

# Understanding pain



## Introduction

Pain is normal and is essential for our survival. It helps us in times of danger. If you put your hand on a hot iron you will quickly remove it! This is a useful pain that stops you from burning yourself. Some pains however just do not get better. Doctors call this persistent or chronic pain. This pain serves no useful purpose. It can put a great strain on you, your family and friends.

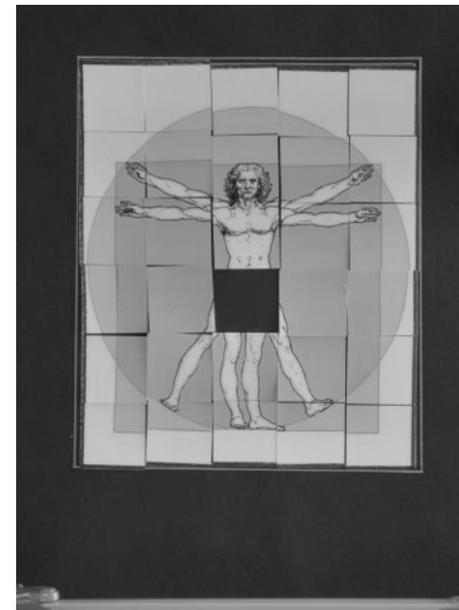
## The Story of Pain

Understanding pain is a bit like a jigsaw puzzle. Not only is it a puzzle but it's a puzzle without the picture on the box to help. Gradually over a number of years scientists have managed to put the pieces together to form a more recognisable picture. Even if some of the pieces are still not in place we can nevertheless 'get the picture'.

# A guide for patients

## Why is it important for you to read this leaflet?

This leaflet will help you if you have been suffering from pain for more than a few months. Understanding how your pain works will help you to manage your symptoms.



Hearing, sight, smell, taste and touch are senses that give us information about our world. Humans have developed a complicated sensory system. These systems enable us to take the right actions for our survival, e.g. if something smells off we don't eat it. If we hear or see a car coming we don't cross the road.

Our sensory system lets us know where we hurt and what sort of pain we are experiencing. E.g. if we have been sitting in one position for a long time our sensory system will remind us to move. At the same time, our brain remembers this and we learn not to do these things again. E.g. we know not to put a hand on a hot iron because we've have learnt and remembered not to do it.

## Nerve endings

There are three types of nerve endings.

- One responds to heat, e.g. If it is too hot or cold it hurts
- One to touch, e.g. too much pressure and it hurts
- One to chemicals, e.g. if we experience a wasp or nettle sting it hurts

There does not seem to be a specific pain nerve ending. Although each trigger is different we feel each as pain.



When we don't hurt our nerves are still active. The nerves sense that the temperature feels just right. The pressure of our clothing feels nice and the chemical levels in our blood are good.

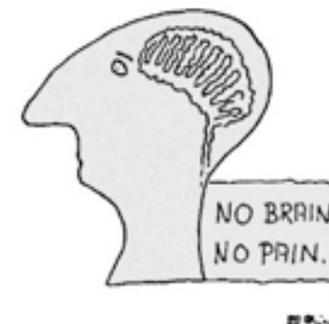
## Our brain

When our nerve endings experience a change in the temperature, pressure or chemical levels within our tissues it is our brain that senses what is happening. Our brain may interpret this as pain.

Experiments have shown that if the brain is unconscious and not alert we will not feel any pain. If we are asleep or distracted we don't feel as much pain as we would if we were fully awake and paying attention.

## Key message 1

Our brain decides how much pain we feel



## The science of pain

Three hundred years ago it was thought that signals were sent from the skin to a pain centre in the brain. The signals travelled up the nerve like the fire along a fuse wire.



Descartes 1664

Anatomists then found nerves which seemed to agree with this theory. This theory does not answer some of the questions that continued to puzzle scientists, e.g.

