

## **Pain: What does it really mean?**

### **Defining Pain**

When we experience pain, we're used to thinking that this means that something is wrong. While some pain is of course the result of injury or harm, new information about the ways our nervous systems function (neuroscience) indicate that we can begin to think about pain differently. Some of this new information should actually help us to learn how to decrease our pain!

There are essentially two kinds of pain:

**Nociceptive Pain** refers to the information received at the brain as a result of tissue damage. This is the body's system for warning us that we are in immediate danger or there is something harming us.



### **Nociceptive Pain Pathway**

Reproduced from National Library of Medicine, Bethesda, Maryland

In the picture above, this silly person has her foot to the fire. A nerve is activated at the foot (called a **peripheral nerve**) which sends an impulse up to the spinal cord, transmitting information up the spinal cord to the brain. At this point she experiences pain, and hopefully removes her foot from the flame. Very shortly her pain subsides.

If the injury is severe enough, **tissue damage** can occur and an **inflammatory process** begins, which then leads to healing. After healing occurs, the nervous system returns to normal. During this time period, pain is called "subacute", referring to pain that results from an injury persisting through the

healing process, and gradually getting better as your body heals spontaneously or you are helped through your healing by your therapist or other health care providers.

**Non-nociceptive pain refers to pain which is no longer related to imminent danger or tissue healing.**

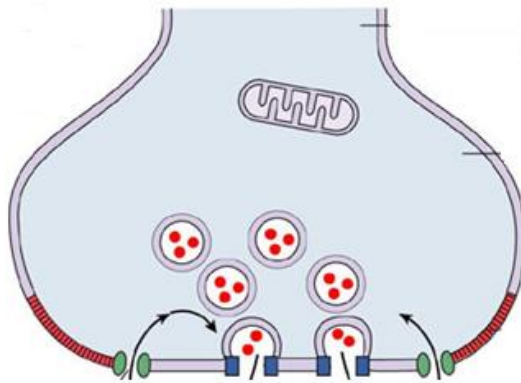
Sometimes pain persists beyond the subacute phase. This can be due to other factors interfering with healing, like when we're worn down after an illness, or if we're having difficulty dealing with stress in our lives. (We'll talk about some of these specifics in a moment.) When this happens, changes can occur in many parts of the body which cause us to experience pain after the original injury has healed. This is called chronic pain, and indicates a need to change the therapeutic approach to make sure that you're getting the help that you need to get things back to normal.

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### **Changes in the Nervous System**

In a more prolonged healing process, changes can occur throughout the body:

**Changes can happen at the place where the injury originally occurred:** A normal nerve ending has a certain number of channels to let in information about possible tissue damage. With prolonged recovery, more channels get laid down. This makes it easier for the nerve to fire, that is, it becomes *hypersensitive*. It then becomes easier to feel pain with less painful stimulus.



### **Ion Channels at a Nerve Ending**

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***THE GOOD NEWS: Most of those ion channels die and rebuild every few days.***

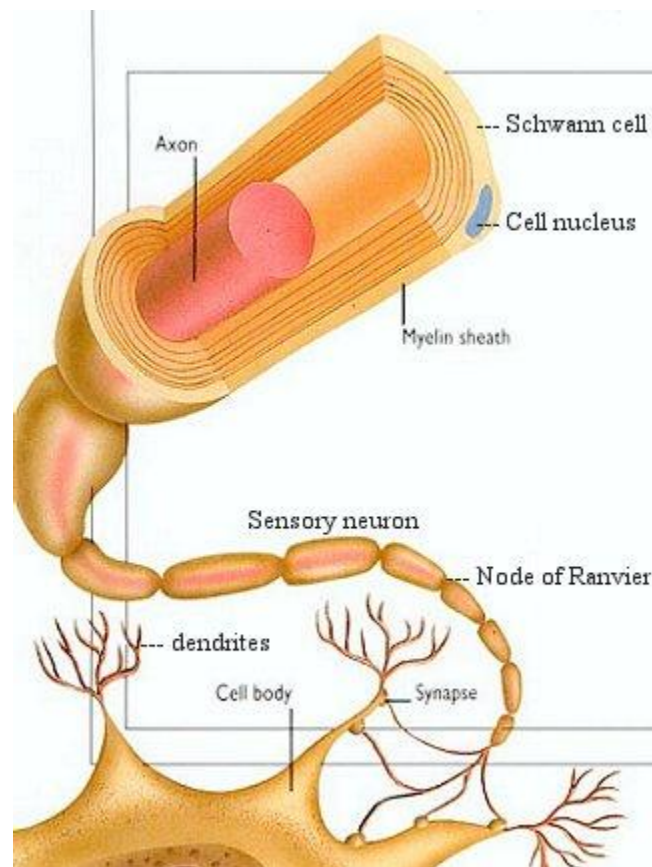
This process reverses as you begin to do more healthy activities.

