

ABSORPTION

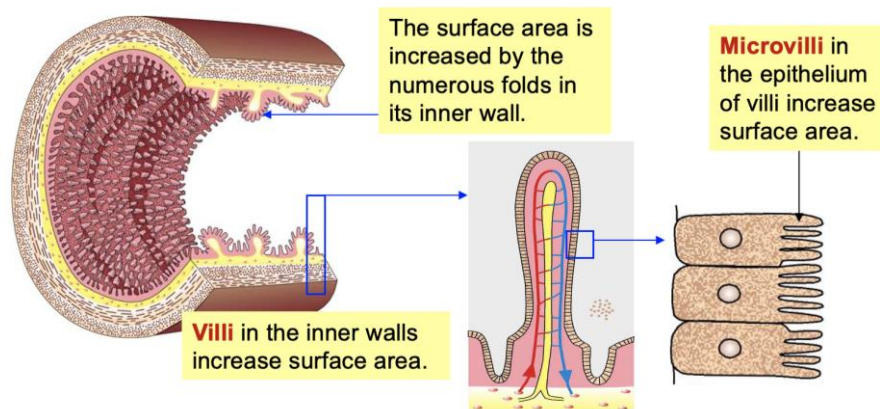
(d) describe the **structure of a villus** and its role, including the role of **capillaries** and **lacteals** in absorption state the function of the **hepatic portal vein** as the transport of blood rich in absorbed nutrients from the **small intestine** to the **liver**

What is Absorption?

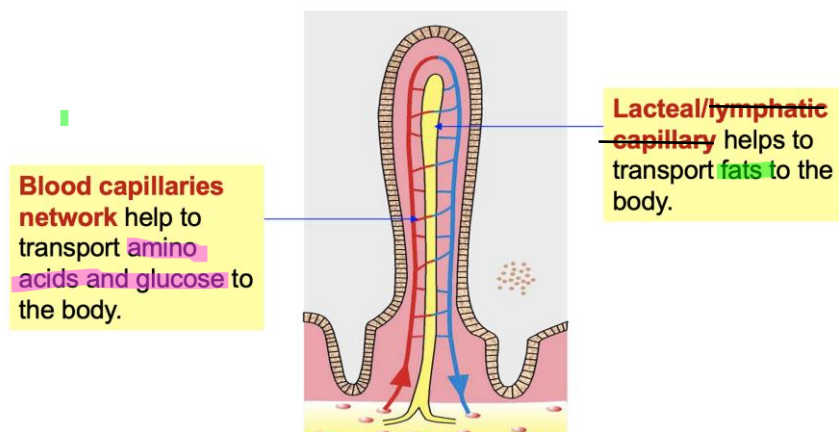
Absorption is the process whereby digested food substances are absorbed into the body cells.

How is the small intestine **adapted** for absorption?

- The **surface area to volume ratio** is increased for absorption.



Structure of a villus



Concentration Gradient

The **continual transport of absorbed nutrients away** by the many capillaries in the villus help to **maintain a concentration gradient** for the absorption of digested food substances.

Glucose and Amino Acids	Absorbed by diffusion into the blood capillaries of the villi
	Absorbed by active transport
Fatty Acids and Glycerol	Absorbed by diffusion into the epithelium, then combines to form minute fat globules which enter the lacteals .

Adaptation of the Small Intestine	Function
One-cell thick epithelium	• Shorter diffusion distance, Faster rate of absorption of digested food substances.
Villi and Microvilli	• To increase surface area to volume ratio to increase the rate of absorption of the digested food substances into the body. • Presence of many capillaries ensure that a concentration gradient is maintained for faster rate of absorption.
<i>Long</i>	• <i>To provide sufficient time for absorption to occur</i>

