Hello, I'm Dr Alex Lathbridge and this is Bitesize Biology.

This is the second episode of a six-part series on the organisation of plants and animals.

Today we're going to be talking about some proteins known as enzymes.

Organisms have loads of chemical reactions, they're happening inside of us all the time. The thing about chemical reactions though, is that they're not all fast.

Without enzymes, everything in an organism would happen too slowly. The chemical reactions just would take too long, and so the organism wouldn't be able to function.

Enzymes speed up the rate of chemical reactions but aren't themselves alive. You can think of them as helpful molecules. They make things happen and that means enzymes are a catalyst.

So, a good definition of enzymes would be: enzymes are biological catalysts which speed up chemical reactions.

Now enzymes don't just help speed up the processes of breaking things down, you could call those breakdown enzymes.

Enzymes also help build things up, so you can call them synthesis enzymes. Synthesis, making things.

We're going to talk about how they work, a model known as Lock and Key. And we're going to go into a little bit more detail about how enzymes aid digestion.

Now something that we've talked about before is this idea of form and function, the two Fs.

It's the idea that the shape of something directly impacts its ability to do its job. This is really, really, really important when it comes to enzymes, they are the perfect example of this.

Enzymes are not just a few molecules thrown together. No, these are large, complex, unique 3-Dimensional structures – they're made up of long chains of proteins, all folded into squiggly shapes. This shape is what helps them to speed up chemical reactions, because on the enzyme, it creates a space known as an active site. This is a biological term that I'm going to help you understand.

I want you to look around right now for a couple of different small objects, that you can safely hold. I'm at my desk, with my dog Ollie sat on his bed next to me. So I've got an old football and a tennis ball. Picking up the tennis ball with my left hand, it naturally cups around it. And picking up the football with my right hand, it makes a far wider and looser grip.

Now – this is the most important bit – if I keep my hand shape the same but I switch the objects round, my left hand can't pick up the football – its grip is perfect for a smaller tennis ball. And if I try to pick up the tennis ball with my right hand, it just falls out – it's made to grip a larger object.

The hands there are two different enzymes and the two objects are two different substrates, the molecules that interact with the enzyme. And the pocket that your hand makes in the palm of your hand, to help pick up the object, that is the active site of the enzyme – which is complementary in shape (that's just a sciencey word of saying that the substrate and active site fit together). If you drop the object (or substrate), your hand (or the enzyme) isn't destroyed.

The actual name for this is the Lock and Key Model. Because a lot like how the pattern of your keys fits perfectly into the shape of the locks in your door, allowing you to open that door, the same key won't work with other doors.

Enzymes are brilliant, but are very sensitive to their shapes changing. If the large, 3-Dimensional structure of the enzyme changes, it means the shape of the active site changes, and that means it can't bind to the substrate (the molecule that interacts with the enzyme) and so it won't work.

There are 2 main ways this change can happen:

1. pH - the acidity or alkalinity of the environment. If this becomes too high (very alkaline) or too low (really acidic), the enzyme changes shape, as the bonds that hold the enzyme together are damaged. Remember, enzymes aren't alive. So these bonds breaking means that they don't die, they become denatured.

2. Temperature – if the temperature is too high, the bonds break and the enzyme denatures. But if the temperature is too low, they don't denature but the molecules move a lot slower, so the rate at which the enzymes and substrates collide, it lowers, so that reduces the rate of reaction.

Now let's look at enzymes in action.

The human digestive system couldn't function without enzymes because they help break food down.

There are two types of digestion – chemical and mechanical. Now if you don't remember that, go back and listen to the previous episode to help get you up to speed.

There are a couple of names of digestive enzymes you are going to need to remember. It's alright because enzymes always end with 'ase' and a lot of these enzymes have similar names to the food that they break down, which makes them a lot easier to remember.

Carbohydrases are enzymes that break down carbohydrates into sugars.

Amylase is a type of carbohydrase. It breaks down starch, a carbohydrate, and turns it into simple sugars. Amylase is made in the salivary glands, the pancreas and the small intestine.

Next up we have proteases. Those break down proteins into amino acids. Proteins are really long chains so they can't be easily digested, so protease is another enzyme that comes in and helps us do this. Proteases are in the stomach, the pancreas and small intestine.

And Lipases are enzymes that break down lipids, now those are fats and oils. It breaks it down into smaller molecules called glycerol and fatty acids. Lipases are found in two places, the pancreas and small intestine.

I'm Dr Alex Lathbridge and this is Bitesize Biology – you can listen to the whole series now on BBC Sounds