

## Is Chronic Pain a Disease?

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### Abstract

**Objective.** The discovery of neuroplastic phenomena such as central sensitization of nociception has challenged pain theory to evolve, to encompass unpredictable and unlikely chronic pain states, and to cope with the emerging complexity of the brain. Recently, the proposition that chronic pain is a disease in its own right has gained currency, based upon functional and structural changes in the brain constituting a distinctive pathology. Proponents have expanded the theory to identify “eudynia” (“good” pain) and “maldynia” (“bad” pain).

**Methods.** A critical examination of the proposition that chronic pain is a disease was conducted within the framework of evolution of pain medicine theory.

**Results.** Three dominant theories were identified: specificity theory (the “hard-wired” nervous system); neuroplasticity theory (the “soft-wired” nervous system); and pain-as-a-disease. The progression from specificity theory to neuroplasticity theory was based upon empirical evidence and conceptual clarity. The latter theory confronts the uncertainty and the unpredictability of pain, and offers explanations for conditions where ongoing noxious input is not discernible. However, not only does pain-

as-a-disease elevate the neurophysiological mechanisms underlying the experience of chronic pain to the status of a disease, but also it conceives of pain as a “thing” that is itself capable of producing an effect. This reasoning is found to be faulty on two grounds: the confusion of pain as a symptom, a cause, and a pathology; and the fallacy that can arise when an interpretation is claimed to be a truth.

**Conclusions.** The proposition that chronic pain is a disease cannot be supported on clinical and pathological grounds, as well as in terms of ways of knowing. The promulgation of “good” and “bad” pain has the potential to obstruct necessary dialogue for advancing the science and treatment of pain. We suggest a way forward to resolve this impasse.

**Key Words:** Chronic Pain; Disease; Pain Theory

### Introduction

The generally accepted definition of pain, as adopted in 1979 by the International Association for the Study of Pain (IASP), is “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” [1].

This definition encompasses three phenomena: the experience which is both sensory and emotional; the linkage of this particular experience to tissue damage; and the anticipation of tissue damage (as “potential” in fact includes “actual” and also accommodates the “described in terms of such damage” provision). The definition’s footnote states, “Pain is always subjective,” thus emphasizing its experiential nature but allowing the less tangible “emotional” dimension to rank equally with a more “hard-wired” sensory dimension.

This linkage of pain to tissue damage is not problematic and is concordant not only with common-sense human experience but also with the biomedical model of illness which posits that pain is a symptom of a disease process. If “disease” is taken to include “damage,” then the linkage in the definition becomes between the experience (“pain”) and the signaling (by the nervous system of the organism) of damage (“nociception”). However, the definition implies that such linkage, although conceptually fundamental, is neither necessary (pain may be experienced in the absence of nociception) nor sufficient (pain may not be experienced in the presence of nociception).

The IASP definition remains a robust attempt to accommodate the lack of a linear cause-and-effect relationship between an experience that is usually expressed as a

symptom and any disease or damage process that is presumed to underlie it. As such, it captures the inherent uncertainty about any such relationship.

Nonetheless, many instances of *chronic* pain, somewhat arbitrarily described as pain that persists for more than 3 months or pain that persists after the “usual” time for tissue healing or pain in the absence of obvious nociception, are complex biologically and psychologically if not also sociologically. It has been proposed therefore that chronic pain should be considered as a condition-in-its-own right for scientific, teaching, and administrative purposes, as well as for clinical practice.

But does this justify conceptualizing chronic pain as a disease? The purpose of this article is to examine the validity of the arguments underlying this claim.

### Defining Disease

This examination turns on the definition of disease. According to Engelhardt [2] this exercise imposes a medical view of reality, reflecting prevailing biomedical theories of etiology and pathology. He observes that disease language is explanatory and powerful, and shapes our social reality.

In all societies, how diseases are conceived determines not only how people are treated but also how they are expected to behave [3]. Current social concepts of “sick role” and “illness behaviour” are fashioned on the basis of the many ideas people have about disease in general as well as in particular. Moynihan [4] has expressed concern over the “well meaning march of medicalisation” and calls for a radical reappraisal of the way in which diseases are currently being defined. With an experience as complex as “pain,” these considerations are brought into sharp focus.

