Descending Modulation

COMPLEX BIT

Individuals vary a great deal in how they experience pain and as we know nociception and pain do not have a straightforward relationship. The presence of an endogenous pain modulation system may in part explain this.

Immediate reductions in pain after many clinical interventions, from manual therapy to exercise, probably arise from activation of the descending modulatory system. One of the reasons why nociception does not simply equal pain is that there is a multitude of chemicals released supraspinally that can act to suppress or block ascending nociceptive signals.

A key brain region involved is the periaqueductal grey matter (PAG) that projects to the rostral ventromedial medulla (RVM). Multiple brain areas project to the PAG, such as the cortex, limbic system and hypothalamus, meaning it can be affected by factors such as thoughts, emotions and stress. This circuit is opioid mediated leading to endogenous opioids providing analgesia (pain relief) when activated.

The RVM connects to the dorsal horn and can act to inhibit or facilitate nociception. It contains on cells that act to facilitate and off cells that act to inhibit noxious stimulus when they are respectively activated.

Descending pathways can inhibit post synaptic elements within the dorsal horn and presynaptic afferent fibers at the terminal endings, there is also the excitation of inhibitory or facilitatory interneurons within the spinal cord that also affect nociceptive signalling.

The placebo effect has been shown to be underpinned by these top down inhibitory mechanisms and expectation, distraction, emotional context can all activate the PAG/RVM and associated pathways.

Increasing evidence reinforces the concept that chronic pain is associated with alterations in the descending pain modulation system leading to a facilitation and amplification of the pain experience.

There are a host other chemicals, mechanisms and systems that are involved in mediating descending modulation including:

- Noradrenaline (system)
- Serotonin
- GABA
- Cannabinoids

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Understanding descending modulation provides us with a real chemical link to explain why pain can be weird and often out of whack with the damage to our bodies!

The descending modulatory system has been described as the drug cabinet in the brain. The brain can release super strong natural pain killing chemicals in response to lots of factors including how we feel and our expectations of something having an effect. Many long term ineffective treatments work by short term activation of these mechanisms to provide pain relief through the placebo effect and simply make people feel better. Equally lots of chronic pain sufferers are not good at activating this system and may even have the system biased more towards facilitation, increasing sensitivity and pain over the long term.

Think about setting small achievable targets to get positive associations with exercise and activate the reward analgesia system involving the nucleus accumbens and dopamine.

The simple story

Imagine the descending modulation system is like a big knob that can be turned right up to the highest sensitivity setting meaning that things can be much more painful or sensitive than usual or turned right down so things are not so painful or sensitive. The knob might even get stuck turned right up sometimes meaning people can be supersensitive such as with chronic pain.

This ‘setting’ can be influenced by many factors including stress, health, mood and expectation.

Reading List

Descending Inhibitory Systems
Pertovaara. Handb Clin Neurol 2006

Descending pain modulation and chronification of pain

Central modulation of pain
Ossipov J Clin Invest. 2010