

# Pain

*This article is about physical pain. For other uses, see Pain (disambiguation).*

**Pain** is a distressing feeling often caused by intense or damaging stimuli, such as stubbing a toe, burning a finger, putting alcohol on a cut, and bumping the "funny bone".<sup>[1]</sup> Because it is a complex, subjective phenomenon, defining pain has been a challenge. The International Association for the Study of Pain's widely used definition states: "Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."<sup>[2]</sup> In medical diagnosis, pain is regarded as a symptom of an underlying condition.

Pain motivates the individual to withdraw from damaging situations, to protect a damaged body part while it heals, and to avoid similar experiences in the future.<sup>[3]</sup> Most pain resolves once the noxious stimulus is removed and the body has healed, but it may persist despite removal of the stimulus and apparent healing of the body. Sometimes pain arises in the absence of any detectable stimulus, damage or disease.<sup>[4]</sup>

Pain is the most common reason for physician consultation in most developed countries.<sup>[5][6]</sup> It is a major symptom in many medical conditions, and can interfere with a person's quality of life and general functioning.<sup>[7]</sup> Simple pain medications are useful in 20% to 70% of cases.<sup>[8]</sup> Psychological factors such as social support, hypnotic

suggestion, excitement, or distraction can significantly affect pain's intensity or unpleasantness.<sup>[9][10]</sup> In some arguments put forth in physician-assisted suicide or euthanasia debates, pain has been used as an argument to permit people who are terminally ill to end their lives.<sup>[11]</sup>

One judgment on the value of pain is given by German philosopher, Friedrich Nietzsche, who wrote: "Only great pain is the ultimate liberator of the spirit....I doubt that such pain makes us 'better'; but I know that it makes us more profound".<sup>[12]</sup> Nietzsche and philosophers influenced by him thus oppose the entirely negative valuation of pain, instead holding that "What does not destroy me, makes me stronger."<sup>[12][13]</sup>

## Classification

In 1994, responding to the need for a more useful system for describing chronic pain, the International Association for the Study of Pain (IASP) classified pain according to specific characteristics:

1. region of the body involved (e.g. abdomen, lower limbs),
2. system whose dysfunction may be causing the pain (e.g., nervous, gastrointestinal),
3. duration and pattern of occurrence,

### Pain



A woman grimacing while having blood drawn

#### Classification and external resources

<b>Specialty</b>	Neurology
<b>ICD-10</b>	R52
<b>ICD-9-CM</b>	338
<b>DiseasesDB</b>	9503
<b>MedlinePlus</b>	002164
<b>MeSH</b>	D010146

4. intensity and time since onset, and
5. cause<sup>[14]</sup>

However, this system has been criticized by Clifford J. Woolf and others as inadequate for guiding research and treatment.<sup>[15]</sup> Woolf suggests three classes of pain:

1. nociceptive pain,
2. inflammatory pain which is associated with tissue damage and the infiltration of immune cells, and
3. pathological pain which is a disease state caused by damage to the nervous system or by its abnormal function (e.g. fibromyalgia, peripheral neuropathy, tension type headache, etc.).<sup>[16]</sup>

## Duration

*Main article: Chronic pain*

Pain is usually transitory, lasting only until the noxious stimulus is removed or the underlying damage or pathology has healed, but some painful conditions, such as rheumatoid arthritis, peripheral neuropathy, cancer and idiopathic pain, may persist for years. Pain that lasts a long time is called *chronic* or persistent, and pain that resolves quickly is called *acute*. Traditionally, the distinction between *acute* and *chronic* pain has relied upon an arbitrary interval of time from onset; the two most commonly used markers being 3 months and 6 months since the onset of pain,<sup>[17]</sup> though some theorists and researchers have placed the transition from acute to chronic pain at 12 months.<sup>[18]:93</sup> Others apply *acute* to pain that lasts less than 30 days, *chronic* to pain of more than six months' duration, and *subacute* to pain that lasts from one to six months.<sup>[19]</sup> A popular alternative definition of *chronic pain*, involving no arbitrarily fixed durations, is "pain that extends beyond the expected period of healing".<sup>[17]</sup> Chronic pain may be classified as cancer pain or else as benign.<sup>[19]</sup>

## Nociceptive

*Main article: Nociception*

Nociceptive pain is caused by stimulation of sensory nerve fibers that respond to stimuli approaching or exceeding harmful intensity (nociceptors), and may be classified according to the mode of noxious stimulation. The most common categories are "thermal" (e.g. heat or cold), "mechanical" (e.g. crushing, tearing, shearing, etc.) and "chemical" (e.g. iodine in a cut or chemicals released during inflammation). Some nociceptors respond to more than one of these modalities and are consequently designated polymodal.

