

## Lesson 1: Why Pain Science Education (SLIDE 1 TITLE SLIDE)

Hello, my name is ..... and I am a specialist physiotherapist working in the Pain Clinic at James Cook Univ Hospital of South Tees NHS Foundation Trust. This is a brief educational video, and the first part of a series of seven virtual lessons. We encourage our patients to use these videos and related resources first and before undertaking any of the active self-management advice. This series of lessons is very much the groundwork to help you understand why we will come to suggest certain strategies; and how they can have a meaningful impact on your pain symptoms.

Why is pain science education important ? Like building a house on uneven ground, (**Slide 2 HOUSE**) if we don't get the foundations right at the beginning then the structure may be unstable later on. Likewise, trying to build your self management plan needs to have sound underpinning knowledge. Some of the messages may sound both challenging and complex at first, but we are not trying to make you a scientist overnight. The more that you learn the more that you take back control, so it may be helpful to watch these videos more than once and after a few days.

(**Slide 3 NNT**) Some research suggests that understanding pain science can often be more effective than medication but without the side effects, because it can change the way that you respond to pain and the way pain feels. Compare pain education to Gabapentin for example which has a NNT of 6; meaning that if we gave it to six people, only one person would feel the benefit.

There is strong evidence that pain education improves pain ratings and disability, and has a reduced NNT compared to medications. Pain education can change your attitudes and beliefs about physical activity and about living a better life alongside pain.

Accepting and coming to terms with persistent pain takes time, but understanding your pain and what it means, allows you to be in charge of it which can then help you manage pain better. (**Slide 4 JIGSAW**) We see Explaining Pain as a key piece and part of your overall self-management jigsaw puzzle and a first step in understanding that you do not need to cope alone and in fear.

If you want to find out more, then follow the links provided to external resources below.

## Lesson 2: Rethinking Pain (Slide 5 TITLE)

Hello, my name is ..... and I am a specialist physiotherapist working in the Pain Clinic at James Cook Univ Hospital of South Tees NHS Foundation Trust. This is a brief educational video, and the second part of a series of seven virtual lessons. This lesson focuses on how our understanding of pain has changed significantly over the years.

Our understanding of pain mechanisms have changed a lot. (slide 6 **Descartes**) For centuries our understanding of how pain worked was based on Descartes theory from the 1600s that pain was a direct measure of tissue damage. On the screen you can see Descartes illustration of how pain works. We see a boy has placed his foot into a fire, this produces a pain signal that travels up his leg, up the spinal cord to the brain and a virtual alarm bell rings that prompts the boy to remove his foot from the fire. **Do you feel this is a reasonable explanation for how pain works? Taken at face value most people would. But the key flaw is that this model sees pain as an input to the brain, but what we actually know is that pain is an output of the brain and its interactions with the rest of body's systems. Im going to use another example to help demonstrate this point.**

Think about human vision, (Slide 7 **VISION**) something we take for granted. Vision could be seen as an input, where light reflects off objects and enters our eye, our optic nerve is stimulated and sends a message to our brain and we see objects accurately and consistently based on this information. However, we know that much like pain, vision is a complex output influenced by many factors. Which is to say that the brain will try to interpret the information it is receiving but can also easily misinterpret that information.

Take this visual illusion for example (Slide 8 **SHADED BOX**). If I was to ask you which square is darker, I would hope that you would say the top one; as would I. However, if you now place your thumb across the light strip in the middle, you will actually see that both squares are the same colour. **Whats going on here? If vision was purely an input then everyone would always see the two squares as the same colour, which we now know is the case. But because vision is an output of the brain, the brain interprets the information based on the context and shadows, and ultimately we see an alternative representation of the image.**

**So going back to pain...** We now know due to up to date research, that much like vision, pain is also an output. which again is to say that our experience of pain will vary vastly based on a number of factors such as our past experiences, the current context and our expectations. **Saying that pain is an output isnt saying that pain isnt real, and this is a common misunderstanding; your pain experience is 100% real. But it is a complex and individual experience rather than an accurate representation of what is happening in the tissues.**

Thinking about pain again, lets continue to challenge the idea that pain is not a direct indicator of tissue damage. (Slide 9 **SEVERITY/PAIN SLIDE**). Descartes' input based theory would suggest that the greater the tissue damage or more severe the injury, then the greater the pain will be. But consider a common example such as why a tiny papercut which is mild in terms of damage but can cause moderate pain, or think about how often have you noticed a bruise with no idea of what caused it, despite this being an indicator of moderate tissue damage.