## **Pain: What Does It Really Mean?**

### **Changes in the Nervous System (continued)**

#### **Changes can happen along the nerve travelling up to the spine:**

The nerve can also become **sensitized along the outer part of the nerve itself** (this is the protective layer around the nerve fibers.) You may originally feel pain in the foot when you sit, but now you're feeling with walking or with putting on pants.



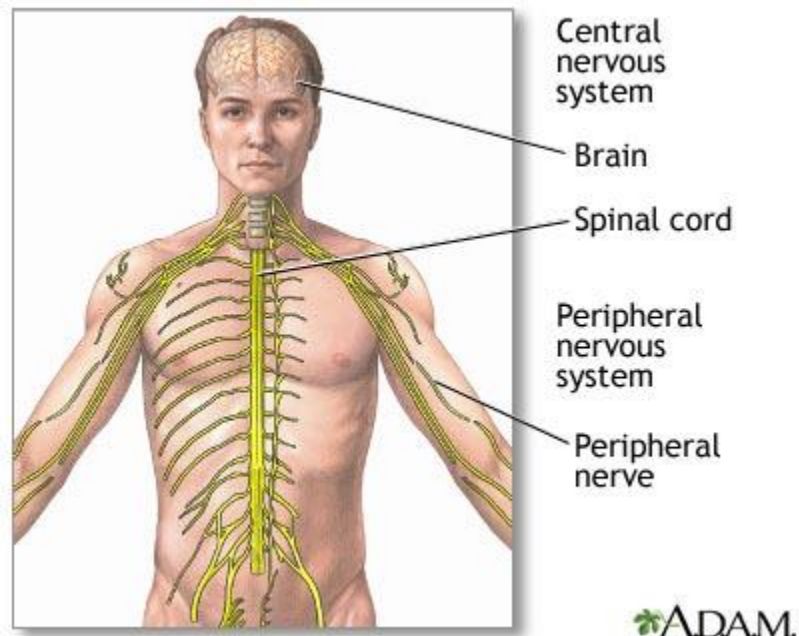
#### **Myelin Sheath of Neuron**

What this can mean is that instead of, or in addition to, pain sensation originating in one place, like the foot, **other places along the nerve can activate the nerve and send a signal up to the brain.**

***THE GOOD NEWS: There is a lot that we can do in therapy and in your home program to reduce the sensitivity along your nerve and to restore the normal mobility of the nerve.***

## **Pain: What Does It Really Mean?**

### **Changes at the Spinal Cord**



#### **Information Travels Up the Spinal Cord to the Brain**

Reproduced from ADAM

When that nerve travels into the **spinal cord**, it makes connections which send information to the brain. If you have been sending a lot of signals to activate the pain system, you can develop sprouts into the wrong parts of your spinal cord. When this happens, non-painful sensation can be experienced as pain simply because the wrong centers are being contacted.

***THE GOOD NEWS: This change in your pain experience is not a result of something bad happening.***

The pain hurts, but it doesn't indicate that something is harming you. Essentially the nerve receptors are working over-time. You can help reverse this by decreasing the overactivity coming from sensitized nerves, which we just talked about, and by quieting down the processing at the brain, which we'll talk about in a moment.

## ***Pain: What Does It Really Mean?***

### **Changes in the Brain**

#### **Changes can occur at the brain that increase or decrease your sensation of pain:**

The signal continues up the spinal cord to the **brain** and travels through various brain centers where it is then **interpreted as pain. It isn't actually pain until then, it's just an electrical signal.** There are many ways that the pain sensation is increased or decreased at the brain.

**Multiple parts of the Brain Send Pain Information Back and Forth:** The more excited the system becomes, the more likely that a person will feel pain or feel worsening pain.