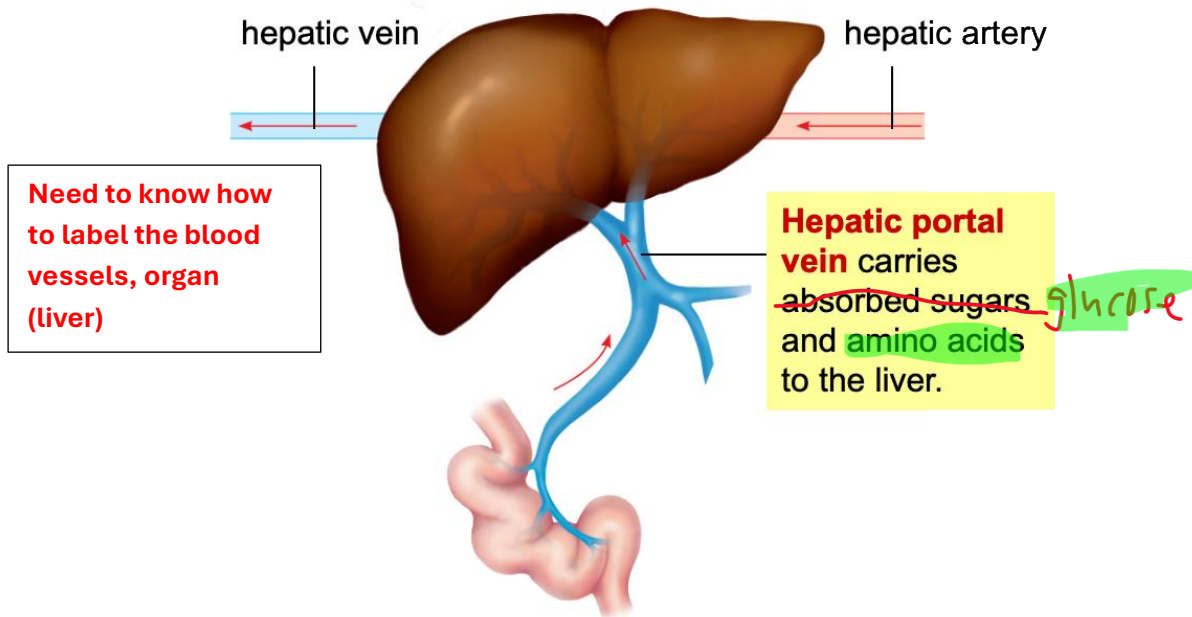
TRANSPORT AND ASSIMILATION OF ABSORBED NUTRIENTS

What is **assimilation?** (own understanding: how does our body **use** the absorbed nutrients?)

Assimilation is the process whereby some of the absorbed food substances are **converted** into **new protoplasm** or **used to provide energy**.

Hepatic Portal Vein

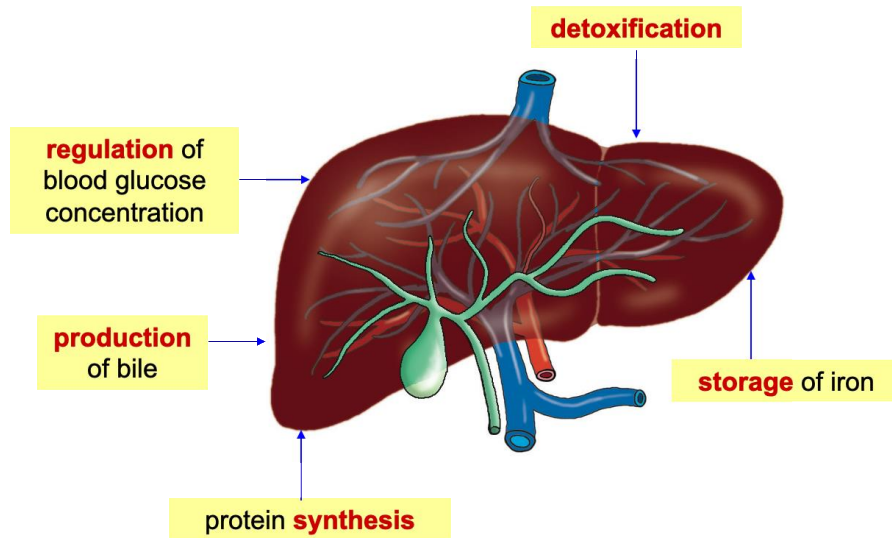
- After absorption in the small intestine, the **blood capillaries carry the nutrients** away from the small intestine.
- The **blood capillaries** unite to form a larger **hepatic portal vein** that leads to the **liver**.
- Fats are carried by lymphatic capillaries that join to form larger lymphatic vessels which discharge fats into the bloodstream.