Given the emphasis on *pathology* that characterizes the arguments advanced by the proponents of pain-as-a-disease, the definition of disease offered by Dorland's Medical Dictionary, 32nd edition [5], seems appropriate for the purpose of this examination: *any deviation from or interruption of the normal structure or function of any body part, organ, or system that is manifested by a characteristic set of symptoms and signs whose etiology, pathology, and prognosis may be known or unknown.*

According to this definition (from which the last clause can be excised without compromise), if we accept that the experience of chronic pain is not “normal,” itself a slippery concept [6], then whether or not it qualifies as a disease depends upon its association with abnormal structure or function of a body system *and* its association with a characteristic *clinical* profile.

In this definition, a disease is considered to be a direct cause of a clinical presentation. The trap can readily be appreciated that the lived experience of pain, including any complaint or behavior that is considered to reflect that experience, needs to be distinguished from any disease

process that may “cause” it. To assert that “pain” is one of a “characteristic set of symptoms” by which any neurobiological disease process denoted as “pain” is manifest, invites confusion, both semantically and conceptually. To address this confusion, it is necessary to briefly retrace the evolution of pain theory.

### Evolution of Pain Theory

This overview of the evolution of theories concerning pain will focus upon their explanatory power in this gap between conjecture and accepted knowledge.

The first theory, of a hard-wired nervous system, gave rise to a neurophysiological research project that sought to understand the mechanism of transmission of sensory information from the periphery to the central nervous system [7]. This project had to address what was special about pain-as-a-sensation and led to the concept of a nociceptor, specifically to signal potential or actual tissue damage.

This theory had two “Achilles’ heels.” Firstly, it predicted that physical interruption to those parts of the nervous system involved in transmission of noxious information should be associated with abolition of pain. This led to the performance of destructive procedures such as spinal cordotomy, dorsal root entry zone lesions, and brain lesions: all largely failures if not also associated with worsening of the patients’ experience.

Secondly, the rigid neural pattern elucidated by sensory physiologists during the 18th and 19th centuries could not account for the diversity of sensation experienced in both clinical and experimental settings [7]. Furthermore, this theory could not account for the known modification of the experience of pain by emotional factors or by real-life events. In these situations Descartes’ “bell in the brain” [8] neither rang nor was found. Any modification to the experience of pain from non-noxious sensory input or even no input placed it under the rubric of “pain of non-organic origin” [9], thus perpetuating the dualistic body/mind constraint under which the theory evolved. As this perpetuation became unacceptable to modern pain theorists [10], the explanatory power of this theory waned.

It was not until the inspirational proposition in 1965 of the “gate-control” theory [11] that the possibility of a soft-wired apparatus for sensing and processing noxious stimuli was formally proposed. This theory signposted a change in worldview for the field of pain medicine. Gate control postulated an explanation for the modulation of pain by non-noxious stimulation (“bottom-up”) and introduced the concept that the brain somehow could modulate the transmission of nociceptive information (“top-down”).

This second theory generated a burgeoning research program that culminated in the discovery and elucidation of the phenomenon of central sensitization of nociception [12]. This process, occurring in spinal cord and brain, not

only provided a better explanation of the phenomena than the first theory but also offered an explanation for the apparent disconnect between the experience of pain and the amount of tissue damage. Neuroplasticity theory also opened up the potential for understanding the influence on the experience of pain of cognitive factors considered to be the province of brain function [13].

Implicit in this theory is the realization that the property of synaptic plasticity underlies the ability of the brain to be self-referential and able to change itself continuously when sensing and adapting to environmental conditions [14]. Thus, neuroplasticity theory accommodates the inherent uncertainty and unpredictability of the pain experience.

In parallel with this evolution of neuroplasticity theory, which remains fundamentally a neurophysiological exercise, was the formulation of the “bio-psycho-social” framework of human illness that recognized the influence of non-biological factors [15]. However, “-psycho-” and “-social” factors are not locatable in the body. The inability to reduce these factors to biological processes, taken together with the realization that “biopsychosocial” is not a *model* of disease or illness (as the relationships between the three components are not defined), has resulted in a default to the more “comfortable” biomedical position [10], in which the proposition has been advanced that chronic pain can be considered to be a (*neurobiologic*) disease in its own right [16,17].

