intestinal villi?
A. A multitudinous finger-like projections having many microvilli
B. Increase the internal surface area of the intestinal wall.
C. Supplied with capillaries and the lacteal vessels.
D. Participate only in digestion of fats.
Question 3
If for some reason our goblet cells are non-functional this will adversely affect
A. Smooth movement of food down the intestine
B. production of somatostatin
C. secretion of sebum from the sebaceous glands
D. maturation of sperms

Question 4
The inner walls of the small intestine have millions of small finger-like projections called
A. villi
B. trachae
C. appendix
D. esophagus

Question 5
The walls of the large intestine absorb
A. water
B. proteins
C. cellulose
D. roughage

Question 6
Nutrients absorbed into the blood of intestinal villi goes to
A. aorta
B. precaval vein
C. hepatic portal vein
D. hepatic artery

Question 7
The three portions of the small intestine, in the correct order, are
A. caecum, colon, rectum
B. ileum, duodenum, jejunum
C. colon, caecum, rectum
D. duodenum, jejunum, ileum

Question 8
Large intestine in man mainly carries out
A. digestion of fats
B. absorption
C. assimilation
D. digestion of carbohydrates
Improve your Skills

Question 1
1.1 Distinguish between absorption and assimilation. (3)
1.2 Explain how the structure of the villus is related to its role in absorption and transport of the products of digestion. (2)
1.3 Where does most of the fat digestion occur in the body? (1)
1.4 Describe how the small intestine is adapted to perform the function of absorption. (8)
1.5 Which organ plays a major role in assimilation? (1)
1.6 Name the vein that transports nutrients from the digestive system to the liver. What is unique about this vein? (2)

Question 2
(Adapted from Solutions for Life, Macmillan)
2.1 Draw a fully labelled diagram of a villus. (8)
2.2 Define digestion. (2)
2.3 Name two hormones that are broken down by the liver. (2)

Question 3
Describe the role of the liver under the following headings:
a) Glucose assimilation (3)
b) Deamination (4)
c) Detoxification (1)
d) Hormone breakdown (3)