

CONFERENCE PAPER


History of Pain: From Avicenna to Melzack

Abstract

Pain has been a universal and enduring element of the human condition since antiquity. From the early humoral theories to modern neuroscience, its conceptualization reflects the evolution of both medicine and philosophy. Galen (2nd century AD) regarded pain as a disturbance of tissues within the framework of bodily humors, establishing an anatomical but peripheral perspective. In Canon of Medicine, Avicenna (980–1037) introduced a more advanced proto-neurophysiological model, describing the brain as the central organ for pain perception and recognizing that pain could persist even without tissue damage. René Descartes (1596–1650) transformed pain theory through a mechanistic model, describing it as a linear transmission of signals along nerve “threads” to the brain, a revolutionary but reductive framework. The 20th century marked a paradigm shift with Ronald Melzack and Patrick Wall’s Gate Control Theory (1965), and later Melzack’s Neuromatrix Theory (1990s), which reframed pain as an active, multidimensional brain output shaped by genetics, cognition, and emotion. This review traces the historical trajectory of pain theory, emphasizing the continuity between Avicenna’s insights and Melzack’s neuroscience, highlighting the intellectual transition from humoral and mechanistic frameworks to the biopsychosocial model that dominates contemporary pain medicine.

Key words: Neuropathic Pain, Pain Perception, Analgesics, Cognition, History of pain

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Kader Keskinbora (M.D.)¹ 
Kadircan H. Keskinbora (M.D.,
Ph.D.)²

1- Professor of Anesthesiology and Pain,
Istinye University, School of Medicine,
Istanbul, Turkiye

2- Professor of Ophthalmology, History
of Medicine and Medical Ethics, Bahçe-
sehir University, School of Medicine
Istanbul, Turkiye

Correspondence:

Kader Keskinbora
Professor of Anesthesiology and Pain,
Istinye University, School of Medicine,
Istanbul, Turkiye

e-mail: kader.keskinbora@gmail.com

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Introduction

Pain has accompanied humanity since its earliest existence, shaping both individual suffering and collective approaches to healing. The International Association for the Study of Pain (IASP) defines pain as “*an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.*” (International Association for the Study of Pain (IASP), 1979). This modern definition underscores the multidimensional nature of pain, encompassing sensory, emotional, and cognitive components, and moving far beyond a purely physiological response.

Throughout history, pain has been a clinical challenge, a philosophical question, and often a theological mystery. Ancient civilizations interpreted pain through spiritual paradigms, employing ritualistic, magical, or herbal remedies. Classical physicians such as Hippocrates and Galen sought systematic explanations, framing pain within humoral theory and neural pathways. In medieval Islamic medicine, Avicenna (Ibn Sina) integrated Aristotelian philosophy, Galenic medicine, and his own observations into a refined framework that emphasized the central role of the brain. During the Renaissance and Enlightenment, the mechanistic philosophies of Descartes placed pain within a linear neurophysiological context.

The philosophical weight of pain is captured in timeless reflections: Hippocrates declared, “*To relieve pain is the art of God*” (*Divinum est opus sedare dolorem*), emphasizing the sacred duty of physicians. Centuries later, Albert Schweitzer (1875–1965) echoed the sentiment, writing: “*Pain is a more terrible lord of mankind than even death itself*” (1931). These remarks illustrate the enduring centrality of pain in medicine and underscore its role as both a biological condition and a moral imperative.

This article reviews the history of pain theory from Avicenna to Melzack, contextualizing their contributions within the broader trajectory of medical thought. It emphasizes the intellectual continuity between Avicenna’s proto-neurophysiology and Melzack’s neuromatrix framework, bridging a millennium of inquiry into one of medicine’s most complex phenomena.

Discussion

Early Concepts of Pain: Galen and Antiquity

Galen (129–216 AD), the prominent Greco-Roman physician, offered a humoral-anatomical explanation of pain. He described pain as a disturbance arising from imbalance or alteration in the four bodily humors—blood, phlegm, yellow bile, and black bile—or from physical disruption in tissues. Pain, in Galen’s view, was not merely a local phenomenon but a systemic disturbance reflecting broader imbalances in the body. He also associated pain with nervous structures, recognizing nerves as conduits for sensation, though his understanding lacked the central processing role of the brain.

While groundbreaking for its time, Galen’s perspective had limitations. It located the origin of pain primarily in peripheral tissues and systemic humors, underestimating the central role of the brain in perception. Nevertheless, his synthesis of humoral theory and anatomy provided a crucial foundation for subsequent medical thought.

Avicenna and Medieval Islamic Medicine

Avicenna (Ibn Sina, 980–1037), one of the most influential figures in Islamic and world medicine, provided remarkably advanced insights into the physiology of pain. In *Canon of Medicine*, he identified the brain as the central organ responsible for the conscious perception of pain. He suggested that specialized receptors located throughout the body, once stimulated, transmitted signals to the brain, where they were processed into the experience of pain.