This third theory was most comprehensively put forward by Siddall and Cousins [16] who recited the knowledge to that date on the (*patho*)*physiology of nociception*, including central sensitization, which they termed “a host of pathological changes” that in turn constitute a “pain pathology.” They noted that:

“People [experiencing pain] often report mood disturbances, including irritability, helplessness, and depression. More complex cognitive responses can also develop, such as loss of belief in the ability to perform tasks and fear avoidance. These in turn can result in loss of employment, breakdown of family relationships, and loss of community status.”

These authors asserted that these changes are “pathologies” that are “dependent on and unique to the presence of pain,” termed by them “secondary pathologies.” They then invoked, as the “tertiary pathology” of pain, “factors such as genetic makeup, level of spinal inhibition, psychological status and the societal litigation system.” These *in toto*, they argued, justify considering pain as “an environmental disease.”

The variant of this theory put forward by the American Academy of Pain Medicine [17,18] has gone further by identifying two types of pain, “eudynia” (“good” pain) and “maldynia” (“bad” pain). These descriptors were introduced to reflect whether or not the experience of pain could be adjudicated by an observer as being useful (at least in a biological sense) to the person.

“Eudynia,” which refers to “the pain of an underlying pathological disorder, either an illness or an injury,” is said somehow even to promote healing and repair [18]; “maldynia” is characterized by the absence of detectable ongoing noxious stimulation, failure to promote healing and repair, and poor response to pharmaceutical treatment.

The rationale offered for the term *maldynia* is that the consequences of severe unrelieved pain are “bad” as they include shortened life span, inability to work, development of psychiatric disorders, and suicide. However, similar “bad” life outcomes can be the consequence of many other chronically painful conditions that are identifiable as diseases, for example, rheumatoid arthritis.

Furthermore *maldynia* as a disease apparently can be viewed either as “primary” when it is “initiated or caused by a primary lesion or dysfunction in the nervous system”—thus recalling the now outdated IASP definition of “neuropathic” pain [1]—or as *secondary* when it results from “persistent, inadequately relieved nociceptive stimulation (*sic*)” [18]. Adding to the confusion, apparently the symptom (*eudynia*) and the disease (*maldynia*) can coexist so that, if persistent, the symptom can become the disease [17].

To be fair, Siddall and Cousins [16] recognized that much of their primary argument regarding “pain pathology” is at a neurophysiological level and, in 2004, necessarily incomplete, especially with respect to studies of functional brain imaging. The same cannot be said of the argument [17] “[T]he evolution of pain from a neurobiologic response (‘eudynia’) to a neurobiologic disease (‘maldynia’) is supported by research that has demonstrated reduced volumes of neocortical gray matter in patients with chronic back pain” (parentheses added), which cites only one reference [19].

In a critical review of 108 neuroimaging reports of human central pain processing, Tracey and Bushnell [20] set out to “. . . examine the information from these functional, structural and molecular studies within the framework of a *disease state*” (emphasis added). They conclude, not unreasonably, that there is “. . . substantial functional, anatomical and neurochemical evidence that chronic-pain patients have abnormal brains.” However, they do identify the “chicken-and-egg” problem inherent in further inference, by asking whether the evidence of “altered and dysfunctional central nervous system processing” is “an adaptive response to the constant nociceptive barrage” or constitutes a “disease like process.”

The claim by the proponents of pain-as-a-disease, that the decrease in gray matter in “pain-processing” areas of the brains of patients with chronic pain is an indication of an underlying pathognomonic process that justifies disease status, must be tempered by the absence of “. . . conclusive data regarding the cause or the consequence of the different cortical and subcortical morphological changes that have been observed in chronic pain states . . .” [21].

Reviewing 30 independent studies in 15 chronic pain states, May [21] states, “. . . it must be taken into account that it is simply not clear whether the changes described in all the above-mentioned studies reflect changes due to pain (i.e., nociceptive input) or changes due to the consequences of pain or both.” He points out that changes due to the presence of pain such as altered physical activity, disturbed social function and lifestyle effects, as well as the unknown “impact of pain killers and other medications” may contribute to the observed morphometric findings and concludes that the “. . . data of an increase or decrease in gray matter in pain syndromes need to be considered in light of all observations gathered in the past 10 years and probably do not justify a discussion of brain damage or whether the disease (*sic*) is progressive.”

