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Review Article

An alternative perspective on heart-brain information processing: a narrative review

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ABSTRACT

The intricate relationship between the heart and the brain has captivated human curiosity for centuries. It is a fascinating aspect of human experience, encompassing both physiological and psychological dimensions. A complex relationship that has been contemplated, explored, and interpreted by philosophers, poets, psychologists, and scientists throughout history. Historical perspectives, ranging from the ancient Egyptians who thought the heart was the seat of the soul to the Eastern philosophies that emphasize the significance of the heart's function in meditation and mindfulness, resonate with contemporary scientific discoveries. This review article bridges the gap between the physical and emotional aspects of human existence by exploring the concept of the heart and mind. The purpose of the article is to elucidate the concepts and functioning of the Prana and mind in the cardiac plexus that play an intrinsic role in communication between the heart and brain. Furthermore, the impact of regulated cardiac plexus on physical, mental, and spiritual upliftment with respect to traditional Vedic wisdom and contemporary research. In conclusion, this article mainly presents the two different concepts of information processing as understood by Western and Eastern thought processes. The essential aspect of this difference is the element of the ‘mind’ which, according to the Eastern perspective, stimulates the heart and subsequently the brain to process the information. Understanding and harnessing the concept of mind in the model of cognitive processing offers the potential to open new avenues for readdressing the established cognitive and health models that ultimately help in promoting cognitive health, mental health, and emotional harmony.

Keywords: Cardiac plexus, Prana, Mind, Heart, Brain, Emotion

INTRODUCTION

The Western perspective of the heart and mind is an important concept in psychology and philosophy. It refers to the way in which the heart and mind are viewed and understood in Western cultures, particularly in Europe and North America. The heart and mind have been studied and analyzed for centuries, with different theories and perspectives emerging over time. The Western perspective of the heart and mind is based on the idea that the heart and mind are separate entities, with the mind being the source of rational thought and the heart being the source of emotions and feelings. This perspective has influenced many aspects of Western culture, including art, literature, and even medicine. For instance, the concept of the 'broken heart' is often used in literature and popular culture to describe the emotional pain associated with heartbreak or loss.

In philosophy, the Western perspective of the heart and mind has been a subject of debate for centuries. French philosopher, René Descartes proposed dualism, the idea that the mind (or soul) and body are separate entities. The mind is the source of rational thought and knowledge, while the heart is associated with emotions and passions.[1] However, the Greek philosopher, Aristotle believed in the

interconnectedness of the heart and mind. He considered the heart to be the seat of the mind and the source of life.[2,3] According to him, the mind interacts with the body through the pineal gland. In psychology, the Western perspective of the heart and mind has influenced the way in which mental health and illness are understood and treated. The mind is often seen as the source of mental processes such as cognition, perception, and memory, while the heart is associated with emotions and feelings.[4]

This perspective has led to the development of various therapeutic approaches, such as cognitive-behavioral therapy, which focuses on changing negative thought patterns to improve mental health. However, some critics argue that this perspective oversimplifies the complex relationship between the heart and mind.

The heart-mind connection was a fundamental aspect of ancient Egyptian religion, reflecting the importance of balance and harmony in all aspects of life. The weighing of the heart against the feather of Ma'at served as a powerful motivator for individuals to strive for righteousness and ethical behavior, and it reinforced the belief that the mind is located in the heart which is the source of wisdom and knowledge.[5]

EASTERN PERSPECTIVE OF HEART AND MIND

According to Buddhist philosophy, the heart and mind are considered to be intimately connected, and cultivating a balanced and harmonious relationship between them is essential to inner peace and well-being. The mind in heart plays a pivotal role in mental and emotional experiences. An imbalanced heart-mind connection leads to negative consequences in mental state. To develop a balanced state of mind, Buddhist practice emphasizes the importance of cultivating mindfulness, wisdom, and compassion.[6]

The heart-mind connection is a fundamental concept in traditional Chinese medicine (TCM), which emphasizes the interconnectedness of the heart and the mind.[7] According to TCM, the heart is not only responsible for pumping blood but also for regulating emotions and mental states. The heart is considered the emperor of the body, and the mind is its loyal subject. Therefore, the heart and mind must work together in harmony to maintain physical and mental health.[8]

In TCM, emotions are believed to be closely related to physical health. For example, excessive anger can lead to liver problems, while excessive worry can affect the spleen. The heart is particularly sensitive to emotions, and emotional imbalances can manifest as physical symptoms such as palpitations, insomnia, or chest pain. Therefore, maintaining a healthy heart-mind connection is essential for overall health and well-being.[9]

In TCM, the heart-mind connection is considered in the diagnosis and treatment of various physical and mental health conditions. Acupuncture, herbal medicine, and other therapies are used to address imbalances in the heart-mind connection and promote overall well-being.