This proto-neurophysiological view anticipated, in rudimentary form, modern concepts of nociceptors and central processing pathways (Pormann, and Savage-Smith, 2007).

Avicenna's conceptual framework combined Aristotelian philosophy and Galenic tradition with original observations. He argued that not all stimuli caused pain by tissue disruption alone, but rather by altering the temperament (*Mizaj*) of organs—reflecting humoral thought. Importantly, he noted that pain could persist even after the removal of the stimulus, classifying such conditions as “*non-genuine pain*” (*dolor non verus*). He advised physicians not to pursue direct treatment in such cases, implicitly recognizing persistent or neuropathic forms of pain (Porter, 1997).

This dual approach—integrating humoral medicine with a proto-neurophysiological framework—was centuries ahead of its time. Avicenna's observations highlighted pain as a perceptual and central process, distinguishing him from purely peripheral models. His insights would resonate a millennium later in Melzack's understanding of pain as a brain-centered experience.

Descartes and the Mechanistic Model of Pain

René Descartes (1596–1650) advanced a mechanistic model of pain in his influential work *Traité de l'Homme* (*Treatise of Man*, 1664). He described pain transmission as a linear process: an external stimulus, such as heat from a fire, activates the skin, which in turn pulls on a “*thread*” (nerve) that conveys the signal directly to the brain. This analogy of a bell rope was revolutionary, shifting pain theory from humoral disturbances to neural transmission.

Descartes' model highlighted the nervous system as the medium of pain, laying the groundwork for the reflex concept and the early neurophysiological study of sensation. However, it oversimplified pain as a one-dimensional, stimulus-response process, excluding the emotional, cognitive, and psychological components that are now recognized as integral. Nonetheless, his framework was a critical milestone in redirecting medical inquiry toward the nervous system.

Melzack, Gate Control, and the Neuromatrix

The 20th century marked a revolution in pain theory with the contributions of Ronald Melzack and Patrick Wall. Their *Gate Control Theory of Pain*, published in *Science* in 1965, challenged the linear models of Descartes. They proposed that pain is not merely a direct consequence of nociceptor activation but is dynamically modulated at the spinal level by a “*gate*” mechanism in the dorsal horn. Large-diameter fibers carrying touch and pressure could close the gate, inhibiting pain signals, while small-diameter nociceptive fibers opened it, facilitating pain. This model explained everyday observations, such as the reduction of pain when rubbing the skin near an injury (Melzack, and Wall, 1965).

In the 1990s, Melzack extended this work into the Neuromatrix Theory. He argued that pain is generated by a distributed neural network in the brain, the “*neuromatrix*,” which produces characteristic patterns of activity known as “*neurosignatures*.” These patterns are shaped by genetics, sensory input, memory, cognition, and emotion. Crucially, pain could exist without peripheral input, as in phantom limb pain, reframing it as a brain-generated experience. This theory established the multidimensional and biopsychosocial character of pain, fundamentally changing clinical practice and research (Melzack, 1999).

The historical trajectory of pain theory illustrates a profound intellectual evolution. Galen localized pain to peripheral tissues and humoral imbalances, providing a systemic but limited view. Avicenna advanced the concept by placing the brain at the center of pain perception and distinguishing between genuine and persistent forms of pain. Descartes' mechanistic model



redirected attention toward the nervous system, highlighting transmission and reflexive responses. Finally, Melzack synthesized these traditions into a network-based theory, recognizing the dynamic and multidimensional nature of pain.

This progression reveals continuity as well as transformation. Avicenna's insight that the brain organizes pain prefigures Melzack's recognition of the neuromatrix. Descartes' emphasis on neural transmission remains foundational, though expanded by modern neurophysiology. Together, these thinkers show how pain has been interpreted as a disturbance of humors, a perceptual experience, a mechanistic process, and ultimately, a multidimensional neurocognitive output.

Conclusion

Pain has been a central concern of medicine and philosophy since antiquity, serving as both a biological phenomenon and a profound human experience. From Galen's humoral framework to Avicenna's proto-neurophysiology, from Descartes' mechanistic model to Melzack's neuromatrix, the evolution of pain theory reflects broader shifts in scientific thought. Avicenna's recognition of the brain as the organizing center of pain resonates strongly with Melzack's model a millennium later, underscoring the enduring relevance of historical insights. Today's biopsychosocial model integrates these perspectives, acknowledging that pain is not simply a signal of injury but a complex, individualized experience shaped by biology, psychology, and society. Understanding this history not only honors the intellectual lineage of pain theory but also informs its future directions in clinical and research practice.

Authors' Contribution

Kader Keskinbora conceived and designed the study, collected and analyzed the data, interpreted the results, and drafted the initial manuscript. Kader Keskinbora also contributed to the critical revision and approved the final version of the article. Kadircaan H. Keskinbora conceived the study and supervised the project. All authors reviewed and approved the final version.

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Conflict of Interest

None.

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