These are some of the areas of the brain that increase if decrease a person's experience of pain:

- **Premotor and motor cortex:** organizing and preparing for movement
- **Cingulate cortex:** concentration and focus
- **Prefrontal cortex:** problem solving and memory
- **Amygdala:** fear, fear conditioning and addiction
- **Sensory cortex:** sensory discrimination
- **Hypothalamus and thalamus:** stress responses, autonomic regulation, motivation
- **Cerebellum:** perception of movement
- **Hippocampus:** memory, spatial cognition, fear conditioning
- **Spinal cord:** gating from the periphery

***THE GOOD NEWS: As you begin to return to more normal activities, the brain decreases the activity of the pain information in the brain making it easier to be aware of things besides pain.***

Each part of your brain that processes pain information has the ability to increase or decrease your pain experience. As these parts of your brain begin to focus on a return to normal activity, your pain may diminish. For example, if your pre-frontal lobe understands now that your pain is not a signal of danger, then that may decrease your pain somewhat, turning down the intensity of the signal as it travels through this center. If you start to move more comfortably, less guarded, your motor cortex will then also quiet the pain information a bit as the signal passes through that region.

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### **Changes in the Brain: Pain and Emotion**

**Emotions:** People in pain are often also dealing with depression or anxiety. This is completely understandable as you work on making adjustments in your life, and you worry about what is happening in your body. What brain imaging is showing us is that **pain sensation is processed in some of the same areas as these emotions are processed**, which very likely explains why **people who are anxious or depressed tend to experience more pain, or more intense pain**, than people who are not struggling with anxiety and depression.

***THE GOOD NEWS: As you do things that help yourself feel more emotionally supported, you may begin to feel less painful.***

#### **Things you can do:**

- Spend time with friends who make you feel good
- Continue to do hobbies and activities that you enjoy
- Check out whether you have become socially isolated and developing strategy to change that
- Relaxation training, breathing and exercise
- Counseling from a mental health professional is useful in working through emotional issues.
- Cognitive behavioral therapy: Because some of our pain is a result of patterns of thinking that we can get stuck in, a method called Cognitive Behavioral Therapy can be very helpful in restructuring our thought habits.

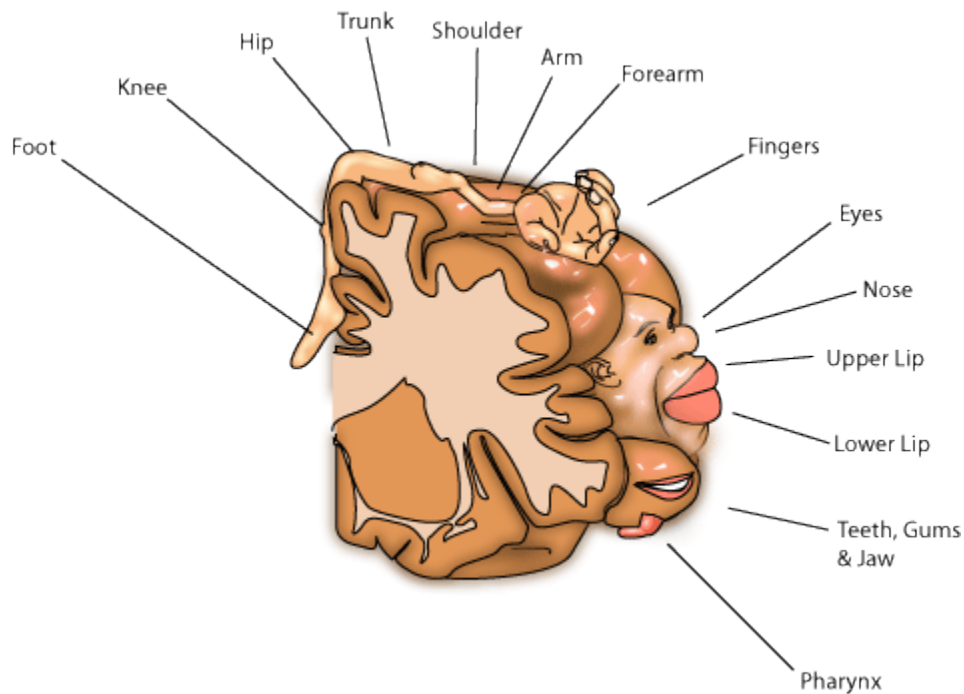
When we live with pain for a long time, the pain can become a primary focus, and we can begin to limit our activities because we're afraid of hurting. But if you **remember that the pain you're experiencing is not due to harm or danger, then you can start to return to the things you enjoy.** (If you do your exercises while watching a Laurel and Hardy movie, your whole nervous system will process that pain differently.)