Moreover, the heart-mind connection can inform the development of integrative healthcare approaches that combine Western medicine and TCM. By recognizing the importance of emotional well-being and its impact on physical health, healthcare providers can offer more holistic and patient-centered care.[10]

Vedic perspective of the heart and mind

The ancient Vedic tradition, rooted in the wisdom of the Indian subcontinent, offers profound insights into the nature of human existence, consciousness, and the interconnectedness of various aspects of our being. Central to this understanding is the exploration of the heart and mind, two integral facets of our inner realm. In the Vedic perspective, the heart and mind are not just physiological organs but hold deeper metaphysical and spiritual significance. In Vedic philosophy, the heart, or “Hrid” in Sanskrit, is considered the seat of consciousness and the dwelling place of the self (Atman). It is not merely a pump circulating blood but a metaphysical center where emotions, intuition, and spiritual insights originate. The heart is seen as the bridge between the physical and spiritual realms, serving as a conduit for higher wisdom and divine connection. The Rigveda, one of the oldest Vedic scriptures, frequently speaks about the heart in symbolic and spiritual terms. The heart is described as the source of feelings, compassion, and love. The idea is to go beyond the physical heart and delve into its spiritual seat or essence, recognizing it as a repository of higher emotions and virtues.[11]

In contrast, the mind (Manas) in Vedic philosophy is considered the seat of thoughts, desires, and intellectual faculties.[12] It is a complex and dynamic aspect of the human psyche that governs reasoning, decision-making, and the processing of sensory information. The mind is often likened to a restless monkey, constantly jumping from one thought to another. The Bhagavad Gita, a sacred Vedic text, extensively discusses the nature of the mind and the challenges of controlling its incessant fluctuations. Lord Krishna, in his teachings to Arjuna, emphasizes the importance of mastering the mind to attain self-realization and spiritual enlightenment. The mind, when disciplined and aligned with higher principles, becomes a powerful tool for self-discovery and transformation.[13]

The traditional texts have provided multiple explanations for heart and mind. There are energy centers in the human body that are responsible for assimilating, regulating, and distributing the electromagnetic fields in the body called Chakra. The word “Chakra” is a vortex, disc, circle, or wheel, meaning bundles of nerves that are origins in Susumna Nadi.[14] The energy or subtle body is represented by the seven Chakras or energy centers. The spine has seven chakras, starting from the base of the spine to the

top of the head. The concept of Chakra comes from the oldest text Rigveda. Moreover, Upanishads describe the Chakra, for instance, Shandilya Upanishad, Chudamani Upanishad, Yoga-Shikha Upanishad, Shri Jabala Darshana Upanishad, Brahmopanishad, and Yogatattvopanishad.[15] According to the aforementioned texts, there are two different categories of Chakra such as physical or Earthly or materiality or Lower Chakra, and higher or spiritual Chakra. Physical Chakra including Moolabandha or Root Chakra is situated at the tailbone, responsible for the sense of security, survival, and stability; Svadhisthana, or Sacral Chakra is located above the pubic bone and below the navel, responsible for creativity, sexuality, and sensuality, and adaptability; and Manipura or solar plexus is situated above the navel and below the bottom of the rib cage, related to the digestive system and metabolic functions. Spiritual or higher Chakra including Vishudhi or Throat chakra is located in the throat region, responsible for communication, confidence, and self-expression; Ajna, or third eye chakra is situated between eyebrows or Bhrumadhya, associated with intuition, wisdom, intellect, spiritual enhancement; and Sahastrara or crown chakra is located at the top of the head.

It is the center of spirituality and enlightenment, associated with Pindanda, human body, and Brahmanda, or cosmos.[14] However, the Anahata Chakra is situated at the heart center with an air element. Anahata Chakra connects the lower Chakra and upper Chakra, at the heart center to experience unconditional love, compassion, kindness, and empathy.[14] Detailed information on all Chakra including color, deity, location, Beeja mantra, and elements are given in Table 1.[16,17]

Spiritual understanding of Anahata chakra (cardiac plexus)

