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

This is the fourth episode in an eight-part series on Homeostasis.
In this episode we're going to talk about blood glucose levels and how this is regulated in the body by hormones. Plus, what happens if it's too high, or too low. And we're going to talk about the two types of diabetes.

In the last episode we looked at how the endocrine system uses glands to secrete hormones that regulate our bodies.

We spoke about what a hormone is, make sure you remember the definition:

A hormone is a chemical messenger produced in glands and carried by the blood to specific organs in the body.

Today, we're going to take a look specifically at how the hormone insulin controls blood glucose levels.

Glucose is a simple sugar that our body uses for respiration (remember episode nine of our series on The Cell, go back if you need a recap.)

It is very important that the concentration of glucose in the blood is carefully controlled.

This is the job of insulin, a hormone produced by the pancreas, an organ that monitors your blood glucose level.

When you eat food, your intestine starts absorbing nutrients. Carbohydrates especially are converted into glucose, which goes into the blood, causing your blood glucose levels to rise.

The pancreas detects this rise and starts producing more insulin than normal.

The reason why this is so important, is that glucose can't go straight into your cells, even though they need it. Imagine that your cells are locked, insulin is the key to open that lock and allow glucose in.

So if blood glucose levels are too high:

An increase in blood glucose is detected by the pancreas.

The pancreas produces insulin and releases it into the bloodstream.

The insulin causes glucose to move out of the bloodstream and into body cells.

So obviously, glucose going from blood into cells reduces the glucose levels in the blood.

And cells in the liver and muscles can take up excess glucose and convert it into glycogen, where it can be stored. Remember glycogen is insoluble.

So that's how insulin reduces blood glucose levels.

If blood glucose levels are too low:

A decrease in blood glucose is detected by the pancreas.

The pancreas produces another hormone, glucagon, and releases it into the bloodstream. You can think of glucagon as the anti-insulin.

The glucagon causes the glycogen stored in the liver and muscles to be converted back into glucose.

This increases the glucose levels in the bloodstream, so glucagon increases blood glucose levels.

So insulin and glucagon are our hormones.

Insulin decreases blood glucose levels by moving glucose into cells.

Glucagon increases blood glucose levels by converting stored glycogen into glucose.

Glucagon and glycogen are very similar words, so let's not get them mixed up.

Glycogen is what excess glucose is converted into and stored in the liver and muscle tissues.

Glycogen, think "generated for later."

Glucagon is a hormone produced by the pancreas when blood glucose levels are too low. This in turn causes the glycogen stored in the liver to be turned back into glucose.

Glucagon, my glucose is gone, please use the stuff I have in storage.

It's really important that your blood glucose level is controlled.

Because having lots of glucose in your blood for an extended period of time is not good.

At a cellular level, It can damage the small blood vessels that provide oxygen and essential nutrients from reaching your cells, literally starving them.

Over the long term, this increases the risk of eye diseases, circulation issues, damage to the feet, the gums, the kidney and more. Not to mention, damage to nerve cells, which can make it harder for them to carry messages between the brain the rest of the body, so it can affect how you see, hear, feel and move.

A condition where the blood glucose levels remain too high is known as diabetes.

It’s actually really common, you might have heard of it or even have friends or family members that have it.
Depending on the type of diabetes, it can be controlled by injecting the hormone insulin, which we now know causes the liver and the muscles to convert excess glucose into glycogen, lowering the blood glucose levels.

There are two types of diabetes, Type 1 and Type 2, and you need to know the differences between them.

The symptoms are similar, but the causes are different:

Type 1 diabetes is when blood glucose levels are too high because the pancreas doesn’t produce enough, or any, insulin.

Type 1 diabetes is detected from an early age and is controlled by injecting insulin into the bloodstream, replacing the insulin that your own body can’t make.

People with type 1 diabetes have to monitor the blood glucose levels throughout the day. If left untreated, blood glucose levels can rise to a fatal amount.

Insulin injections normally happen throughout the day after mealtimes, to stop glucose levels getting too high.

Insulin injections are the crucial method of treating Type 1 diabetes.

Patients with Type 1 diabetes can also carefully monitor the amount of simple sugars found in carbohydrates they eat and exercise regularly.

Type 2 diabetes is when the cells in someone’s body no longer respond to their own insulin produced by the pancreas, as the result of an unhealthy lifestyle.

They still make enough of their insulin, but the cells don’t respond as they should, so if insulin is a key, it’s like the cells have changed their locks and the glucose stays in the blood.

Type 2 diabetes is more common in older and overweight people. Injecting more insulin doesn’t have any effect so it's not a method of treatment.

Type 2 diabetes is controlled by eating a diet low in in carbohydrates and doing regular exercise, to lower the blood glucose levels.

Being obese and not exercising enough are big risk factors that can lead to diabetes. But a good diet and regular exercise can usually fully reverse Type 2 diabetes.

It’s really important that people avoid getting Type 2 diabetes because diabetes leads to almost 9,600 leg, toe or foot amputations every year in the UK. That's 185 a week.

I’m Dr Alex Lathbridge and this is Bitesize Biology. You can find more Bitesize podcasts by searching Bitesize on the BBC Sounds app.