This is not to deny the accumulating evidence of altered brain function in chronic pain states, especially in those areas known to be involved with processing of nociceptive information, such as the cingulate cortex, insula, temporal lobe, and dorsolateral prefrontal cortex [20,21]. Nor is it to deny the importance of the new anatomical and neurophysiological evidence, as well as the functional studies referred to earlier.

However, by the definition earlier, a disease must be “*manifested by a characteristic set of symptoms and signs,*” which raises the question, which “characteristic” clinical features apart from the complaint of pain constitute the “disease” of pain? It is not sufficient to invoke a “syndrome” or a grouping of symptoms of which pain might be a component, especially when the diversity of conditions associated with pain is considered. On neither pathological nor clinical criteria can pain-as-a-disease be justified.

### Issues of Conceptual Clarity

The relationship of “theory” to “truth” is the subject of ongoing philosophical debate between those who insist upon truth (or at least an approximation to truth) in a theory and those who would judge a theory in terms of its usefulness in the relevant context.

According to Lipton [22], to make a scientific claim is to assert that the claim is true. As he puts it, “. . . scientific inferences are often driven by asking how good an explanation a given hypothesis would provide of the phenomena if it *were* true, and then, if it would be good enough, inferring that it *is* true” (emphasis in original). That is, “the activity of explanation itself supposes truth.” This argument does not detract from the importance of theory in guiding research and practice, as it may encourage the defense of ideas that eventually turn out to be valid.

The question we pose here is, to what extent do the various theories of pain offer valid explanations that might be true?

The conjecture that the nervous system is anatomically hard-wired was untrue, but it did provide a conceptual

frame for the study of pain. Even today, some 350 years later, vestiges of this concept persist in the pain literature: pain fibers; pain signals; pain pathways; pain processing; and pain sensitivity [18].

Neuroplasticity theory accommodates the uncertainty and also the unpredictability of pain as embodied in the IASP definition and has given rise to the concept of a dynamic *pain matrix* [23], which finds support from patterns of neural activity observed in real-time imaging studies of the brain [20,21]. Moreover, it affords novel explanations for conditions where ongoing noxious input is not discernible, such as phantom limb pain and central poststroke pain. It is now unacceptable to argue that they do not exist or are “all in the mind.” Neuroplasticity theory offers an explanation of pain that may be true; at the very least, it has generated a progressive research program.

To what extent does the theory of pain-as-a-disease offer an *explanation* of pain?

The proponents of this thesis argue not only that pain is a disease defined by a unique pathology but also that pain functions as a causative agent: “Pain activates brain structures”; “these pathologies . . . are . . . dependent on . . . the presence of pain”; “persistent pain does give rise to its own secondary pathology” [16]. But the lived experience of pain is too complex and pervasive to be reducible to a “thing” that can cause itself. This argument confuses pain-as-an-experience, pain-as-a-symptom, pain-as-a-pathological-entity, and pain-as-a-cause-of-pathology.

By blurring the lines of cause and effect and of antecedent and consequent, taken together with the failure to propose an acceptable name for this “disease” other than the morally charged “maldynia” [24], this proclamation ultimately constitutes the philosophical error captured by Wittgenstein [25] in his aphorism #114: “One thinks that one is tracing the outline of the thing’s nature over and over again, and one is merely tracing round the frame through which we look at it.” The claim that *pain is a disease* is thus passed off as an assertion of certainty but only because that is demanded by the frame of reasoning through which it was conceived.

### A Way Forward

This essay contends that the theory of pain-as-a-disease is a retreat to the false sanctuary of biomedical certainty. By asserting that pain is an agent that can cause a disease also called “pain,” the proponents of this theory have fallen foul of circular argument. Thus, the truth-claim of pain-as-a-disease can be seen as motivated more by a desire to make sense of a slippery phenomenon than by making sense. By contrast, neuroplasticity theory, when seen as part of a broader manifestation of how an organism might survive in a hostile environment, offers both greater explanatory power for the observed phenomena and a platform for progressive research.

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