- How can pain of an amputated limb ('phantom limb pain') still be felt when the limb no longer exists?
- Why doesn't cutting nerves work? Operations done in the 50's to cut nerves did not help chronic pain sufferers
- How can the pain of a heart attack go into your left arm?

You may actually have had experiences that show how the fuse wire theory can not be the whole picture.

- How sore is a paper cut? A paper cut can be unexpectedly sore for such a small injury. This is an example of a small injury giving high intensity of pain.

- Have you ever found a bruise that you didn't know was there? Clearly you suffered an injury but it didn't hurt at the time. This is an example of a definite injury not giving pain.

Research has shown that there are many people living with changes on X-rays or scans who do not have pain. Many people who are in pain have normal looking scans and X-rays!



This patient has arthritis on x-ray but feels no pain



This patient has a normal x-ray but feels pain

This can be the case after laparoscopy when nothing untoward is found but pain persists; or when pain persists despite medical treatment of a condition such as endometriosis.

### Key message 2

There is often little or no link between pain intensity and damage

## Pain gate

How can a small injury sometimes result in intense pain yet other injuries sometimes result in no pain at all? How can an amputated leg still hurt?

These questions led two doctors in the 1960's to believe that there must be more to pain than was originally thought. They suggested the idea of pain 'gates' that allow or prevent signals getting to the brain. This idea is now accepted and we know how it works.

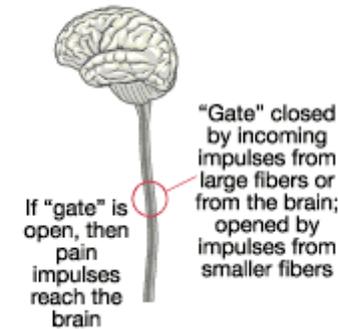
1. Each sort of nerve, i.e. ones that respond to pressure, chemicals or temperature has a certain size of nerve to carry its signals. The thicker the nerve, the faster the signal will travel
2. The nerve from the skin to the brain is not continuous but is in three stages with gaps between them. The first order nerves go from the skin to the spinal cord; the second order nerves goes up the spinal cord to brain; and the third order nerves go around in the brain.
3. When signals reach the gap they have to cross it.

## Opening and shutting the pain gate

Signals travelling up the fast-track nerves will get to the gap first. When signals travelling along the slower nerves reach the gap the second order nerve endings are already 'full'. This means the slower signals can't get through. The 'gates' are closed. Touch sensation travels up the fast tack nerves. This is how 'rubbing it better works. Some medications and applying heat also work this way.

Chemicals (e.g. endorphins) which the brain can release can also stop the pain signals crossing the gaps. This explains those injuries that don't appear to hurt. Many wounded soldiers or victims of trauma have reported little or no pain at the time of injury. We often hear stories of people doing heroic acts even though they have injuries themselves.

### THE GATE-CONTROL THEORY OF PAIN



Our understanding of the pain gate has given an explanation to some of these strange questions. The severity of injury or degeneration cannot predict the severity of any pain. There are many other factors that affect what we each feel and experience.

### Key message 3

In pain management there are things we can each do that may help close the gate. We should do more of them. There are also things that help to open the gate. We should do less of them

## Wind-up

Researchers have looked into how nerves function and now understand it better.

Nerves that signal a lot over a period of time are able to turn up the volume of the pain. It can also be likened to a fire alarm; the bell keeps ringing even after the fire has been put out. The nerves become "wound up". This means they respond much more readily and for much longer. The condition causing the pain may not have changed. For example the wound may have healed following an operation, or there may be the same amount of endometriosis seen on investigation. It is the wound up nerves that have changed.

The brain is now receiving many more signals so it hurts more.



At the gap in the nerves lots of chemicals are released. This is because of the increase in signals. Nearby nerves sense this and grow 'sprouts' to pick up these signals. These new nerves are now involved, sending even more signals along the system. This can then make us feel our pain has spread.