Nociceptive pain may also be divided into "visceral", "deep somatic" and "superficial somatic" pain. Visceral structures are highly sensitive to stretch, ischemia and inflammation, but relatively insensitive to other stimuli that normally evoke pain in other structures, such as burning and cutting. *Visceral pain* is diffuse, difficult to locate and often referred to a distant, usually superficial, structure. It may be accompanied by nausea and vomiting and may be described as sickening, deep, squeezing, and dull.<sup>[20]</sup> *Deep somatic* pain is initiated by stimulation of nociceptors in ligaments, tendons, bones, blood vessels, fasciae and muscles, and is dull, aching, poorly-localized pain. Examples include sprains and broken bones. *Superficial* pain is initiated by activation of nociceptors in the skin or other superficial tissue, and is sharp, well-defined and clearly located. Examples of injuries that produce superficial somatic pain include minor wounds and minor (first degree) burns.<sup>[18]</sup>

## Neuropathic

### *Main article: Neuropathic pain*

Neuropathic pain is caused by damage or disease affecting any part of the nervous system involved in bodily feelings (the somatosensory system).<sup>[21]</sup> Peripheral neuropathic pain is often described as "burning", "tingling", "electrical", "stabbing", or "pins and needles".<sup>[22]</sup> Bumping the "funny bone" elicits acute peripheral neuropathic pain.

## **Phantom**

### *Main article: Phantom pain*

Phantom pain is pain felt in a part of the body that has been lost or from which the brain no longer receives signals. It is a type of neuropathic pain. Phantom limb pain is a common experience of amputees.<sup>[23]</sup>

The prevalence of phantom pain in upper limb amputees is nearly 82%, and in lower limb amputees is 54%.<sup>[23]</sup> One study found that eight days after amputation, 72 percent of patients had phantom limb pain, and six months later, 65 percent reported it.<sup>[24][25]</sup> Some amputees experience continuous pain that varies in intensity or quality; others experience several bouts a day, or it may occur only once every week or two. It is often described as shooting, crushing, burning or cramping. If the pain is continuous for a long period, parts of the intact body may become sensitized, so that touching them evokes pain in the phantom limb. Phantom limb pain may accompany urination or defecation.<sup>[26]</sup>

Local anesthetic injections into the nerves or sensitive areas of the stump may relieve pain for days, weeks, or sometimes permanently, despite the drug wearing off in a matter of hours; and small injections of hypertonic saline into the soft tissue between vertebrae produces local pain that radiates into the phantom limb for ten minutes or so and may be followed by hours, weeks or even longer of partial or total relief from phantom pain. Vigorous vibration or electrical stimulation of the stump, or current from electrodes surgically implanted onto the spinal cord, all produce relief in some patients.<sup>[26]</sup>

Mirror box therapy produces the illusion of movement and touch in a phantom limb which in turn may cause a reduction in pain.<sup>[27]</sup>

Paraplegia, the loss of sensation and voluntary motor control after serious spinal cord damage, may be accompanied by girdle pain at the level of the spinal cord damage, visceral pain evoked by a filling bladder or bowel, or, in five to ten per cent of paraplegics, phantom body pain in areas of complete sensory loss. This phantom body pain is initially described as burning or tingling but may evolve into severe crushing or pinching pain, or the sensation of fire running down the legs or of a knife twisting in the flesh. Onset may be immediate or may not occur until years after the disabling injury. Surgical treatment rarely provides lasting relief.<sup>[26]</sup>

## **Psychogenic**

### *Main article: Psychogenic pain*

Psychogenic pain, also called *psychalgia* or *somatoform pain*, is pain caused, increased, or prolonged by mental, emotional, or behavioral factors.<sup>[28]</sup> Headache, back pain, and stomach pain are sometimes diagnosed as psychogenic.<sup>[29]</sup> Sufferers are often stigmatized, because both medical professionals and the general public tend to think that pain from a psychological source is not "real". However, specialists consider that it is no less actual

or hurtful than pain from any other source.<sup>[30]</sup>

People with long-term pain frequently display psychological disturbance, with elevated scores on the Minnesota Multiphasic Personality Inventory scales of hysteria, depression and hypochondriasis (the "neurotic triad"). Some investigators have argued that it is this neuroticism that causes acute pain to turn chronic, but clinical evidence points the other way, to chronic pain causing neuroticism. When long-term pain is relieved by therapeutic intervention, scores on the neurotic triad and anxiety fall, often to normal levels. Self-esteem, often low in chronic pain patients, also shows improvement once pain has resolved.<sup>[31]</sup>

The term 'psychogenic' assumes that medical diagnosis is so perfect that all organic causes of pain can be detected; regrettably, we are far from such infallibility... All too often, the diagnosis of neurosis as the cause of pain hides our ignorance of many aspects of pain medicine.

