Nociception

COMPLEX BIT

Nociceptors are high threshold free nerve endings (A and C fibres). They respond to noxious stimulus and transduce/encode this stimulus and then project an afferent signal to the spinal cord where they synapse with second order neurons in the dorsal horn. Many second order neurons have ascending axons to supra spinal sites within the brain stem and brain. This process is called nociception.

Most nociceptors are polymodal meaning they respond to noxious stimulus arising from mechanical, thermal and chemical stimulus. The mechanical sensitivity of many nociceptors increases, meaning the mechanical threshold for activation drops, an example being after the chemical irritation that can occur during inflammation. The thresholds required to activate nociceptors are variable in different tissues meaning they may have different responses.

Nociception is no longer seen as a simple process whereby a “pain signal” is transmitted and faithfully reproduced as the sensation of pain. A well used phrase is “nociception is neither sufficient or necessary for pain” and is only one part of the multi dimensional nature of pain.

There can be nociception without the conscious experience of pain such as getting a scratch or bruise without being aware of it and also we can have pain without body parts to contain nociceptors with phenomenon such as phantom limb pain.

These signals can be turned up or down by the many stages of processing that MAY eventually end up as the conscious experience of pain based on the many affective/behavioral aspects that make up humans.

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Nociception

SIMPLE SIDE

Nociceptors have been described simply as “danger sensors” alerting us to potentially damaging or damaging stimulus. Many nociceptors are activated at levels below the conscious threshold for pain so nociceptor activity may actually help us avoid pain.

Martial artists, gymnasts and ballerinas all regularly perform physical actions, such as striking objects or extreme joint angles, that would give rise to the activation of nociception in untrained individuals without ever experiencing pain. This is because their perception of these potentially harmful stimulus has been altered by training.

We can have paper cuts, ice cream headaches and burns that cause disproportionate levels of pain to the threat that they provide to our survival and tears and degeneration in our tissues that cause no pain showing that the state of our tissues and what we experience are not simply one and the same.

The simple story

“Sensors in the tissue are pretty dumb. They are a lot like the sensors in our cars, they just send a signal when something specific happens.

It’s like a low petrol light in the car. When the petrol gets too low the sensor is triggered and a light goes on on the dashboard.

On its own this is pretty insignificant. It’s the human operating the car who interprets them and decides what to do about it. Some people will freak out and head to the nearest garage to get more fuel.

Others will be far more relaxed, ignore it and carry on for ages with the light on.

The response could depend on if you have run out of petrol before and been stranded on the motorway!

This is just like what happens with signals from our tissues, it depends on how they are interpreted which can be affected by our previous pain experiences”

Reading List

Crossmodal shaping of pain: a multisensory approach to nociception.
Senkowoski Trends Cogn Sci. 2014

Peripheral and Central Mechanisms of Pain Generation.
Schable Handb Exp Pharmacol. 2007

Nociception, Pain, Negative Moods, and Behavior Selection
Baliki Neuron. 2015

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