(Slide 10 **BMJ BUILDER**) A well known example which hopefully summarises the above is a documented case of a builder in the 90's who jumped onto a 6 inch nail which pierced his steel toe capped boot, he was in so much pain even the slightest movement was agonising. But when he got to hospital and the boot was eventually removed they noticed that the nail had passed inbetween his toes and no tissue damage was sustained. He experienced real pain because in that context, if the nail had gone through a thick steel and leather boot then the immediate expectation is that it must have pierced his skin and bone. And so we now know that actually pain is a more complex interaction (Slide 11 **NEW DESCARTES**); but the positive to this is that we have many options to help us manage pain.

If you want to find out more, then follow the links provided to external resources below.

LINK: EP in 5 minutes

### Lesson 3: The Meaning of Pain (Slide 12 TITLE)

**Hello, my name is ..... and I am a specialist physiotherapist working in the Pain Clinic at James Cook Univ Hospital of South Tees NHS Foundation Trust. This is a brief educational video, and the third part of a series of seven virtual lessons. This lesson focuses on the meaning of pain and the magic of the brain.**

Pain is always about protection, (**Slide 13 CAR ALARM**) an internal alarm that alerts us to real or potential danger; but like a fire alarm or a car alarm it can become over sensitive. Just like one of your body's many internal systems, like your digestive system for example, sometimes they malfunction and don't work exactly right. Sometimes it doesn't produce enough pain, (**Slide 14 CONGENITAL INSENSITIVITY**) as in the children born without the ability to feel pain and then struggle living often short lives with permanent injuries, because they are born without receptors which send the right input signals to the spinal cord and brain.

**However, something you may be more familiar with is when the pain system can produce too much pain or become too sensitive, so things that shouldn't hurt, like a hug, feel painful. Sometimes pain can even be produced randomly and without any stimulus.** Think of phantom limb pain (**Slide 15 EPMAN and highlight hand**), or when you feel random electric shock like impulses.

**Normally, pain stops you burning yourself when you accidentally pick up a hot saucepan, or bend your finger back too far; motivating you to move or stop what you are doing and well before there is any actual tissue damage.** However, ask yourself how do people walk over hot coals ? (**Slide 16 HOT COALS**) (**Slide 17 BASEBALL**) Or think about this player who has just hit the winning home run in baseball, and the cumulative weight of his fellow players is about 1 ton, but he is not in pain. This tells us that context is key! If this person had ?10 strangers on top of him, in the middle of a street, he would probably feel like he was being crushed and would be experiencing intense pain.

**Pain is a protective mechanism which can become loud, intrusive and sometimes unreliable. It is based upon the information coming from the tissues and influenced by our thoughts & emotions, previous experiences and expectations, and genetics.**

**There is hope, and by understanding the biology of pain mechanisms and factors that influence its sensitivity, and by looking back at your own individual pain story, you can learn ways to re-evaluate the threat messages and learn more effective ways to live well again.**

**For more information and inspiration, use the resources below and reflect on your journey so far.**

LINK: Tamar Pincus

#### Lesson 4: The Body's Alarm System (Slide 18 TITLE)

Hello, my name is ..... and I am a specialist physiotherapist working in the Pain Clinic at James Cook Univ Hospital of South Tees NHS Foundation Trust. This is a brief educational video, and the fourth part of a series of seven virtual lessons. This lesson focuses on how the body's alarm system works and how it can become over sensitive or persistent long after any original injury has occurred.

Throughout our bodies we have a network of nerve endings (**Slide 19 EPMAN**) which respond to touch, stretch and temperature for example. Part of that network includes our alarm system which responds to mechanical, heat or chemical threats. These specific nerves are called Nociceptors, but we will just call them the alarm system. If you break a bone in your foot, inflammatory chemicals are released which stimulate nerve endings which send a signal to the spinal cord and then onto the brain alerting you about a problem. This is a normal and crucial mechanism to stop you walking on the foot and doing any more potential harm. Also, the inflammation in the foot turns up the sensitivity of all the other nerves nearby; and this is a normal defense. Think of sunburn (**Slide 20 SUNBURN**), which is temporary chemical inflammation of the skin but a warm shower burns or light touch stings. There is no damage caused by the light touch, but the heightened sensitivity feels painful and protects you.

Sometimes, (**Slide 21 EPMAN**) when inflammation hangs around for a while then this can mean that all the other nerves adapt and become more sensitive even to minimal or normal stimuli. We can see this in the example of JHMS, where low level inflammation around hypermobile joints can eventually sensitise other nerves so that stretch activates the alarm system. Or in OA of a joint, where sensitised alarm can be triggered with over activity, and without any clear tissue damage.