— Ronald Melzack, 1996.<sup>[31]</sup>

## Breakthrough pain

Breakthrough pain is transitory acute pain that comes on suddenly and is not alleviated by the patient's regular pain management. It is common in cancer patients who often have background pain that is generally well-controlled by medications, but who also sometimes experience bouts of severe pain that from time to time "breaks through" the medication. The characteristics of breakthrough cancer pain vary from person to person and according to the cause. Management of breakthrough pain can entail intensive use of opioids, including fentanyl.<sup>[32][33][34]</sup>

## Incident pain

Incident pain is pain that arises as a result of activity, such as movement of an arthritic joint, stretching a wound, etc.

## Pain asymbolia and insensitivity

*Main articles: Pain asymbolia and Congenital insensitivity to pain*

*"Painless" redirects here. For other uses, see Painless (disambiguation).*

The ability to experience pain is essential for protection from injury, and recognition of the presence of injury. Episodic analgesia may occur under special circumstances, such as in the excitement of sport or war: a soldier on the battlefield may feel no pain for many hours from a traumatic amputation or other severe injury.<sup>[35]</sup>

Although unpleasantness is an essential part of the IASP definition of pain,<sup>[2]</sup> it is possible to induce a state described as intense pain devoid of unpleasantness in some patients, with morphine injection or psychosurgery.<sup>[30]</sup> Such patients report that they have pain but are not bothered by it; they recognize the sensation of pain but suffer little, or not at all.<sup>[36]</sup> Indifference to pain can also rarely be present from birth; these people have normal nerves on medical investigations, and find pain unpleasant, but do not avoid repetition of the pain stimulus.<sup>[37]</sup>

Insensitivity to pain may also result from abnormalities in the nervous system. This is usually the result of acquired damage to the nerves, such as spinal cord injury, diabetes mellitus (diabetic neuropathy), or leprosy in countries where that disease is prevalent.<sup>[38]</sup> These individuals are at risk of tissue damage and infection due to

undiscovered injuries. People with diabetes-related nerve damage, for instance, sustain poorly-healing foot ulcers as a result of decreased sensation.<sup>[39]</sup>

A much smaller number of people are insensitive to pain due to an inborn abnormality of the nervous system, known as "congenital insensitivity to pain".<sup>[37]</sup> Children with this condition incur carelessly-repeated damage to their tongues, eyes, joints, skin, and muscles. Some die before adulthood, and others have a reduced life expectancy. Most people with congenital insensitivity to pain have one of five hereditary sensory and autonomic neuropathies (which includes familial dysautonomia and congenital insensitivity to pain with anhidrosis).<sup>[40]</sup> These conditions feature decreased sensitivity to pain together with other neurological abnormalities, particularly of the autonomic nervous system.<sup>[37][40]</sup> A very rare syndrome with isolated congenital insensitivity to pain has been linked with mutations in the *SCN9A* gene, which codes for a sodium channel (Na<sub>v</sub>1.7) necessary in conducting pain nerve stimuli.<sup>[41]</sup>

## Effect on functioning

Experimental subjects challenged by acute pain and patients in chronic pain experience impairments in attention control, working memory, mental flexibility, problem solving, and information processing speed.<sup>[42]</sup> Acute and chronic pain are also associated with increased depression, anxiety, fear, and anger.<sup>[43]</sup>

If I have matters right, the consequences of pain will include direct physical distress, unemployment, financial difficulties, marital disharmony, and difficulties in concentration and attention...

— Harold Merskey 2000<sup>[44]</sup>

## Theory

### Historical theories

*See also: History of pain theory*

Before the relatively recent discovery of neurons and their role in pain, various different body functions were proposed to account for pain. There were several competing early theories of pain among the ancient Greeks: Hippocrates believed that it was due to an imbalance in vital fluids.<sup>[45]</sup> In the 11th century, Avicenna theorized that there were a number of feeling senses including touch, pain and titillation.<sup>[46]</sup>

In 1644, René Descartes theorized that pain was a disturbance that passed down along nerve fibers until the disturbance reached the brain,<sup>[45][47]</sup> a development that transformed the perception of pain from a spiritual, mystical experience to a physical, mechanical sensation. Descartes's work, along with Avicenna's, prefigured the 19th-century development of specificity theory. Specificity theory saw pain as "a specific sensation, with its own sensory apparatus independent of touch and other senses".<sup>[48]</sup> Another theory that came to prominence in the 18th and 19th centuries was intensive theory, which conceived of pain not as a unique sensory modality, but an emotional state produced by stronger than normal stimuli such as intense light, pressure or temperature.<sup>[49]</sup> By the mid-1890s, specificity was backed mostly by physiologists and physicians, and the intensive theory was mostly backed by psychologists. However, after a series of clinical observations by Henry Head and experiments by Max von Frey, the psychologists migrated to specificity almost en masse, and by century's end,

most textbooks on physiology and psychology were presenting pain specificity as fact.<sup>[46][48]</sup>

