UNDERSTANDING PAIN

Introduction

In trying to understand persistent (chronic) pain, it is helpful to know how you experience pain normally. Everybody has different experiences of pain. Hence, the internationally recognised definition of pain by the IASP (International Association for the Study of Pain) is; ‘An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage’. In other words pain is both an individual experience and can be unrelated to the amount of damage of your body. However the mechanisms at work in the body are similar for all.

The Nervous system

Nerves exist in all parts of our body. There are basically 2 types, sensory and motor. Sensory nerves primary action is to tell the brain what is going on in the body. The nerve endings have specialised functions and these can be to detect changes in temperature, pressure or chemicals. This can be to say that the stomach or bladder is full or that your skin temperature is dropping/rising or that muscles or joints are moving.

Motor nerves are used by the brain to tell the body what actions to take; these include activating muscles, but also the release of chemicals in the body. The brain is interpreting and actioning most of these signals at a sub-conscious level, so that you are not aware of what is happening.

Let’s take an example; you are outside on a warm sunny morning, the warmth of the sun on your skin initially makes you feel good (this could be both conscious and sub-conscious). As the sun warms up your body it starts to sweat to cool your skin, which initially you will not be aware is happening. As it becomes warmer or the strength of the sun more acute the ability of your body to control its temperature by sweating will be reached. At that point the feeling of warmth on your skin will be interpreted as dangerous by the brain and you will become more consciously aware that action needs to be taken, such as seeking shade, water, etc. (This example will be continued later).

Nerve signals are often compared to electrical signals along wires; however this similarity is very limited. The signals are more complex than that. Firstly, nerve cells are very long and they can reach from the most extreme part of your body to your spine. Secondly, they have places where they connect (synapse) with other nerves. Most of the synapses are in the brain, but there is also a connection in the spinal cord (in your back or neck). At these connection points it can be that one nerve connects to another or more usually a number of nerves connect to one out-going nerve. Thirdly, for the continuation of the signal towards the brain to occur, is dependent upon the balance of chemicals at these connection points. The in-coming
signal releases a certain amount of chemical at the connection point which alters the balance. When this level reaches a critical amount, a signal continues towards the brain. Hence, it is not automatic that the signal will continue towards the brain.

**Nerve chemicals**

Two types of nerve chemicals exist; excitatory, ‘putting more fuel on the fire’ and inhibitory, ‘putting more water on the fire’. So the more excitatory chemicals at the connection point the more likely the signal is going to continue or the smaller amount of in-coming signal that is required to make it continue and visa-versa.

**Control from above**

The brain is able to alter the amount of chemical that is in the nerve connections. This is a normal physiological response when injury occurs (and at other times) because your brain needs to know what is going on in your body. Also local responses in the spinal cord may result in alterations to the chemicals at the nerve connection points. So, more excitatory chemicals are released so that the brain can capture as much information as possible from the site of injury to assess the damage. But if you are in battle or playing the grand finale, your brain can suppress the signals with inhibitory chemicals. There are many stories of soldiers or sports people continuing after they have sustained a significant injury, because of the ‘heat of the moment’. In other words the signals were suppressed so that the task at hand could be completed, the game won, a position of safety reached. ‘It is not the injury per se that determines the pain, but also the meaning of the injury’, Professor Henry Beecher.

**When is a signal considered to be ‘pain’?**

When you touch something that is hot from the oven without gloves, your reaction is to drop it immediately. This type of reaction is a spinal reflex, and occurs so fast because it happens without interpretation from the brain. This is a different response than normal nerve signals. The brain is interpreting signals from your body continuously and dealing with the majority sub-consciously. If your brain continues to get signals from part of your body which it considers unusual then your brain will send excitatory chemicals to see what other information it can obtain.

For example; your brain receives signals saying that you have pressure and heat on a small area on your leg. The brain rings an alarm bell and says danger, ‘pain’. You normal response would be to look at that section of your leg, where you see a small red swelling. Sure enough you have been bitten by a mosquito or something similar!
So it is your brains interpretation of the incoming signals that decide when you should experience pain or not.

**Other Systems and Chemicals**

Other systems in your body will also have an influence on the pain experience. These include the sympathetic/parasympathetic nervous system, endocrine system and immune systems. In simple terms these systems help to regulate your body; to keep it in balance. However, if you are put in to a stressful situation these systems will react to protect you in the short-term. Chemicals (including adrenaline and cortisol) will be released which will have a number of effects; blood flow, especially to your brain and muscles, will be increased, energy for muscles will be released, heart rate and breathing will increase, your pupils will dilate, your immune, digestive and reproductive systems will be suppressed. This stress response is known as 'fight or flight'. Your body is ready for action, to think quickly, to defend itself or to run away fast. In the short-term this is great and completely normal. However, if these chemicals are consistently maintained at a high level, then they can have negative effects which prolong your healing and can magnify the nerve signals.

**What other aspects affect the pain experience?**

Up until this point we have talked about the internal workings of the pain experience and we have touched upon some external influences, but let's clarify these. Except for the physical (including tissue damage), 2 influences produce the internal effects that are outlined in the above section. These influences can have either positive or negative effects upon the pain experience and they may overlap:

- Social
- Work situation
- Family relationships
- Financial situation
- Your learnt responses to pain (previous pain experiences)
- Psychological
- Anxiety
- Depression
- Grief
- Fear
- Low mood

*Taking the example of earlier, when you can feel the sun on your skin becoming too hot:*

a. *If you are on holiday, wish to have a suntan and have sun-block upon your skin, you would be able to ignore the signals regarding the temperature of your skin for a time. This is an example of social factors suppressing the heat (pain) sensation.*
b. If the sunlight was reflecting into your eyes and you were becoming thirsty. Then you would probably get up and find your sunglasses and get yourself a drink. This is an example of other physical factors that may influence your perception of the heat sensation.

c. If you had just seen a graphic advertisement regarding the dangers of skin cancer, you may jump up immediately and run into the shade. This is an example of psychological factors increasing the influence of the heat sensation.

How does pain become persistent?

So we have learnt that there are many influences on the pain experience and that these are very individual. Also the greater the amount of excitatory chemicals that are released the greater the perception of pain. This is called sensitisation (your body is on red alert). The longer this state of sensitization continues then the more likely that changes start to occur at the nerve connection points and within the brain which reduce the ability of inhibitory chemicals to work effectively. Hence pain can continue after the initial reason for pain has healed.

This can result in the brain interpreting normal nerve signals such as pressure or the stretch of muscles in and around the area (and other areas) as pain. Hence the pain becomes persistent because the sensory system has changed and is now more likely to consider any incoming signal as dangerous. These changes, in the processing of signals, are a normal occurrence to protect you, but the longer they continue the more ingrained it becomes.

- Many factors influence the pain that you experience
- The sensory nervous system has been changed, due to ‘stress chemicals’ within your body

Now, what would be considered as normal sensations, can be interpret as pain?