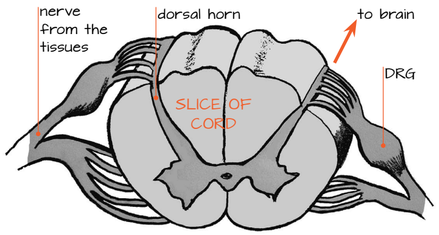
Altered central nervous system alarms – the spinal cord

Let's hop into the spinal cord before we move to the brain. You may need to keep your hat on here! Read slowly and hang in there! Remember that sensors in the tissues cause danger messages to be sent to the spinal cord, which in turn cause the release of chemicals into the synapse there (pages 36 and 37). Those chemicals activate chemical sensors on the next neurone, (the spinal messenger neurone on the way to the brain) which open and allow positively charged particles to rush into that neurone, bringing it closer to firing. Remember too that chemicals released from descending neurones from the brain activate different sensors on the neurone. This can increase or decrease the excitement of the spinal messenger neurone and take it closer or further away from firing. We are now talking about the dorsal horn of the spinal cord. See the figure below to remind yourself where that is located.



The essential neuroscience[115]

The nervous system is highly adaptable and will respond to most demands that it is given. So, when impulses from inflamed, scarred, weak or acidic tissues keep arriving at the synapse in the dorsal horn, or when neurones from the brain release excitatory chemicals, the spinal danger messenger neurone in the spinal cord adapts to meet the demand – that is, to get better at sending danger messages up to the brain. This adaptation begins within seconds of the demand increasing.

In the short term, the spinal danger messenger neurone increases its sensitivity to the incoming excitatory chemicals.[116,117] This means that things that used to hurt now hurt more. This is called **'hyperalgesia'**. It also means that things that didn't hurt before now hurt. This is called **'allodynia'**. Hyperalgesia and allodynia are just two effects of increased sensitivity.

The sensors then change the way they work so that they stay open longer each time they are opened, which lets more positively charged particles into the danger messenger neurone. Finally, the danger messenger neurone increases its manufacture of sensors for excitatory chemicals, including sensors that 'sleep' until they are needed (this is as though a danger memory is placed in the cells). All of these things change the sensitivity of the danger messenger neurone. Your alarm system is really looking out for you.

More long-term processes also happen – floods of sensitivity-enhancing chemicals can swamp the synapse and some of the incoming neurones can go sprouting.[118] For example, neurones that don't even carry danger messages sprout in close to the danger messenger neurone so that the chemicals that they release activate that neurone. This means that just touching the skin or a slight temperature change, might cause danger messages to be sent to the brain.

In a way, your brain is being tricked. It is operating on faulty information about the condition of your tissues. But remember – your body and brain are acting in your best interests – it's to protect you.

Enhanced sensitivity of the alarm system is nearly always a main feature in persistent pain. Remember that the **pain is normal, but the processes behind it are altered.**