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Why do we experience physical pain?

There's no doubt about it: Pain ***sucks***. We all hate it — and some people go to immense lengths to try and get rid of chronic pain. And yet, it's a constant part of human experience. But why do people feel physical pain? How does it even work? And does everybody feel pain the same way?

As loathe as we are to admit this, pain does play an important role in our lives. Without it, we wouldn't be able to sense an injury, and we'd be in danger of harming ourselves even further. Here's why pain exists, how it works — and why scientists are struggling to quantify it.

Why is pain so... painful?

Pain is a remarkably complex and multifaceted process. Nature clearly went out of its way to ensure that animals experience pain to the degree that they do — and there's clearly no better way for evolution (and our genes) to influence certain life preserving behaviors.

At its simplest, pain is an evolved defense mechanism that alerts animals to an injury, thus allowing them to protect their bodies and not damage themselves any further. It's also an extremely efficient way to get an organism to respond quickly (and even savagely) to threats — and this "pain reflex" is probably a major reason for the very existence of pain.

Indeed, anyone who has accidently put their hand on a hot stove knows all too well about this response; the instinct to pull away is as overwhelming as it is quick. The pain reflex is a response that saves lives, and by virtue of that, has become a potent genetic trait that gets passed down from generation to generation.

Some biologists have wondered, however, why animals evolved the pain response instead of something else, such as an internal "red flag" that essentially serves the same purpose. The psychological duress that results from pain, it would seem, is a kind of evolutionary overkill. Couldn't nature have come up with something a bit more elegant and less...unpleasant?

Evolutionary biologist Richard Dawkins believes the answer is no. Writing in his book, ***The Greatest Show on Earth: The Evidence for Evolution***, he makes the case that pain is the most effective way of getting an animal to quickly understand the gravity of a perilous situation and react accordingly. And in fact, the more agonizing the pain is, the stronger the message.

Dawkins makes the case that a "red flag" signifier wouldn't really do the trick, and that an animal would likely underestimate even the most life threatening of situations. The most successful organisms in this regard, says Dawkins, are the ones who have evolved the requisite degree of pain response when facing a threat — levels of pain that are impossible to ignore.

And importantly, this still translates to us humans living in the modern world. Studies show that people with congenital insensitivity to pain have reduced life expectancy. Whether we like it or not, we ***need*** physical pain.

How do we classify pain?

Pain comes in all shapes and sizes — and intensities.

The most common form of pain is what's called nociceptive pain, what's typically the result of a physical injury. When you stub your toe, burn yourself, or experience a cut, you're are activating the nociceptive pain receptors (more on this in the next section).

Another primary classification is neuropathic pain which is caused by damage to any part of the nervous system. It's this sort of injury that results in sensations like tingling, electrical shocks, or pins and needles. It's also the same pain you feel when you hit your funny bone.

There's also phantom pain, which is pain felt in a body part that has been amputated, or from a limb which is no longer transmitting signals to the brain.

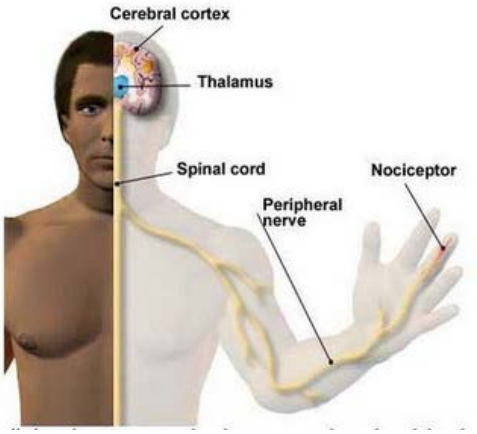
In addition to these, other forms of pain include psychogenic (or psychosomatic pain), breakthrough pain (what cannot be alleviated by normal pain management), incident pain (such as stretching a wound), and pain asymbolia and insensitivity (which is the sudden alleviation or masking of pain, like the experience of an athlete who has seriously injured himself but feels no pain for a prolonged period).

Lastly, there's also duration to keep in mind, which includes chronic pain. People with rheumatoid arthritis know all too well about this one.

How does pain work?

As noted, the physiological and neurological underpinnings of pain are incredibly complex. There are essentially four mechanisms that make it work: Our nerve fibers, pain receptors, the spinal column, and the brain itself.

