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
Amylase (also known as a carbohydrase)	-Salivary Glands -Pancreas -Small intestine	Carbohydrates	Maltose
Lipase	-Pancreas -Small intestine	Lipids (fats and oils)	Fatty acids and glycerol
Protease	-Stomach -Pancreas -Small intestine	Protein	Amino acids
Trypsin (another protease)	-Small intestine -Pancreas -Duodenum	Peptides	Smaller peptides
Maltase (another carbohydrase)	-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^{o}C. This is the optimum temperature for enzyme action. At temperatures above 38^{o}C enzymes begin to denature, temperatures below 36^{o}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

Cabohydrase- Breaks down Carbohydrates such as starch.

Starch (polysaccharide) —Amylase→ Maltose (disaccharide) —Maltase→ Glucose (monosaccharide)

Protease- Breaks down protein.

Protein → Polypeptides → Dipeptides → Amino Acids

Pepsin (pH-2) Trypsin (pH-7/8) Trypsin (pH-7/8)

Lipase- Catalyses reactions including lipids.

Lipids → Fatty acids & glycerol

Lipase (pH-7/8)