Utilisation of Nutrients

Glucose	1. Converted into glycogen in the liver for storage 2. Some glucose transported out of the liver and distributed around the body 3. Source of energy. Sugar is oxidised during respiration in cells
Amino Acids	1. Converted into new protoplasm that is used for growth and repair of worn-out parts 2. Used to form enzymes and hormones 3. Excess amino acids are deaminated ★
Fats	1. Normal conditions: fats are not broken down when there is sufficient supply of glucose 2. Used to build protoplasm 3. Fasting: Fats broken down to provide energy 4. Excess fats stored in adipose tissues. Adipose tissues protect organs by acting as shock absorbers.

FUNCTIONS OF THE LIVER



Regulation of Blood Glucose Concentration

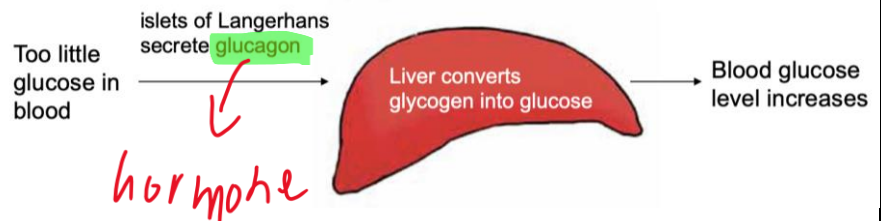


1. Helps to keep the amount of blood glucose constant

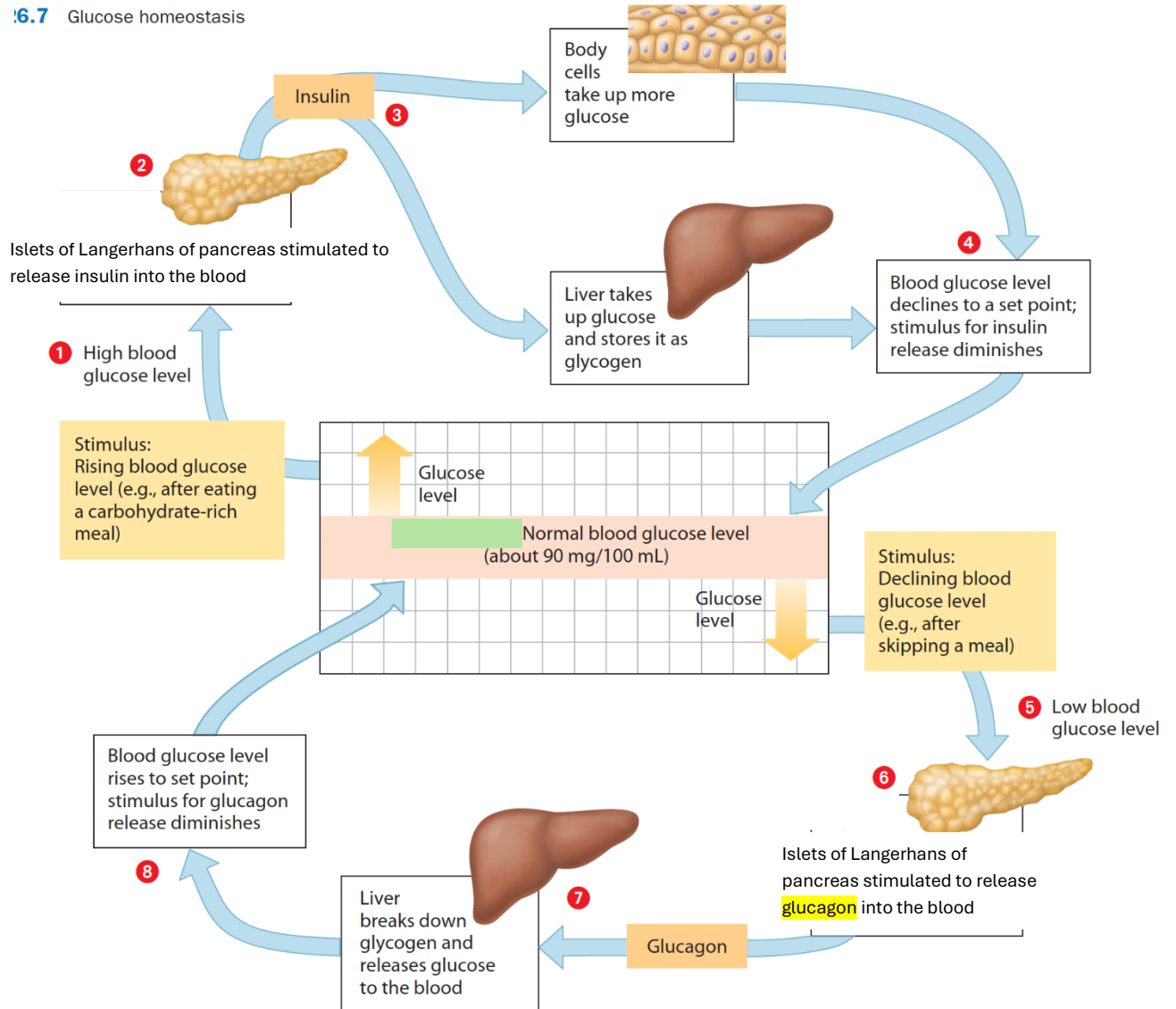
2. After a heavy meal:

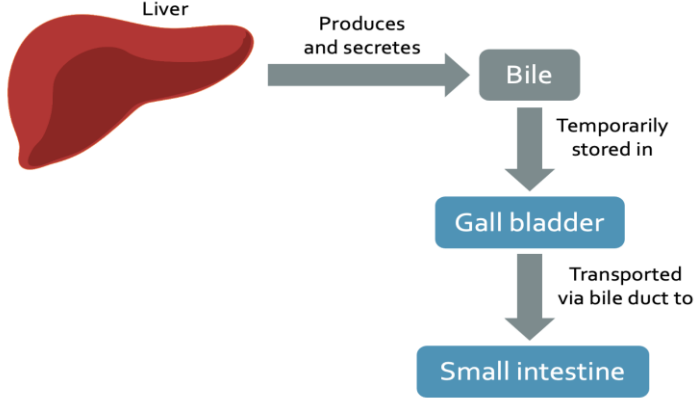
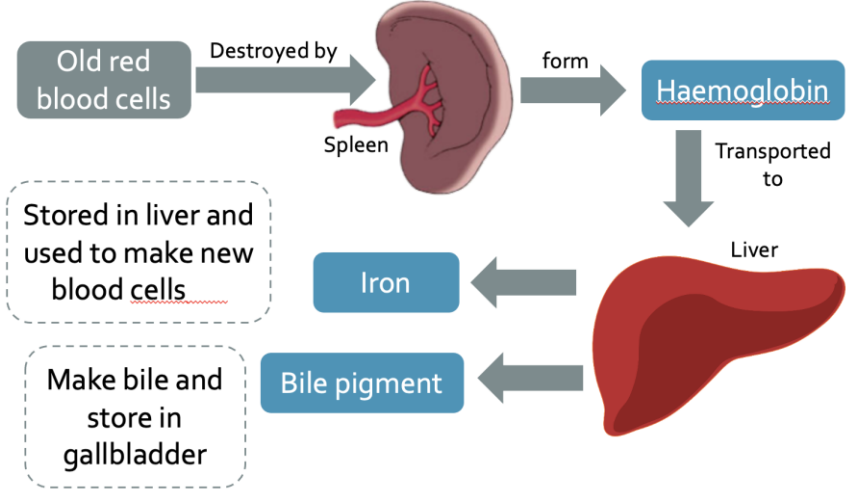