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### **Pain and the Body Map**

#### **Changes can occur in the way we sense our bodies:**

A map of the body exists in your brain. Each area on the map represents sensation for a specific region of the body. This area is called the sensory homunculus. This is another place in the brain where pain is processed differently over time.



#### **Sensory Homunculus or Body Map**

Reproduced from AdInstruments 2009

When you use a specific part of your body a lot, its representation in the body map is changed. So all the teenagers out there texting like maniacs now have extremely large thumb representations on their body maps. If you stop using a part of your body because you're painful and afraid of moving because you're afraid of hurting yourself, then **that part of the body becomes smudged or blurred in the body map**. So what that means is that it becomes harder to pinpoint a sensation and your feeling of pain can become much more generalized, like "my whole back hurts all the time". But because the body map adapts readily

to use and disuse, as you begin to resume normal activities, and focus your awareness on the rich ways that you can and do use your body throughout the day, to breathe, to feel the warm sun on your skin, to smell good food, then **the map can change again to a healthy representation. Remember: if your pain is not due to the nociceptive pathway, then it's not an accurate signal of harm.** So you don't need to be afraid to do the things you've been avoiding. Your therapist can help you relearn your body and figure out how to pace yourself in returning to activity.

***THE GOOD NEWS: As you get back to moving and get back to your activities, you remodel the body map and restore your ability to sense how your body moves.***

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### **Pain and Stress**

The Autonomic Nervous System is the part of your body that controls your organs, doing things like raising and lowering blood pressure, altering digestion, heart rate and sweating. It has a big role to play in the experience of pain.

There are two parts to the Autonomic Nervous System:

#### **Parasympathetic Nervous System:**



The parasympathetic nervous system controls digestion, regulates sleep, slows heart rate, and controls sexual arousal.

## **Pain: What Does It Really Mean?**

### **Pain and Stress (continued)**

#### **Sympathetic Nervous System:**



The sympathetic system, also called the **fight or flight response** because it's the part that helps us get blood to our muscles quickly to flee from danger. It increases heart rate, moves blood away from the gut and to the muscles. **The sympathetic nervous system is associated with response to stress.** When people have been injured, or have been dealing with pain for a long time, their sympathetic nervous system is often overactive.

The Sympathetic Nervous System can increase the experience of pain in several ways:

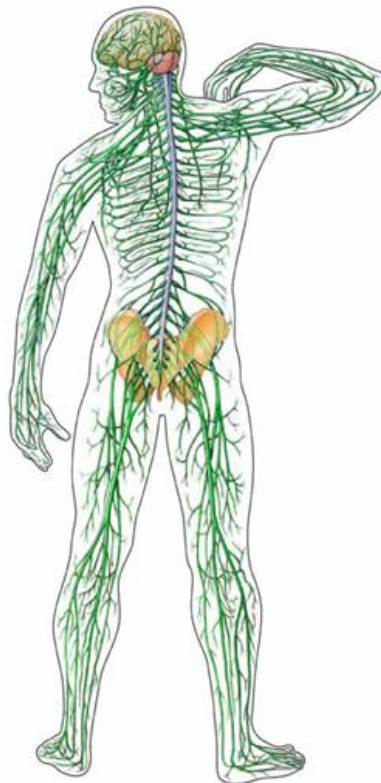
- It can **create more muscle tension** which can cause pain
- It can promote the **release of chemicals in the body that make us more sensitive to pain (such as cortisol)**
- The sympathetic nervous system can actually activate a peripheral nerve that is already sensitive, so **that you experience pain in a stressful situation.** Sometimes people will report that after a fight with a family member, their arm or foot hurts more. Or, if someone is in a constant state of fight or flight, they may simply feel more all-over pain from that increase in cortisol.

***The Good News:*** ***You can do a lot to respond differently in to stress.*** You may not be able to change the things that cause stress in your life, but only you can control how you respond to, and internalize, that stress. And this is in fact something that you have complete control over. Your therapist can help you develop strategies for working with your sympathetic nervous system in ways that will help your recovery from pain.

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**Remember that recovering from complex pain is a gradual process.**

Rehabilitation from complex pain is multi-faceted, and the most important part of your rehabilitation from complex pain is the changes that you make yourself: changes in your level of conditioning, participating in your home program, developing a healthy emotional support system, changing your ways of dealing with stress. Some aspects of this article will be more relevant to you and some will seem less applicable. As you and your therapist work together, you will learn where to focus your attention to best address your stage of healing.



**The most important player is you.**