

Explain pain

- In the Brain there is not just 1 pain centre. Many areas may be involved in pain and we call them **Ignition Nodes**.
- In chronic pain, some of these **nodes** become very sensitive and it is as though they are hijacked into what we call a **pain neurotag**.
- A possible PAIN NEUROTAG
 - 1. **Premotor/Motor Cortex:** organise & prepare movements
 - 2. **Cingulate Cortex:** concentration, focussing
 - 3. **Prefrontal Cortex:** problem solving, memory
 - 4. **Amygdala:** fera, fear conditioning, addiction
 - 5. **Sensory Cortex:** sensory discrimination
 - 6. **Hypothalamus/Thalamus:** stress responses, automatic regulation, motivation
 - 7. **Cerebellum:** movement & cognition
 - 8. **Hippocampus:** memory, spacial cognition, fear conditioning
 - 9. **Spinal Cord:** gating from the periphery
- The particular pattern of activity which creates the perception of pain can be considered a **'neurotag'** for pain.

- Pain is normal - it's the most powerful protective device we have
 - Sprained ankle = pain
 - The pain can be easily related to changes in tissues (ligament in this case).
 - The Brain concludes that the tissues are under threat and that action is required, including *healing behaviours*.
 - Rest, ice and stop any physical activity that causes pain - for a short period of time
 - Chronic pain - e.g. back pain more than 3 months
 - The cause is **multifactorial**. It involves *emotions, thoughts, and beliefs*.
 - "The amount of disc and nerve damage rarely relates to the amount of pain experience"

The Brain is the Big Boss

If he thinks you are in danger you will feel PAIN, otherwise you won't

- Amazing pain stories
 - The amount of pain you experience is not related to the amount of tissue damage
 - A paper cut really hurts !!! A lot of pain but there is not much damage
 - Headache: a lot of pain but no damage at all
 - Soldiers who lost a limb and they reported little or no pain. A severe damage but no pain.
 - Shark attacks: surfers had their legs bitten off and reported feeling nothing more than a bump. Severe damage and no pain
 - "What is happening in your tissues is just **one part** of the amazing pain experience"

- Pain relies on context
 - When you step on a nail in the garden, it may or may not hurt immediately. The BRAIN has to decide it
 - It probably won't hurt if you also observed a snake close to your foot
 - A minor finger injury will cause more pain in a professional violinist than in a professional dancer
 - This is because finger damage poses a greater threat to the violinist
 - Pain experience and Emotional content
 - In pain experience such as grief or rejection from a loved one, where there is a high emotional content, there will be physical issues such as changes in muscle tension and altered cellular healing

- The phantom in the body
 - Phantom limb pain is the experience of pain in a body part that does not exist
 - 70% of people who lose a limb experience a phantom limb
 - The feeling are real. It can itch, tingle and hurt
 - Pain after amputation is usually more severe than before amputation
 - This is a type of PAIN MEMORY
 - The brain holds many virtual bodies
 - Our virtual bodies let us know where our actual body is in space
 - Try closing your eyes and reaching for a cup. You can still do it because your brain uses the virtual body to know where the real body is.
 - In phantoms, although the leg is missing, the virtual leg and the relationship of the leg to the rest of the body is still represented in the brain

Sensory system

- Danger alarm system
 - It has a command centre --> the brain
 - It will tell the brain where in our body the danger is
 - It will tell us the amount of danger and the nature of danger (eg. a burn compared to a pinch)

- Sensors
 - M (Mechanical): respond to mechanical forces such as pinch or pressure
 - T (Temperature): respond to temperature changes, both cold and hot
 - C (Chemical): respond to the presence of chemical changes, either form outside or inside your body

- When sensors respond to a stimulus (eg. acid or a pinch), they open so that positively charged particles from outside the neurone rush into the neurone.
- This sets up an electrical impulse in the neurone
- The life of a sensor is short (only few days), then they are replaced by fresh sensors. This means your sensitivity is continually changing.
- If you are a pain sufferer, it may give you some hope. **Your current level of sensitivity is not fixed**

- Sensors are made inside your neurones under the direction of the DNA
 - If you are in pain
 - The Brain orders the DNA to increase the rate of sensor production.
 - In this way it increases the sensitivity of that neurone to a particular stimulus.
 - The rate of sensor production can be reduced if the demands for production are reduced

- How do sensors and sensor activity relate to pain?
 - We don't have pain receptors, or pain nerves, or pain pathways, or pain centres
 - We have Nociception, which means 'danger reception'
 - This danger reception is neither sufficient nor necessary for pain
 - If there are enough sensors open, positive ions flow into the neurone and send a danger message to the spinal cord (inside your back). *The message only says 'Danger', it doesn't say 'Pain'*
 - If a sensor is open, ions flow through. Many sensors only open to specific input (eg. M opens to Mechanical forces)
 - A second neurone sends the Danger message up to the Brain.