

Complex reflexes

Although some spinal reflexes, such as the patellar reflex, are relatively simple and involve only a few nerve cells, the spinal cord is capable of carrying out more complicated functions without needing to involve the brain.

If you were to step on a sharp object, such as a drawing pin, with your right foot, a complex reflex (the crossed extensor reflex) would be initiated in order to withdraw the foot and to shift the body's weight onto the left leg.

Initially, the drawing pin stimulates pain receptors in the skin of the right foot, causing them to send nerve impulses, via afferent nerve fibres (from the Latin 'afferre' – to carry towards), to the right hand side of the spinal cord. Neurones in this half of the spinal cord send nerve signals away from the cord via efferent nerve fibres to tell the extensor muscles to relax and the flexors to contract.

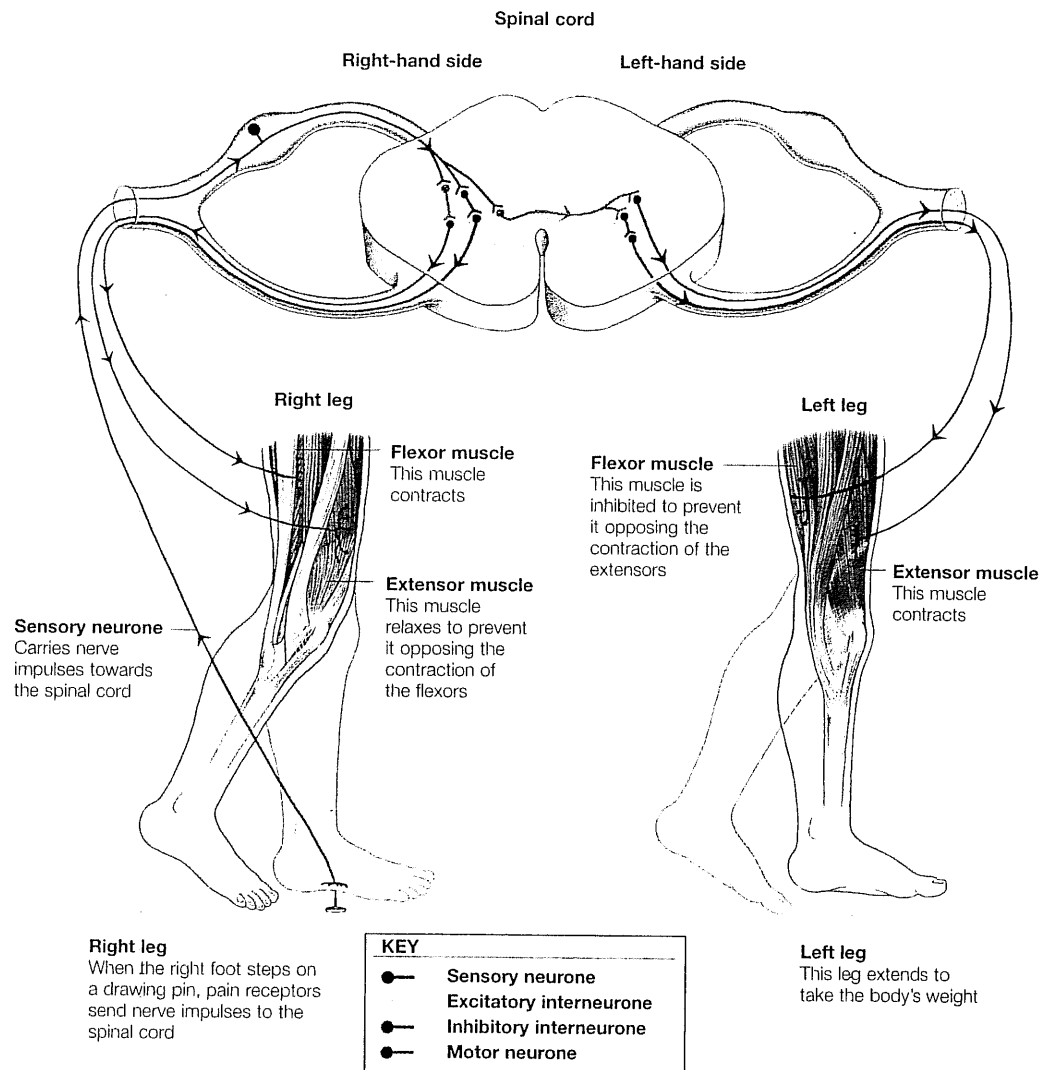
TRANSFER OF WEIGHT

These events result in the injured leg being moved away from the drawing pin. However, unless the body's weight is transferred to the other leg, you will fall over.

Thus neurones from the right-hand side of the spinal cord cross over to the left-hand side and synapse with motor neurones which innervate muscles in the left leg. These motor neurones inform the extensor muscles in the left leg to contract and the flexors to relax, causing the leg to be extended so that it can carry the body's weight.

When a bare foot treads on a sharp object, it is rapidly withdrawn and the body's weight is transferred to the other leg.

The crossed extensor reflex



Learned reflexes



The reflexes that have been discussed so far are 'hard-wired' into the nervous system.

However, while babies are born with the innate ability to learn how to walk, we have to make a conscious effort to learn to drive a car, ride a bicycle or play the piano.

With time, new movements can become as automatic as walking. For example, although learning to drive is a relatively difficult experience for most people, after a while the

Pianists are able to read music and then play the appropriate note without thinking about what they are doing. This is an example of a learned reflex.

movements become automatic and the driver no longer has to consciously think what he or she is doing.

Similarly, touch-typists do not need to think where their fingers are on a keyboard, and as a result many can type at up to 80 words per minute. Assuming that the average word contains around six letters, a fast typist can make up to eight keystrokes every second!

It is thought that during the learning process the neurones involved in controlling the movement change the way that they are connected to each other. Important connections between cells are reinforced and unnecessary synapses are lost.