Hello, I'm Dr Alex Lathbridge and this is Bitesize Biology.
This is episode two in our eight-part series about homeostasis. Today, we're going to focus on the nervous system.

In the last episode, I introduced the concept of homeostasis, the processes that your body uses to maintain constant internal conditions.

The conditions inside your body must be carefully controlled so that enzymes and cells can function effectively.

Our bodies have two types of automatic control systems that regulate our internal conditions: nervous responses and chemical responses.

Automatic control systems have three important components:

Receptors, that detect stimuli (or changes in the environment).

A coordination centre, such as the brain, which processes information from receptors, and generates a response in the...

Effectors, which restore internal conditions to optimum levels.

The nervous system is one of these automatic control systems, and allows us to react to our surroundings and coordinate our behaviour.

And it does all of this without you even realising. For instance, right now – I want you to start thinking about breathing. Also think about that weird feeling your tongue makes in your mouth. If you're anything like me, you've just been forced into the driver's seat of activities that your nervous system manages without you having to consciously do anything.

Like all control systems, the nervous system has receptors, a coordination centre (the brain) and effectors.

I'm going to break the nervous system down into three easy sections:

1. Getting information
2. Transmitting information
3. Using information

First up, getting information:

This involves stimuli being detected by receptors. These are found in all of your sensory organs:

Receptors on your skin detect changes temperature, touch and pain.

Receptors on your tongue can detect chemicals in food, or taste.

Receptors in your nose detect chemicals around us, in the air, which is smell.

Receptors on your eyes detect changes in light, which is sight.

Receptors on your ears detect changes in sound, which is hearing.

These are just the main receptors that each of those sensory organs are known for. Of course, you have pain receptors in your tongue.

Next, transmitting information.

Any information from the receptors, travel as electrical impulses along nerve cells (these are called neurones) to the your brain.

It's easy to shorthand it and say "receptors send signals to your brain" in your exam.

I know what you mean but I want you to get marks. So try to get in the habit of saying that these are "electrical impulses that travel in the nervous system."

So where do those electrical impulses go?

Well, the brain and the spinal cord make up the central nervous system.

It's called that because it collects information from across your whole body and manages activity across your whole body.

Information from receptors passes along neurones as electrical impulses to the central nervous system.

Using the information.

The central nervous system processes the information and generates a response in the effectors, sending an impulse along neurones to them, to create a response.

Examples of effectors include a muscle contracting to move an arm away from a hot oven or your eyelids shutting when you're staring at something too bright, like the sun.

You need to remember the journey of an electrical impulse in response to a stimulus:

Stimulus – receptor – Coordinator: central nervous system – effector – response

Let's take a look at the specialised cells of this system: the neurones. These all come together to

form
nervous tissue.

If you're not sure about neurones, you can head back to our series on The Cell and have a listen to Episode 3.

Quick recap: the two F's; function and form.

What's the function of neurones? To rapidly carrying electrical impulses from one place to another.

And how are they adapted, what's their form? Basically, they've got a long fibre called an axon, and it's covered in a fatty, myelin sheath, so they can easily carry electrical impulses.

The neurones have lots of branches at one end (these are known as dendrites) to connect with other neurones and form a network.

They pass electrical impulses from one neurone to the next, like a baton being passed between runners in a relay race.

And like runners in a relay race, the neurones don't actually touch each other. There are teeny tiny spaces between the neurons called synapses and this is where most of the activity occurs.

Remember those dendrites and axons? Axons send out chemical messengers, known as Neurotransmitters, across synapses to the next neurones.

So, these chemicals, these neurotransmitters, are able to hop across the gap, and carry the electrical impulse onto the next neurone, going from the end of one axon, across the synapse, and into a dendrite of the next neurone.

You might have two questions here:

1. How can electrical impulses become neurotransmitters, which are chemicals, and then become electrical again?

Great question, that's for A-Levels so I shan't waste your time (but it's cool).

2. How do neurotransmitters, which are chemicals, hop across the gap to the next neuron?

This is where our good friend diffusion comes back. These neurotransmitters diffuse across the synapse, and they bind with receptor molecules on the membrane of the second neurone.

These are at the dendrite end of the neurone. The receptors only bind to specific neurotransmitters, released from the first neurone. This then stimulates the second neurone to carry the electrical impulse on to the next one.

And to make things even more hectic, neurones have many branching dendrites for multiple connections with axons, but usually only one long axon.

However, the end of the axon can branch off, to connect to multiple neurones. Now, all these neurones working together can process some complicated natural computations that when all working together are what allows your nervous system to function.

Earlier we talked about the journey of an electrical impulse in response to stimulus:

Stimulus – receptor – Coordination centre – effector – response

There are three types of neurones you need to know for your exams:

1. Sensory neurones. These are specialized to gather and carry sensory information towards the central nervous system. So, think about the cells in your eyes which detect light from the world around you.

2. Motor neurones. These terminate on muscles and they're how you move your body. These carry signals away from your central nervous system. They're also responsible for the fight or flight response working, like slowing your intestines.

3. Relay neurones. Like the name suggests, these help the sensory neurones and motor neurones communicate. So, they're found mainly in the brain and spine.

Easy to remember: sensory neurons deal with sensory information. Motor neurons deal with putting a response in effect. And relay neurons are in-between.

So now that we know the names of our neurones, let's finish up today putting them in our nervous system pathway:

A stimulus is detected by the receptor, in sensory organs.

Then, sensory neurones carry electrical impulses from the receptors to the central nervous system.

Then the central nervous system, which is filled with relay neurones, processes the information.

And sends electrical impulses along the motor neurones to the effectors, which generate a response.

And finally, the response happens like a muscle contracting.

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