In 1955, DC Sinclair and G Weddell developed peripheral pattern theory, based on a 1934 suggestion by John Paul Nafe. They proposed that all skin fiber endings (with the exception of those innervating hair cells) are identical, and that pain is produced by intense stimulation of these fibers.<sup>[48]</sup> Another 20th-century theory was gate control theory, introduced by Ronald Melzack and Patrick Wall in the 1965 *Science* article "Pain Mechanisms: A New Theory".<sup>[50]</sup> The authors proposed that both thin (pain) and large diameter (touch, pressure, vibration) nerve fibers carry information from the site of injury to two destinations in the dorsal horn of the spinal cord, and that the more large fiber activity relative to thin fiber activity at the inhibitory cell, the less pain is felt.<sup>[47]</sup>

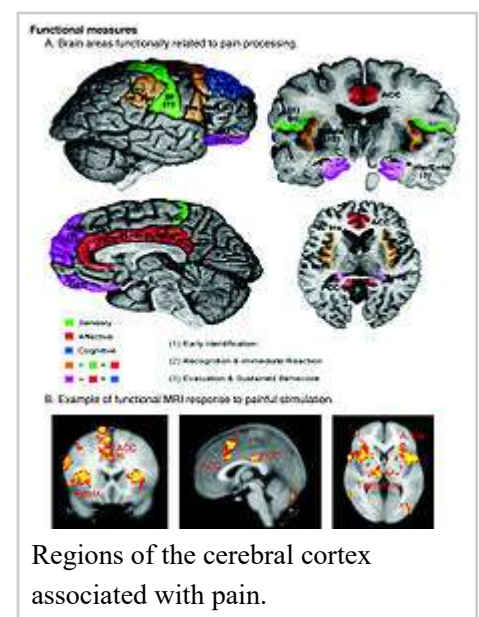
## Three dimensions of pain

In 1968 Ronald Melzack and Kenneth Casey described pain in terms of its three dimensions: "sensory-discriminative" (sense of the intensity, location, quality and duration of the pain), "affective-motivational" (unpleasantness and urge to escape the unpleasantness), and "cognitive-evaluative" (cognitions such as appraisal, cultural values, distraction and hypnotic suggestion).<sup>[10]</sup> They theorized that pain intensity (the sensory discriminative dimension) and unpleasantness (the affective-motivational dimension) are not simply determined by the magnitude of the painful stimulus, but "higher" cognitive activities can influence perceived intensity and unpleasantness. Cognitive activities "may affect both sensory and affective experience or they may modify primarily the affective-motivational dimension. Thus, excitement in games or war appears to block both dimensions of pain, while suggestion and placebos may modulate the affective-motivational dimension and leave the sensory-discriminative dimension relatively undisturbed." (p. 432) The paper ends with a call to action: "Pain can be treated not only by trying to cut down the sensory input by anesthetic block, surgical intervention and the like, but also by influencing the motivational-affective and cognitive factors as well." (p. 435)

## Theory today

Wilhelm Erb's (1874) "intensive" theory, that a pain signal can be generated by intense enough stimulation of *any* sensory receptor, has been soundly disproved. Some sensory fibers do not differentiate between noxious and non-noxious stimuli, while others, nociceptors, respond only to noxious, high intensity stimuli. At the peripheral end of the nociceptor, noxious stimuli generate currents that, above a given threshold, send signals along the nerve fiber to the spinal cord. The "specificity" (whether it responds to thermal, chemical or mechanical features of its environment) of a nociceptor is determined by which ion channels it expresses at its peripheral end. Dozens of different types of nociceptor ion channels have so far been identified, and their exact functions are still being determined.<sup>[51]</sup>

The pain signal travels from the periphery to the spinal cord along an A-delta or C fiber. Because the A-delta fiber is thicker than the C fiber, and is thinly sheathed in an electrically insulating material (myelin), it carries its signal faster (5–30 m/s) than the unmyelinated C fiber (0.5–2 m/s).<sup>[52]</sup> Pain evoked by the A-delta fibers is described as sharp



and is felt first. This is followed by a duller pain, often described as burning, carried by the C fibers.<sup>[53]</sup> These "first order" neurons enter the spinal cord via Lissauer's tract.

These A-delta and C fibers connect with "second order" nerve fibers in the central gelatinous substance of the spinal cord (laminae II and III of the dorsal horns). The second order fibers then cross the cord via the anterior white commissure and ascend in the spinothalamic tract. Before reaching the brain, the spinothalamic tract splits into the lateral, neospinothalamic tract and the medial, paleospinothalamic tract.<sup>[54]</sup>

Second order neospinothalamic tract neurons carry information from A-delta fibers and terminate at the ventral posterolateral nucleus of the thalamus, where they connect with third order neurons of the somatosensory cortex. Paleospinothalamic neurons carry information from C fibers and terminate throughout the brain stem, a tenth of them in the thalamus and the rest in the medulla, pons and periaqueductal gray matter.<sup>[55]</sup>

