

## AS90929 (BIO 1.5)

### Demonstrate understanding of biological ideas relating to a mammal(s) as a consumer(s)

#### Enzymes

Food contains large complex, **insoluble** molecules. These are; carbohydrates, proteins and fats. They are broken down into smaller, soluble substances so that they can be **absorbed** into the bloodstream through the **wall** of the small intestine.

The breakdown of large molecules into smaller molecules is speed up by **enzymes** – biological catalysts.

Enzymes are **proteins**, which are folded into **complex** specific shapes to allow only one type of molecule to fit into them. The molecule that fits into an enzyme is called a **substrate** in the area where the molecule fits into an enzyme is called its **active site**.

Enzyme	Place	Substrate	Products
<b>Amylase</b> (also known as a <b>carbohydrase</b> )	-Salivary Glands -Pancreas -Small intestine	Carbohydrates	Maltose
<b>Lipase</b>	-Pancreas -Small intestine	Lipids (fats and oils)	Fatty acids and glycerol
<b>Protease</b>	-Stomach -Pancreas -Small intestine	Protein	Amino acids
<b>Trypsin (another protease)</b>	-Small intestine -Pancreas -Duodenum	Peptides	Smaller peptides
<b>Maltase (another carbohydrase)</b>	-Small intestine	Maltose	Glucose

Digestion is a complex **series** of chemical reactions carried out by enzymes secreted by glands lining the gut. Most enzymes **catalyse** reactions inside the cell that makes the enzymes, but digestive enzymes are secreted into the gut cavity.

Enzymes have the following important properties:

- They are only produced in **living** cells and are therefore called **biological** enzymes, however they are **not** living and therefore cannot be killed!
- Enzymes can be **reused**, they are not changed in reactions, for this reason only a small number are required
- Enzymes are very **specific**, a particular enzyme will only catalyse **one** type of reaction. Eg. The enzyme amylase converts starch into maltose (a disaccharide), and the enzyme maltase converts maltose in to glucose. Because one enzyme acts on only one chemical constituent of a meal, many **different** types are needed to digest a whole meal.
- They are **3 dimensional** (3D) **proteins**, each type of enzyme has a fixed shape
- The **active site** must stay the same for the enzyme to be able to function
- Enzymes are very sensitive to **temperature**. Like other mammals, humans regulate their temperature at 37°C. This is the **optimum** temperature for enzyme action. At temperatures above 38°C enzymes begin to denature, temperatures below 36°C cause the enzyme activity to slow down. This is explained by the **kinetic/collision theory**. For enzymes to work, they need to collide

with the substrate. The higher the temperature the more energy the molecules have and they move around and collide with each other. However lower temperatures reduce the collisions so the reactions will be much slower.

- Each enzyme functions best at a particular **pH**. Eg. Amylase in the saliva works best in neutral solution, whilst the enzyme pepsin in the stomach juices works best in a very acidic solution. Most enzymes have an optimum pH, but some will work more slowly in a narrow range. Extreme levels can damage the enzymes and stop it working altogether by denaturing it.
- Enzymes are also affected by some chemicals. These chemicals are called **inhibitors**. Inhibitors interfere with the active site by binding to it and changing shape. Many poisons and drugs work like this. Eg. Cyanide inhibits an enzyme involved in respiration.

### Important Enzymes

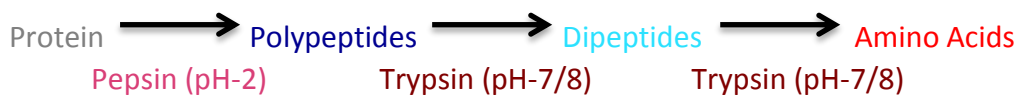
Enzymes can only be produced in living cells if they are working inside a cell they are intra cellular Eg. Cells that can control metabolism are intra cellular enzymes like catalase. Enzymes involved in digestion of food are extra cellular enzymes. These are produced inside special gland cells and secreted into the gut.

### Three types of Digestive Enzymes

Carbohydrase- Breaks down Carbohydrates such as starch.



Protease- Breaks down protein.



Lipase- Catalyses reactions including lipids.