**So now that the brain is receiving more alarm signals from this area because of the increased sensitivity, it quite rightly becomes curious about what is going on. So sometimes nerves can adapt further; either switching their role from touch receptors to become an alarm nerve or by even sprouting more nerve endings. However, this leads to a ramping up of yet more danger information being sent to the brain and can even make pain feel more widespread. This vicious cycle we call peripheral sensitisation, and while it feels out of your control, it can be managed with the right help.**

Lets look at the spinal cord, where the first part of alarm system connects with the next part and before it is relayed on to the brain. (**Slide 22 EPMAN**). This junction is influenced by a complex network of immune system cells which can turn up or down the sensitivity of the alarm further. We all experience this unconscious process continuously in our day to day activities; where the brakes can be applied to the nerves relaying information to the brain / or where the brakes come off allowing more information through. Think of the clothes that you are wearing, a watch, shoes or your glasses. They are clearly stimulating nerves under your skin, and most of the time the brakes are applied at the spinal cord because the brain does not need to know about what your clothes are doing – but as soon as I mentioned clothes, watch, shoes or glasses, temporarily the brakes came off and you could feel those items.

**Let's explore this further. Have you ever picked up a hot plate, but instead of immediately dropping it, you have been able to keep hold of it a little longer and until you can put it down safely. Temperature receptors are activated and alarm signals are sent alerting you to the danger, but in an instant, your brain concludes that you can't drop the plate and smash it, and applies the brakes to the alarm until you can put it down safely.**

While nociception is important, (**Slide 23 BMJ BUILDER**). pain can also be felt without the alarm system actually being triggered at all. If you remember the builder who jumped onto the 6" nail, but the nail had in fact passed between his toes. The brain expected tissue damage and generated pain sensations that were felt in the foot to protect it. All the brakes came off and then also turned up the sensitivity of the other connections in the spinal cord, because even flexing his foot (activating normal stretch receptors) turned up the alarm system.

**Before we look at what happens at the next stage, in lesson 5 about the brain; it is useful to follow the links below to help understand the mechanism of nociception further.**

Lesson 5: Part 2 (Slide 23 TITLE)

**Hello, my name is ..... and I am a specialist physiotherapist working in the Pain Clinic at James Cook Univ Hospital of South Tees NHS Foundation Trust. This is a brief educational video, and this is the fifth part of a series of seven virtual lessons. This lesson looks further at how the body's alarm system works and how the brain plays a crucial role.**

**Once the alarm signal arrives from the spinal cord to the brain, (Slide 24 NEUROTAGS) a large network of brain regions are activated. The subjective experience of pain emerges from all this brain activity called the neuromatrix, and makes everyone's pain experience individual. The brain tries to weigh up the information based on previous experiences and the context.** Do you remember the hot plate example from the previous lesson? The hot plate stimulates thermal receptors under the skin, the brain recognises that the information is coming from your hand (body location), it's unpleasant, it's engaged your full attention (cognition), the brain recognises the kitchen as your context (context), you are unhappy or angry or upset about it (emotional), because last time you dropped it it took ages to clean up (previous experiences). That's a lot of things, which is why pain is often called a 'multidimensional' experience. So, what do you do? Well, from past experiences, learnt responses, and potential outcomes (dropping the plate means no dinner) your brain makes an unconscious decision to put the brakes on. Recruiting extraordinary brain-based networks, you are able to temporarily block the alarm signals and get the hot plate to safety – before running cold water over your hand. We call this whole chain of interconnected pathways in the brain a neurotag. My neurotag for this event would be not be the same as your neurotag and both would be different to a chef's neurotag – someone who's experiences and expectations of handling hot plates would be very unique to them.

**There is no one area responsible for pain, and activating one piece alone can set off the whole pain neurotag pathway. A real life example we use is of a lady who fell from some ladders and broke bones in both of her legs. Years later after the tissues had healed as well as they can, she reported that even seeing a set of ladders produced a sensation of pain in both of her legs.** Each pain neurotag is under the influence of your previous experiences, your expectations, the context you are in, and your emotional state. This explains how your pain can be generated even in the absence of an alarm because of your conditioned expectations; Neuroplasticity is an amazing quality your brain has which allows it to adapt and change and means we can learn new things. Because your brain is adaptable this gives us lots of opportunities to rewire that neurotag. (EP NEUROTAG SLIDE)

**If you *expect* something to hurt, it will. And if you expect something to relieve your pain, then it usually does. To find out more, check out the links below and learn more about neurotags and neuroplasticity.**

LINK: Moseley snake

LINK: Sentis neuroplasticity

Lesson 6: What is contributing to YOUR Pain. (Slide *TITLE*)

**Hello, my name is ..... and I am a specialist physiotherapist working in the Pain Clinic at James Cook Univ Hospital of South Tees NHS Foundation Trust. This is a brief educational video, and this is the sixth part of a series of seven virtual lessons. This lesson looks at the other factors that can contribute to your pain experience, and which of these factors are within your control and modifiable.**

**(Slide JIGSAW)** Pain is usually the combination of different things, most of which you won't see on a scan. The ways that these interacting factors can physically change your alarm systems or how they influence your perception to the environment are complex and not yet fully understood. The links below can offer more learning on this if you are interested. But we now know that prolonged stress, poor sleep, worrying thoughts and emotions about life events, poor coping strategies and your expectations can all influence your pain experience. These all have different amounts of influence upon each individual, but discussing them with your therapist can help you to understand your overall pain management jigsaw picture; to identify the most pressing issues now and how to develop the skills to reduce their impact.