Second order, spinal cord fibers dedicated to carrying A-delta fiber pain signals, and others that carry both A-delta and C fiber pain signals to the thalamus have been identified. Other spinal cord fibers, known as wide dynamic range neurons, respond to A-delta and C fibers, but also to the large A-beta fibers that carry touch, pressure and vibration signals.<sup>[52]</sup> Pain-related activity in the thalamus spreads to the insular cortex (thought to embody, among other things, the feeling that distinguishes pain from other homeostatic emotions such as itch and nausea) and anterior cingulate cortex (thought to embody, among other things, the affective/motivational element, the unpleasantness of pain).<sup>[56]</sup> Pain that is distinctly located also activates primary and secondary somatosensory cortex.<sup>[57]</sup>

## Evolutionary and behavioral role

Pain is part of the body's defense system, producing a reflexive retraction from the painful stimulus, and tendencies to protect the affected body part while it heals, and avoid that harmful situation in the future.<sup>[3][58]</sup> It is an important part of animal life, vital to healthy survival. People with congenital insensitivity to pain have reduced life expectancy.<sup>[37]</sup>

In his book, *The Greatest Show on Earth: The Evidence for Evolution*, biologist Richard Dawkins grapples with the question of why pain has to be so very painful. He describes the alternative as a simple, mental raising of a "red flag". To argue why that red flag might be insufficient, Dawkins explains that drives must compete with each other within living beings. The most fit creature would be the one whose pains are well balanced. Those pains which mean certain death when ignored will become the most powerfully felt. The relative intensities of pain, then, may resemble the relative importance of that risk to our ancestors (lack of food, too much cold, or serious injuries are felt as agony, whereas minor damage is felt as mere discomfort). This resemblance will not be perfect, however, because natural selection can be a poor designer. The result is often glitches in animals, including supernormal stimuli. Such glitches help explain pains which are not, or at least no longer directly adaptive (e.g. perhaps some forms of toothache, or injury to fingernails).<sup>[59]</sup>

Idiopathic pain (pain that persists after the trauma or pathology has healed, or that arises without any apparent cause), may be an exception to the idea that pain is helpful to survival, although some psychodynamic psychologists argue that such pain is psychogenic, enlisted as a protective distraction to keep dangerous emotions unconscious.<sup>[60]</sup>

## Thresholds

In pain science, thresholds are measured by gradually increasing the intensity of a stimulus such as electric current or heat applied to the body. The pain perception threshold is the point at which the stimulus begins to hurt, and the pain tolerance threshold is reached when the subject acts to stop the pain.

Differences in pain perception and tolerance thresholds are associated with, among other factors, ethnicity, genetics, and sex. People of Mediterranean origin report as painful some radiant heat intensities that northern Europeans describe as nonpainful. And Italian women tolerate less intense electric shock than Jewish or Native American women. Some individuals in all cultures have significantly higher than normal pain perception and tolerance thresholds. For instance, patients who experience painless heart attacks have higher pain thresholds for electric shock, muscle cramp and heat.<sup>[61]</sup>

## Assessment

*See also: Pain assessment, Pain scales, and Pain ladder*

A person's self-report is the most reliable measure of pain.<sup>[62][63][64]</sup> Some health care professionals may to underestimate severity.<sup>[65]</sup> A definition of pain widely employed in nursing, emphasizing its subjective nature and the importance of believing patient reports, was introduced by Margo McCaffery in 1968: "Pain is whatever the experiencing person says it is, existing whenever he says it does".<sup>[66]</sup> To assess intensity, the patient may be asked to locate their pain on a scale of 0 to 10, with 0 being no pain at all, and 10 the worst pain they have ever felt. Quality can be established by having the patient complete the McGill Pain Questionnaire indicating which words best describe their pain.<sup>[7]</sup>

## Multidimensional pain inventory

The Multidimensional Pain Inventory (MPI) is a questionnaire designed to assess the psychosocial state of a person with chronic pain. Analysis of MPI results by Turk and Rudy (1988) found three classes of chronic pain patient: "(a) dysfunctional, people who perceived the severity of their pain to be high, reported that pain interfered with much of their lives, reported a higher degree of psychological distress caused by pain, and reported low levels of activity; (b) interpersonally distressed, people with a common perception that significant others were not very supportive of their pain problems; and (c) adaptive copers, patients who reported high levels of social support, relatively low levels of pain and perceived interference, and relatively high levels of activity."<sup>[67]</sup> Combining the MPI characterization of the person with their IASP five-category pain profile is recommended for deriving the most useful case description.<sup>[17]</sup>

## People who are non-verbal

*See also: Pain and dementia and Pain in babies*

When a person is non-verbal and cannot self-report pain, observation becomes critical, and specific behaviors can be monitored as pain indicators. Behaviors such as facial grimacing and guarding indicate pain, as well as an increase or decrease in vocalizations, changes in routine behavior patterns and mental status changes. Patients experiencing pain may exhibit withdrawn social behavior and possibly experience a decreased appetite and decreased nutritional intake. A change in condition that deviates from baseline such as moaning with movement or when manipulating a body part, and limited range of motion are also potential pain indicators. In patients who possess language but are incapable of expressing themselves effectively, such as those with dementia, an increase in confusion or display of aggressive behaviors or agitation may signal that discomfort



exists, and further assessment is necessary.

