

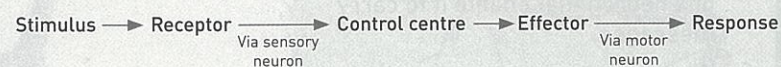
3.3 The nervous system provides fast control of the body



To survive immediate danger, you respond quickly to stimuli. Receptors in the nervous system detect the stimulus and pass it on to control centres. The control centres initiate a message to the effectors, which cause a response. Reflexes are special pathways that allow a response to occur before the brain has time to think.

Stimulus response model

Stimuli can be in many different forms. It may be pressure or heat on the skin, a puff of air or strong light in your eye. These stimuli are detected by the receptors and the message gets sent to the spinal cord and the brain via the sensory neurons. The spinal cord and brain form the control centre of the nervous system. The interneurons in this control centre pass the message on to other interneurons as your brain thinks about how you should respond to the stimuli. Eventually, you make a decision and the motor neurons pass the message on to the muscles. In this case, the muscles are called the effectors as they are the cells that cause the body to respond. This simple pathway is called the stimulus response model.



Reflexes

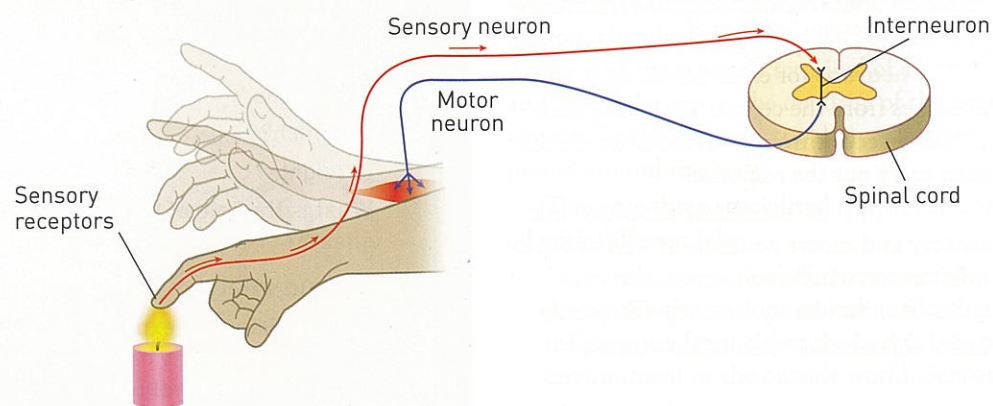
If you ever accidentally touched something very hot, you will remember how quickly you snatched your hand away. In fact, it was so quick that you know you didn't even have time to think about it – it was automatic.

A **reflex**, or reflex action, is an involuntary and nearly instantaneous movement in response to a stimulus.

During a reflex action, the sensory neuron carries the message from the receptor to the spinal cord. The interneuron then sends two messages at the same time, one to the brain and the other to the muscles via the motor neuron. This means the muscle is moving at the same time as the brain gets the message that the object was hot. This makes reflexes even faster than usual responses.

Most reflexes help us in survival situations. Can you think of the advantages to these reflexes?

Figure 3.16 A reflex action ensures that a fraction of a second after you pull your hand away from a hot flame, you feel the pain in your hand.



CHALLENGE 3.3A: HOW FAST IS THE NERVOUS SYSTEM?
GO TO PAGE 189.



Figure 3.17 Grasp reflex. When an object is placed on a baby's palm, their fingers curl over and grasp it.



CHALLENGE 3.3B: TESTING REFLEXES
GO TO PAGE 189.

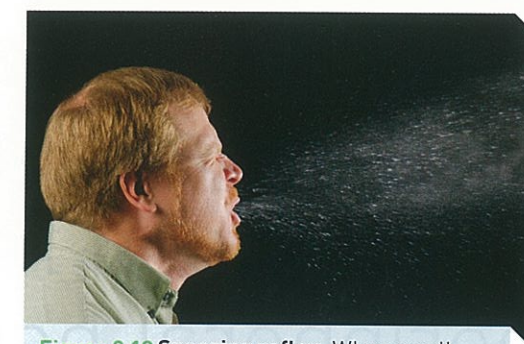


Figure 3.18 Sneezing reflex. When small particles land on receptors in the back of your nose, the muscles in your diaphragm force air out rapidly.



Figure 3.19 Startle reflex. When a newborn baby is startled, they will fling their arms out wide and grab onto anything they touch.



Figure 3.20 Plantar reflex. When a blunt object (such as the blunt end of a pencil) is moved along the underside of the foot, the toes usually curl downwards.

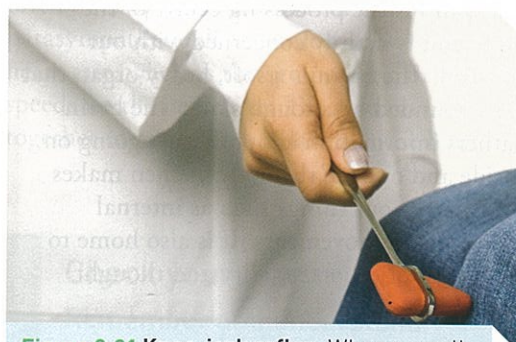


Figure 3.21 Knee-jerk reflex. When a small section below the kneecap (the tendon that connects the muscle to the bone) is stimulated with a tap, the foot will kick out.

Check your learning 3.3

Remember and understand

- Define the following terms.
 - stimulus
 - receptor
 - effector
 - response
- What is the stimulus response model of regulation?

Apply and analyse

- Is the brain involved in a reflex reaction? Explain.
- What is the advantage of a baby having the startle reflex?
- If a person has a damaged spinal cord so that they cannot feel their toes, will they still have a knee-jerk reaction? Explain your answer.