The word ‘Anahata’ means unstruck or unhurt, situated at the thymus gland, heart, and lungs. It’s symbolized by twelve red petals, with the Beeja mantra ‘Yam’, and the element is air. This Chakra is associated with the touch principle, and its Uplabdhi is the Viveka Prapti, or Ishattva. Spirituality begins from the Anahata Chakra, responsible for balancing the higher Chakra and lower Chakra. It is also linked to compassion, love, passion, trust, empathy, and sympathy called Daiveeya Sampath or positive emotion. Imbalance of the heart Chakra leads to anger, anxiety, depression, hatred, lack of trust, jealousy, and fear known as Asuri Sampath or negative emotion. [18] However, the mind plays a significant role in balancing positive and negative emotions. Parashara Muni (sage) has described the mind in the Amritbindu Upanishad, mind as the cause of confinement and salvation for human beings.[15] Sage Patanjali explains the mind in the Patanjali Yoga sutra that the mind can be controlled through yoga practice and the nature of the mind can be understood by contemplating the heart.[19] Sage Angira explains the mind to his disciple in the Mundakopanishad that Brahman is in the form of mind in the heart who controls Prana. By contemplating the heart, one can realize the Brahman and get blissful immortality.[15] Mahidasa Aitareya elucidates in Aitareya Upanishad that the mind is the source of consciousness, perception, wisdom, reverence, love compassion, mental depression, anger, attachment, and desire.[15] Similarly, it is mentioned in the Narayana Suktam that Narayana who is pure consciousness, Brahman, Shiva, Vishnu, or everything for everyone that resides in the midst of the flame in heart, Sadhakas or practitioners should meditate on the heart.[20]

According to Kathopanishad, the Prana, or life force is the Heart Chakra’s element that is regulated by the mind (Brahman).[15] Similarly, Kaushitaki Upanishad (KU) of Rigveda describes the mind as Prana.[15] These shreds of evidence indicate the association of the mind and Prana or life force. Sage Swatamaram describes in his holy text ‘Hathayoga Pradipika’ that if breathing gets disturbed, the mind gets unsteady, and the mind can be calmed down by regulating the breath.[21] Meditating on the Chakras lead to realizing one's inherent nature, awakening of the Chakras, realizing one's innate nature, and experiencing unalloyed bliss.[22] The aforementioned texts explain two different entities of Anahata Chakra that is mind and Prana. The mind has a high potential to elevate one's higher consciousness or life's bondage. The Prana is the life force or energy that regulates the functions of the body. However, neither the mind nor Prana can function alone. This may be reason sage Swatmaram explains in the Hathyoga pradipika that if the mind gets unstable, Prana also loses its rhythmic process. Therefore, it might be said Prana and the mind play a pivotal role in the upliftment of the higher consciousness.

Role of mind and prana in diseases

The ancient systems of holistic medicine, such as yoga, Ayurveda, and TCM, have long recognized the interconnectedness of the mind and body in maintaining health and preventing diseases. The mind-body connection is a concept that emphasizes the profound influence of thoughts, emotions, and mental states on physical well-being. Stress, anxiety, and negative emotions can contribute to the manifestation of diseases, affecting various systems in the body. Scientific research has increasingly validated the importance of psychological factors in the development and progression of illnesses, ranging from cardiovascular disorders to autoimmune conditions.[23] The mind plays a pivotal role in shaping the health of an individual. Stress, negative thought patterns, and unmanaged emotions can create disturbances in the mind, contributing to an imbalance in the body's physiological processes. Chronic stress is associated with a higher risk of conditions such as hypertension, digestive disorders, and immune system dysfunction.[24] Yoga, meditation, and other stress-reduction techniques are advocated to promote mental well-being and prevent the onset of diseases.

In many traditional healing systems, prana is considered

the vital life force that animates the body and sustains overall well-being. Prana is believed to flow through a network of energy channels known as nadis, influencing the physiological and energetic aspects of an individual.[25] When prana is balanced and flows harmoniously, it supports health and vitality. However, disruptions in pranic flow are thought to lead to imbalances and eventually manifest as diseases. In the traditional healing systems, disruptions in the flow of prana are believed to precede the physical manifestation of diseases. Practices like yoga, specifically pranayama, and other techniques such as tai chi are designed to regulate and balance the flow of prana, promoting overall health.[26] Imbalances in prana are thought to lead to blockages in the nadis, resulting in stagnation and susceptibility to diseases. By cultivating awareness of prana and engaging in practices that enhance its flow, individuals may prevent or alleviate various health issues.

The theory of 'Adhija-vyadhi' or psychosomatic diseases described by Sage Vashishtha in the yoga Vashishtha, claims that diseases occur due to the imbalance of the mind and Prana.[27] The word 'Adhi' means disturbance of the mind and Vyadhi is an illness of the physical body. Therefore, Adhijavyadhi is a stress-born psychosomatic disease such as hypertension, indigestion headache, peptic ulcer, insomnia, and so on. The disturbed mind has the potential to percolate the prana or life force resulting in imbalanced Prana channelization for the proper functioning of the cells and tissues. In accordance with yoga Vashishtha's explanation (ch. II, verses 709-723), a turbulent mind, annoys the prana or life force and affects the weakest organ's physiology. The imbalance of the mind and Prana is the imbalance of the Anahata chakra which results in negative emotions such as hatred, jealousy, anxiety, depression, blood pressure, cancer, diabetes, and psychosomatic diseases. It may happen due to the annoyance of Panchakosha or the five sheaths of the subtle body as mentioned in Taittiriya Upanishad (chapter 2, anuvaka 2-5).[15] The disturbance in the Manomaya kosha or mind percolates the Pranamaya kosha or prana or life-energy resulting in disturbed cardiac rhythmic process, lowered or increased blood pressure, hampered respiration rate, and nerve palpitation.