Infants feel pain but they lack the language needed to report it, so communicate distress by crying. A non-verbal pain assessment should be conducted involving the parents, who will notice changes in the infant not obvious to the health care provider. Pre-term babies are more sensitive to painful stimuli than full term babies.<sup>[68]</sup>

## **Other barriers to reporting**

The experience of pain has many cultural dimensions. For instance, the way in which one experiences and responds to pain is related to sociocultural characteristics, such as gender, ethnicity, and age.<sup>[69][70]</sup> An aging adult may not respond to pain in the way that a younger person would. Their ability to recognize pain may be blunted by illness or the use of multiple prescription drugs. Depression may also keep the older adult from reporting they are in pain. The older adult may also stop doing activities they love because it hurts too much. Decline in self-care activities (dressing, grooming, walking, etc.) may also be indicators that the older adult is experiencing pain. The older adult may refrain from reporting pain because they are afraid they will have to have surgery or will be put on a drug they might become addicted to. They may not want others to see them as weak, or may feel there is something impolite or shameful in complaining about pain, or they may feel the pain is deserved punishment for past transgressions.<sup>[71][72]</sup>

Cultural barriers can also keep a person from telling someone they are in pain. Religious beliefs may prevent the individual from seeking help. They may feel certain pain treatment is against their religion. They may not report pain because they feel it is a sign that death is near. Many people fear the stigma of addiction and avoid pain treatment so as not to be prescribed potentially addicting drugs. Many Asians do not want to lose respect in society by admitting they are in pain and need help, believing the pain should be borne in silence, while other cultures feel they should report pain right away and get immediate relief.<sup>[68]</sup> Gender can also be a factor in reporting pain. Sexual differences can be the result of social and cultural expectations, with women expected to be emotional and show pain and men stoic, keeping pain to themselves.<sup>[68]</sup>

## **As an aid to diagnosis**

Pain is a symptom of many medical conditions. Knowing the time of onset, location, intensity, pattern of occurrence (continuous, intermittent, etc.), exacerbating and relieving factors, and quality (burning, sharp, etc.) of the pain will help the examining physician to accurately diagnose the problem. For example, chest pain described as extreme heaviness may indicate myocardial infarction, while chest pain described as tearing may indicate aortic dissection.<sup>[73][74]</sup>

## **Physiological measurement of pain**

fMRI brain scanning has been used to measure pain, giving good correlations with self-reported pain.<sup>[75]</sup>  
<sup>[76][77][78]</sup>

## **Hedonic adaptation**

Hedonic adaptation means that actual long-term suffering due to physical illness is often much lower than expected.<sup>[79]</sup>

## **Legal awards for pain and suffering**

One area where assessments of pain are effectively required to be made is in legal awards for pain and suffering. In the Western world these are typically discretionary awards made by juries and are regarded as difficult to predict, variable and subjective, for instance in the US,<sup>[80]</sup> UK,<sup>[81]</sup> Australia and New Zealand.<sup>[82]</sup>

## Management

*Main article: Pain management*

Inadequate treatment of pain is widespread throughout surgical wards, intensive care units, accident and emergency departments, in general practice, in the management of all forms of chronic pain including cancer pain, and in end of life care.<sup>[83]</sup> This neglect is extended to all ages, from neonates to the frail elderly.<sup>[84]</sup> African and Hispanic Americans are more likely than others to suffer needlessly in the hands of a physician;<sup>[85]</sup> and women's pain is more likely to be undertreated than men's.<sup>[86]</sup>

The International Association for the Study of Pain advocates that the relief of pain should be recognized as a human right, that chronic pain should be considered a disease in its own right, and that pain medicine should have the full status of a specialty.<sup>[87]</sup> It is a specialty only in China and Australia at this time.<sup>[88]</sup> Elsewhere, pain medicine is a subspecialty under disciplines such as anesthesiology, physiatry, neurology, palliative medicine and psychiatry.<sup>[89]</sup> In 2011, Human Rights Watch alerted that tens of millions of people worldwide are still denied access to inexpensive medications for severe pain.<sup>[90]</sup>

## Medication

Acute pain is usually managed with medications such as analgesics and anesthetics. Caffeine, when added to pain medications such as ibuprofen, may provide some additional benefit.<sup>[91][92]</sup> Management of chronic pain, however, is much more difficult and may require the coordinated efforts of a pain management team, which typically includes medical practitioners, clinical pharmacists, clinical psychologists, physiotherapists, occupational therapists, physician assistants, and nurse practitioners.<sup>[93]</sup>