Our bodies are equipped with different sensory nerve fibers that can respond to different physical stimuli, such as a person's touch, running water, or a pin-prick. Depending on the extent of the physical contact, our nerve fibers will produce different chemical responses that in turn influence how the sensations are interpreted.



When we physically hurt ourselves, we activate nociceptive pain receptors. These nerve fibers are single-purposed; their only function is to set the alarm for the pain receptors. Essentially, our bodies are hardwired to feel pain. The nociceptive pain receptors are engaged when we strike a blunt object, like accidentally kicking a table leg, or when the skin is broken from a cut.

Once engaged, the nociceptive pain receptors send impulses through the nerve into the spinal cord where the signals eventually make their way to the brain. This all happens within a fraction of a second; these impulses move through our bodies at a rate of about one meter per second.

Once the pain signal reaches the brain it heads directly for the thalamus, which in turn dispatches it to other areas for ongoing neurological and conscious interpretation. For example, the cortex is responsible for figuring out where the pain came from, and how it compares to other kinds of pain. The thalamus, in addition to acting as a messenger, also facilitates an emotional response — which can result in anger, frustration — or even crying.

And this process is more than just stimulus and response. Given that a traumatic event (like stubbing your toe) set the injury response into action, the pain receptors will continue to sense that an injury has occurred and that you need to be reminded about it until it heals. Consequently, the nerve fibres are specialized enough to recognize an ongoing injury that's in the healing process.

Pain, therefore, is a multi-faceted process (or even a system) that is influenced by any number of factors working at play at any given moment. How you feel pain (what's referred to as interoceptive sensitivity) can be influenced by a number of extraneous circumstances, including mood, fears, expectations, past experiences, and so on.

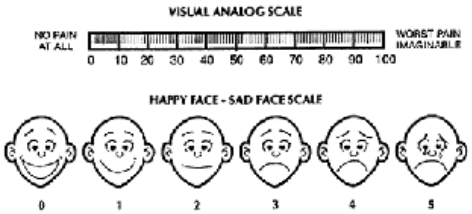
Moreover, the psychological underpinnings of pain strongly indicates that there's a significant (if not exclusive) neurological component. As the example of phantom pain shows, while it feels like the pain is emanating from an injured body part, it's actually the brain that's producing the subjective experience of the pain itself (check out VS Ramachandran's Mirror Box technique for a beautiful illustration of this — a technique that could also help reduce the pain of arthritis).

How do we measure pain?

The International Association for the Study of Pain defines it as an "unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." This is obviously vague and completely insufficient, especially considering the tremendous variations of pain that can be experienced.

And indeed, a fundamental problem with measuring pain is that everyone feels it differently. Some people have a particularly high tolerance for it, while others are profoundly affected by the most unassuming of things. What's needed, therefore, is a scale that takes this internal subjectivity and individual variation into account.

But frustratingly, there is no unified or industry-standard pain scale that has been accepted. There are over 20 different scales that are utilized in different jurisdictions and contexts. The lack of consensus on this issue points to how difficult it is to measure what is essentially phenomenological quale (the individualized or subjective experience of pain).



One standard pain scale is the Visual Analog Scale (VAS). By using illustrations, patients are asked to indicate the picture that most closely corresponds to how they are feeling. Advantages of this scale include its suitability for all age groups, and it doesn't require the understanding of verbal or written descriptions. And in fact, studies show that, when implemented correctly, the scale can be useful.

Another popular scale that has been used widely in primary care settings is the Numeric Rating Scale (NRS). Healthcare workers using

this scale ask their patients to rate their pain from 1 to ten, with ten being the most excruciating pain they can possibly imagine. Unfortunately, follow-up studies have shown that the NRS is only moderately accurate.

Part of the problem with the NRS is that different people can imagine different extremes of pain. Some patients understate their degree of physical discomfort when thinking about just how excruciating things can really get. And those with little experience with pain (or with poor imaginations) may overstate their degree of pain.

Similarly, people have a hard time quantifying the complexities and nuances of pain in something as simple as a scale from one to 10. Women who go through childbirth, for example, often hit a point where they turn inward and feel that time has essentially stopped as they brace themselves for the next contraction. How could something like this possibly be expressed in a scale — especially when it's virtually impossible to re-imagine it after the fact? Moreover, pain that's inflicted through childbirth will be qualitatively different in nature from pain that's inflicted through, say, third-degree burns.

Consequently, the development of a more reliable, detailed, and descriptive scale would seem to be in order. But given the highly complex and subjective nature of pain, this may never happen.

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