**(Slide GRAPH1)** Understanding and then accepting that some factors are outside of your direct control, or do not fluctuate up and down daily or weekly, is important. Genetics, joint loading and normal age-related changes may be contributing to your pain experience; but we can not significantly change them and **(Slide GRAPH2)** so it is often more realistic to look at those contributing factors that are in your control. We acknowledge that surgery can be helpful for some of these changes or in certain conditions, but the general rule is that the longer someone has been living with pain, the less likely that surgery will help.

**(Slide GRAPH3)** Previous unresolved life events can contribute, and sometimes it is necessary to explore these with the right therapist. We can signpost you to the most appropriate service if needed.

If we look at the contributing factors that are modifiable and in your control, then there is hope in managing your pain more effectively. **(Slide GRAPH4)** Acknowledging stress & anxiety and learning new relaxation strategies such as Mindfulness can help build your resilience to stress and reduce its contribution to your pain. **(Slide GRAPH5)** Considering modifications to your diet and lifestyle can help. **(Slide GRAPH6)** Learning sleep hygiene techniques can promote your normal restorative sleep processes. **(Slide GRAPH7)** Re-engaging with friends or work can rebuild your support networks. **(Slide GRAPH8)** Understanding the right exercise for you and gradually exposing your body to activity has a positive impact on your physical and mental wellbeing. And what we know from the research is that all these can all be tools to better manage your pain.

**(Slide GRAPH9)** Often a temporary pain flare-up can be triggered by the modifiable factors that do fluctuate up and down. A short period of stress or several nights of poor sleep can contribute to an increased pain experience. A temporary but significant increase in your usual activity levels can likewise trigger a flare-up, especially if it was unplanned and sudden.

**We find it helpful to work on one battle or jigsaw piece at a time, as introducing small life changes can be difficult enough. But the cumulative effect can reduce your pain experience, and improve your function. To find out more about these resources check out the links below.**

Lesson 7: The Road to Recovery

Lesson 6: What is contributing to YOUR Pain. (Slide TITLE)

Hello, my name Nick and I am a specialist physiotherapist working in the Pain Clinic at James Cook Univ Hospital of South Tees NHS Foundation Trust. This is a brief educational video, and this is the last part of a series of seven virtual lessons. This lesson looks at the road to recovery, in terms of what the therapies team at the Pain Clinic has to offer, and how we can work together to help you better manage your pain.

(Slide Working as a Team) Within the pain clinic all members of the physiotherapy are highly specialised, with expertise that allows us to advise and help manage a very wide range of complex persistent pain conditions. We most likely work in a different way to physiotherapists that you have seen previously. One crucial factor that allows us to help you better manage your pain is that we work as part of a wider team of pain specialists; including psychological therapists, pharmacists, nurses and consultants. Working closely with our colleagues allows us to give you a well rounded management approach.

(Slide: What to expect from physiotherapy) In a one to one physiotherapy clinic you can expect us to take the time needed to hear your story. This is key and often undervalued. We know the pressures that GPs and other health care providers are under, and learning and listening to your pain story is not something that can be done in 10 minutes. We are lucky here to have the time required to understand your pain story and how to best help you. Every patient is individual and it is important that our management approach reflects this.

(slide: Interventions) Some of the interventions that we offer as physiotherapists have been mentioned in earlier lessons. These include pacing, exercise and graded exposure, sleep hygiene, dietary advice, understanding your values and setting goals around these, stress management and relaxation. All of these are done with an underpinning focus on pain science, to help you understand why we do what we do, and how they can influence your pain. All of the above is, of course, individualised to you and during your assessment we try and gauge where help is needed most.

For instance, some patients we see already sleep well, others are exercising plenty, and others are not dealing with any major stress. So we offer help where it is needed. Another challenging, but equally brilliant part of working with physiotherapy, is that what we offer requires you to be an equal and active member of your treatment. Often, people have been exposed to passive treatments, where interventions are done to an individual, rather than with them. Such as taking medications, surgeries, massages and acupuncture.

(Slide: Being active with chronic pain) But when dealing with persistent pain the evidence shows us that active treatments, where choice is offered and patients are part of the process, have the most meaningful impact on our pain and our ability to manage it.

**END**

*Tailored to you based on your pain story, alongside our pain colleagues.*

*Acceptance can be a first step, acknowledging when further psychological help is needed*

*Understanding your values, values based goals setting,  
Graded exposure, what physio offers, sleep hygiene  
Can be done virtually or face to face.  
Collaborative goal setting, agreeing the plan together etc*