The sugar (sucrose) when taken by mouth reduces pain in newborn babies undergoing some medical procedures (a single lancing of the heel, venipuncture, and intramuscular injections). Sugar does not remove pain from circumcision, and it is unknown if sugar reduces pain for other procedures.<sup>[94]</sup>

Sugar did not affect pain-related electrical activity in the brains of newborns one second after the heel lance procedure.<sup>[95]</sup> Sweet liquid by mouth moderately reduces the rate and duration of crying caused by immunization injection in children between one and twelve months of age.<sup>[96]</sup>

## Psychological

Individuals with more social support experience less cancer pain, take less pain medication, report less labor pain and are less likely to use epidural anesthesia during childbirth or suffer from chest pain after coronary artery bypass surgery.<sup>[97]</sup>

Suggestion can significantly affect pain intensity. About 35% of people report marked relief after receiving a saline injection they believe to have been morphine. This "placebo" effect is more pronounced in people who are prone to anxiety, so anxiety reduction may account for some of the effect, but it does not account for all of

it. Placebos are more effective in intense pain than mild pain; and they produce progressively weaker effects with repeated administration.<sup>[98]</sup>

It is possible for many chronic pain sufferers to become so absorbed in an activity or entertainment that the pain is no longer felt, or is greatly diminished.<sup>[99]</sup>

Cognitive behavioral therapy (CBT) has been shown effective for improving quality of life in those with chronic pain but the reduction in suffering is quite modest, and the CBT method employed seems to have no effect on outcome.<sup>[100]</sup> Acceptance and Commitment Therapy (ACT) is likely also effective in the treatment of chronic pain.<sup>[101]</sup>

A number of meta-analyses have found clinical hypnosis to be effective in controlling pain associated with diagnostic and surgical procedures in both adults and children, as well as pain associated with cancer and childbirth.<sup>[102]</sup> A 2007 review of 13 studies found evidence for the efficacy of hypnosis in the reduction of chronic pain in some conditions, though the number of patients enrolled in the studies was low, bringing up issues of power to detect group differences, and most lacked credible controls for placebo and/or expectation. The authors concluded that "although the findings provide support for the general applicability of hypnosis in the treatment of chronic pain, considerably more research will be needed to fully determine the effects of hypnosis for different chronic-pain conditions."<sup>[103]</sup>

## Alternative medicine

Pain is the most common reason for people to use complementary and alternative medicine.<sup>[104]</sup> An analysis of the 13 highest quality studies of pain treatment with acupuncture, published in January 2009, concluded there is little difference in the effect of real, sham and no acupuncture.<sup>[105]</sup> However other reviews have found benefit.<sup>[106][107][108]</sup> Additionally, there is tentative evidence for a few herbal medicines.<sup>[109]</sup> There is interest in the relationship between vitamin D and pain, but the evidence so far from controlled trials for such a relationship, other than in osteomalacia, is unconvincing.<sup>[110]</sup>

A 2003 meta-analysis of randomized clinical trials found that spinal manipulation was "more effective than sham therapy but was no more or less effective than general practitioner care, analgesics, physical therapy, exercise, or back school" in the treatment of low back pain.<sup>[111]</sup>

## Epidemiology

Pain is the main reason for visiting the emergency department in more than 50% of cases<sup>[112]</sup> and is present in 30% of family practice visits.<sup>[113]</sup> Several epidemiological studies from different countries have reported widely varying prevalence rates for chronic pain, ranging from 12 to 80% of the population.<sup>[114]</sup> It becomes more common as people approach death. A study of 4,703 patients found that 26% had pain in the last two years of life, increasing to 46% in the last month.<sup>[115]</sup>

A survey of 6,636 children (0–18 years of age) found that, of the 5,424 respondents, 54% had experienced pain in the preceding three months. A quarter reported having experienced recurrent or continuous pain for three months or more, and a third of these reported frequent and intense pain. The intensity of chronic pain was higher for girls, and girls' reports of chronic pain increased markedly between ages 12 and 14.<sup>[116]</sup>

## Society and culture

The nature or meaning of physical pain has been diversely understood by religious or secular traditions from antiquity to modern times.  
[117][118]

Physical pain is an important political topic in relation to various issues, including pain management policy, drug control, animal rights or animal welfare, torture, and pain compliance. In various contexts, the deliberate infliction of pain in the form of corporal punishment is used as retribution for an offence, or for the purpose of disciplining or reforming a wrongdoer, or to deter attitudes or behaviour deemed unacceptable. In some cultures, extreme practices such as mortification of the flesh or painful rites of passage are highly regarded.



The okipa ceremony as witnessed by George Catlin, circa 1835.

Philosophy of pain is a branch of philosophy of mind that deals essentially with physical pain, especially in connection with such views as dualism, identity theory, and functionalism.

More generally, it is often as a part of pain in the broad sense, i.e. suffering, that physical pain is dealt with in culture, religion, philosophy, or society.