3. During fasting:



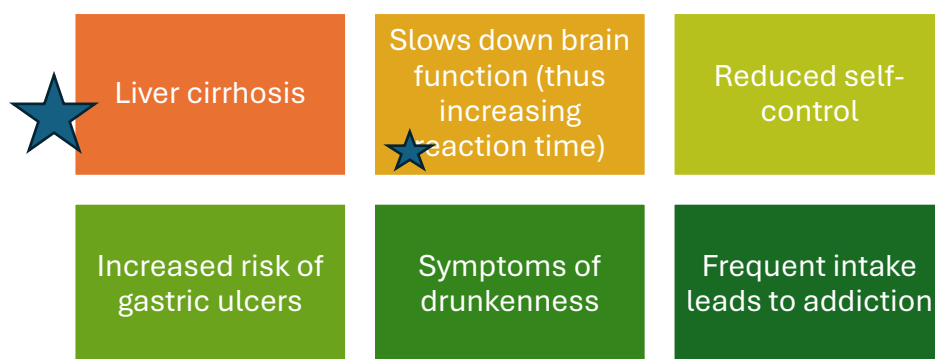
6.7 Glucose homeostasis



Production of Bile 	1. Plays an important role in fat digestion. 2. Secretes bile which is stored in the gall bladder  <pre> graph TD Liver[Liver] -- "Produces and secretes" --> Bile[Bile] Bile -- "Temporarily stored in" --> GallBladder[Gall bladder] GallBladder -- "Transported via bile duct to" --> SmallIntestine[Small intestine] </pre>
Iron Storage	1. Red blood cells become worn out after 3-4 months and need to be replaced 2. These worn-out RBCs are destroyed in the spleen and their haemoglobin is brought to the liver 3. Liver breaks down the haemoglobin and stores the iron released in the process 4. Bile pigments also formed from breakdown of haemoglobin  <pre> graph TD OldRBCs[Old red blood cells] -- "Destroyed by" --> Spleen[Spleen] Spleen -- "form" --> Haemoglobin[Haemoglobin] Haemoglobin -- "Transported to" --> Liver[Liver] Liver --> Iron[Iron] Iron -.-> Note1[Stored in liver and used to make new blood cells] Liver --> BilePigment[Bile pigment] BilePigment -.-> Note2[Make bile and store in gallbladder] </pre>
Protein Synthesis	1. Produces prothrombin and fibrinogen which are essential for clotting of blood
Deamination of amino acids 	1. Excess amino acids transported to the liver 2. Amino groups removed and converted into urea 3. This is called deamination (must write!) 4. Remains of the amino acid are converted into glucose and then into glycogen

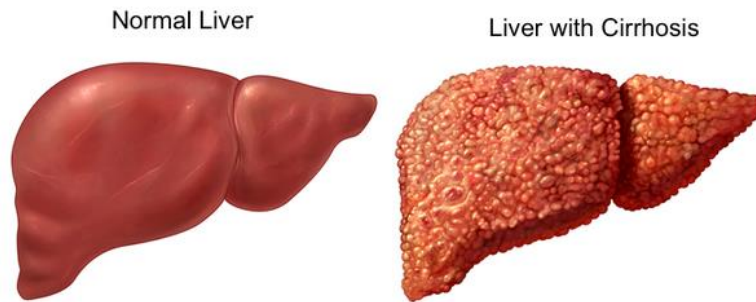
	<pre> graph TD AA[Amino acids] -- "Transported via hepatic portal vein to" --> Liver[Liver] Liver -- "To form" --> NP[New protoplasm] Liver -- "To form" --> EH[Enzymes and hormones] Liver -- "Excess amino acids are" --> D[Deaminated] </pre>
Detoxification 	- Harmful substances may be absorbed into the blood and is made harmless by the liver. The process of converting harmful substance into harmless ones is known as <u>detoxification</u>. - e.g. Alcohol is broken down to acetaldehyde in the liver by an enzyme called alcohol dehydrogenase <pre> graph LR A[Alcohol] -- "Alcohol dehydrogenase" --> B[Acetaldehyde] B --> C[Energy + water + carbon dioxide] </pre>

The Effects of Excessive Consumption of Alcohol



On the Digestive System

- Stimulates acid secretion** in the stomach leading to increased risk of gastric ulcers
- Prolonged alcohol abuse may lead to **cirrhosis** of the liver: liver cells destroyed and replaced with fibrous tissue. May lead to **haemorrhage or bleeding** in the liver
- May lead to liver failure and death



On the Nervous System

1. Depressant: Slows down brain functions
2. Reduced self-control: becomes carefree, removes inhibitions, self-control reduced.

Effect on Reaction Times

1. Slurred speech, blurred vision and poor muscle coordination
2. Deterioration in judgement
3. Reaction time increases (SLOWER reaction)

Social Implications

1. Frequently drinking alcohol can make someone addicted and thus, becomes dependable on alcohol
2. Neglect work and families and exhibit violent behaviour towards family members