The theory that the nervous system is like a simple fuse wire has altered. We now agree that it is changeable or "plastic", i.e. it changes in response to what is happening. This is called 'neuroplasticity' or 'wind-up'. Luckily we can reverse these changes.

### Key message 4

Through pain management, people with chronic and persistent pain can wind-down their pain system

## Attention or distraction and pain

Scientists have also shown how attending to our pain helps to wind up the system. In hospitals, play therapists keep the children minds off their traumas through play. Scientists have discovered that chronic pain sufferers' symptoms are better when they are distracted. Some pain sufferers report getting into a habit of daily self-checking to see if the pain is still there (called hyper-vigilance). This activity will in itself help to wind up the pain system.

Understanding the effect 'wind up' has on pain is the first step to change and winding down the pain system.

### Key message 5

Distraction will wind down our pain system

## Memory

Memory also plays a part. We have all learnt that if we put our hand on a hot iron it will hurt. We all have our personal memory bank of painful experiences. Chronic or persistent pain sufferers have a larger bank of memories.



Those of us with chronic pain will have more, fresher and stronger memories of things that hurt. We will know that doing a particular activity or movement is going to hurt. This either stops us from doing it or makes us fearful or anxious about doing it. We will start to adapt to avoid the pain.

Our posture and body movements may change and this can lead to weakness and stiffness. Unusual movement patterns lead to other changes in our bodies and prevent normal healing and recovery. To overcome this we need to install new memories that are not associated with pain. With practice we can learn to move normally again. Exercise helps with this. This helps reduce stiffness, make our tissues stronger and give us a healthier body.

### Key message 6

Movement helps to reverse unhelpful pain memories

## Pain and Stress

Adrenaline is a powerful hormone that is designed to help us when we are in danger. It makes us more alert, our hearts pump a bit faster and it gets more blood to our muscles. If you've ever had a fright your adrenaline levels will have gone up. They normally return to normal once the stressful situation has settled.



Adrenaline is helpful in short bursts like this but when it's high all the time it causes problems.

Having pain is stressful. People with chronic pain tell us that they worry about all sorts of things. Common thoughts can be 'what is causing my pain' or 'is my pain going to stop'. They may be worried

about money, work, and relationships. Their adrenaline levels tend to be high. The problem is that adrenalin also stimulates the pain signals and adds to the 'wind-up'.



Stress also causes our body to produce a hormone called Cortisol. It causes problems such as low mood, poor memory and a decreased ability to fight infection. This is why many people with chronic pain have difficulty concentrating or have frequent colds. Taking action to reduce stress in your life will help to reduce pain.

Our bodies also produce 'happy' hormones called Endorphins. They are our body's own natural painkillers. They help stop the pain signals crossing the gaps in the nervous system. They can also make us feel better and improve our mood.

## Key message 7

Relaxation can increase the level of endorphins in the body and reduce pain the natural way. Relaxation is therefore an important part of pain management

## So how can the pain system be changed?

Pain management can involve:

- Learning more about chronic pain.
- Testing out different ways of engaging in activities that don't make your pain worse.
- Relaxation and stress management
- Sleep and sleep management
- Increasing your confidence to take part in the things that you enjoy whilst managing the impact of pain.
- Exercise
- Flare up management

## Further information

Recommended web pages;

<http://www.paintoolkit.org/>

[http://www.youtube.com/watch?v=4b8oB757DKc&feature=player\\_embedded](http://www.youtube.com/watch?v=4b8oB757DKc&feature=player_embedded) This is a 5 minute clip explaining pain

<http://www.getsomeheadspace.com/meditation> This sites explains the effect of stress etc on your pain

<http://www.painconcern.org.uk/> This site has link to "Airing Pain". This is radio a station that gives information on developments in pain and patient experiences

<http://www.patient.co.uk/support/Pain-Association-Scotland.htm>  
This site offers support to people in chronic pain

This leaflet was adapted from a leaflet compiled by the Lothian Physiotherapy Pain Network in association with Patient Information Leaflet Group, NHS Lothian Physiotherapy Services.