## Other animals

*Main articles: Pain in animals and Pain in invertebrates*

The most reliable method for assessing pain in most humans is by asking a question: a person may report pain that cannot be detected by any known physiological measure. However, like infants, animals cannot answer questions about whether they feel pain; thus the defining criterion for pain in humans cannot be applied to them. Philosophers and scientists have responded to this difficulty in a variety of ways. René Descartes for example argued that animals lack consciousness and therefore do not experience pain and suffering in the way that humans do.<sup>[119]</sup> Bernard Rollin of Colorado State University, the principal author of two U.S. federal laws regulating pain relief for animals,<sup>[120]</sup> writes that researchers remained unsure into the 1980s as to whether animals experience pain, and that veterinarians trained in the U.S. before 1989 were simply taught to ignore animal pain.<sup>[121]</sup> In his interactions with scientists and other veterinarians, he was regularly asked to "prove" that animals are conscious, and to provide "scientifically acceptable" grounds for claiming that they feel pain.<sup>[121]</sup> Carbone writes that the view that animals feel pain differently is now a minority view. Academic reviews of the topic are more equivocal, noting that although the argument that animals have at least simple conscious thoughts and feelings has strong support,<sup>[122]</sup> some critics continue to question how reliably animal mental states can be determined.  
[119][123] The ability of invertebrate species of animals, such as insects, to feel pain and suffering is also unclear.  
[124][125][126]



Portrait of René Descartes by Jan Baptist Weenix 1647-1649

The presence of pain in an animal cannot be known for certain, but it can be inferred through physical and

behavioral reactions.<sup>[127]</sup> Specialists currently believe that all vertebrates can feel pain, and that certain invertebrates, like the octopus, might too.<sup>[124][128][129]</sup> As for other animals, plants, or other entities, their ability to feel physical pain is at present a question beyond scientific reach, since no mechanism is known by which they could have such a feeling. In particular, there are no known nociceptors in groups such as plants, fungi, and most insects,<sup>[130]</sup> except for instance in fruit flies.<sup>[131]</sup>

In vertebrates, endogenous opioids are neuromodulators that moderate pain by interacting with opioid receptors.<sup>[132]</sup> Opioids and opioid receptors occur naturally in crustaceans and, although at present no certain conclusion can be drawn,<sup>[133]</sup> their presence indicates that lobsters may be able to experience pain.<sup>[133][134]</sup> Opioids may mediate their pain in the same way as in vertebrates.<sup>[134]</sup> Veterinary medicine uses, for actual or potential animal pain, the same analgesics and anesthetics as used in humans.<sup>[135]</sup>

## Etymology

First attested in English in 1297, the word *peyn* comes from the Old French *peine*, in turn from Latin *poena* meaning "punishment, penalty"<sup>[136]</sup> (in L.L. also meaning "torment, hardship, suffering") and that from Greek *ποινή* (*poine*), generally meaning "price paid, penalty, punishment".<sup>[137][138]</sup>

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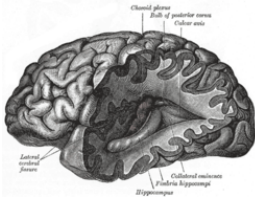
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**Pain and nociception**

	<b>HEENT</b>	Headache · Neck · Odynophagia (swallowing) · Toothache
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	<b>Musculoskeletal</b>	Arthralgia (joint) · Bone pain · Myalgia (muscle) · Muscle soreness: Acute / Delayed onset
<b>By region/system</b>		Congenital insensitivity to pain · HSAN ( Type I · II congenital sensory neuropathy · III familial dysautonomia · IV congenital insensitivity to pain with anhidrosis · V congenital insensitivity to pain with partial anhidrosis) · Neuralgia · Pain asymbolia · Pain disorder · Paroxysmal extreme pain disorder · Allodynia ·
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	Chronic pain · Hyperalgesia · Hypoalgesia · Hyperpathia · Phantom pain · Referred pain
	<b>Other</b> Pelvic pain · Proctalgia · Back
<b>Tests</b>	Cold pressor test · Dolorimeter · Grimace scale (animals) · Hot plate test · Tail flick test
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<b>Touch</b>	Mechanoreceptor · Vibration ( Lamellar corpuscle) · Light touch ( Tactile corpuscle) · Pressure ( Merkel nerve ending) · Stretch ( Bulbous corpuscle)
<b>Pain</b>	Free nerve endings – pain · Nociceptors
<b>Temperature</b>	Thermoreceptors
<b>Proprioception</b>	Golgi organ · Muscle spindle ( Intrafusal muscle fiber · Nuclear chain fiber · Nuclear bag fiber)
<b>Other</b>	Hair cells · Baroreceptor
<b>The sensory system</b>	
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<b>Touch and position</b>	Pain ( Nociception) · Temperature ( Thermoception) · Sense of balance ( Vestibular system) · Mechanoreception ( Pressure · vibration) · Proprioception ( Sense of body parts and movement)
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