Therefore, several traditional texts give solutions to balance the mind and Prana by meditating on the Ahanata chakra. Sage Gorakhnath asks us to meditate on the heart to control the prana (chapter 2, verses 35-36).[28] Similarly, Sage Swatmarama explains controlling the Prana is to control the mind.[21] In the recent electroencephalogram (EEG) and meditation study, neuroscientists have found higher alpha and theta while contemplating the heart region, which indicates a deeper relaxation of the mind.[29] Understanding the role of the mind and prana in diseases provides a holistic perspective on health and wellness. By cultivating mental well-being, managing stress, and promoting the harmonious flow of prana, individuals can take proactive steps in preventing and addressing a wide range of health issues. Embracing a holistic approach to health not only treats symptoms but also addresses the root causes, fostering a state of balance and vitality.

THE RELEVANCE OF CARDIAC PLEXUS IN MODERN SCIENCE

The human body is an intricate tapestry of interconnected systems, and understanding the nuances of these networks remains a fascinating endeavor for modern science. The cardiac plexus, a complex web of nerves situated near the heart, has garnered attention for its crucial role in regulating cardiac function. According to Indian scripture, specifically Shvetashvara Upanishad commentary given by Acharya Sriram Sharma, the mind resides in the heart and serves as the sinus node, the body's natural pacemaker which is in charge of maintaining sinus rhythm, or regular heartbeat.[15,30] Modern science has been conducting research on Anahata meditation to see its effect on psychophysiological changes. Previous heartfulness meditation reported that enhanced sympathovagal balance is important for better mental and cognitive functioning.[31] Similarly, Vipassana meditation testified to increased HF and decreased LF power during meditation which indicates better regulation of cardiac rhythmic process and emotion, interpersonal connection, and stability of mind.[32] The heart-based meditation not only regulates functions of heart but also over-regulation of other domains of body's physiology and functions. Heartfulness meditation has shown to reduce anxiety and impulsivity; and enhanced mindfulness and quality of life in meditators.[33] It has also been reported its impact on emotional well-being and improvement in telomere length, sleep, and loneliness, cyclic vomiting syndrome, cognitive processes, and overall wellbeing.[34-37] Kindness, love, compassion, and any emotion are directly linked with the heart hence, loving-kindness and compassion meditation have shown positive emotion regulation in meditators, decreases anxiety, impulsivity, and negative emotion, and increasing positive emotion through meditation.[33,38,39] The cardiac plexus in modern science underscores the intricate interplay between neural regulation and cardiovascular health. Unraveling the mysteries of this complex network has the potential to reshape our understanding of cardiac disorders and pave way for innovative therapeutic interventions. As research in neurocardiology progresses, cardiac plexus may emerge as focal point for precision medicine approaches, ushering in new possibilities for prevention and treatment of cardiovascular diseases.

MODERN SCIENCE PERSPECTIVE OF THE HEART AND MIND

The heart-mind is a network constantly communicating with the brain via the vagus nerve. The field of neurocardiology has emerged as a crucial bridge between the heart and brain, exploring the intricate communication pathways between the heart and the brain. Neurotransmitters, hormones, and electrical signals play a pivotal role in this bidirectional communication,

influencing mood, emotion, cognition, and behavior. According to a previous study, sinoatrial (SA) nodes generate action potentials that cause regions of the heart muscles to contract in a coordinated manner, causing a heartbeat to occur.[40] After receiving signals, heart generates rhythmic electrical activity which forms an electromagnetic field. Research in the field of bioelectromagnetics has revealed that the heart's electromagnetic field is not only detectable but also interactive and influential.[41]

Studies suggest that every amplitude and frequency of electromagnetic field of the heart provides different information including emotions, thoughts, and intentions.[42] Recent advancements in neuroimaging techniques, such as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), and electrocardiogram (ECG) have allowed researchers to observe the real-time interaction between the heart and brain.[43,44] These studies have unveiled the profound impact of emotions on cognitive processes, challenging the traditional view of the brain as the sole orchestrator of mental functions. Contemporary science has delved into the concept of emotional intelligence, emphasizing the role of emotions in decision-making and overall well-being.[45] Heart rate variability (HRV), a measure of the variation in time between heartbeats, has emerged as a key indicator of emotional regulation and overall mental health.[46] High HRV is associated with better emotional flexibility and adaptability, contributing to improved decision-making and stress management. The phenomenon of heart coherence, where the heart's rhythms become synchronized and more ordered, has been linked to positive emotional states.[47] Emotional experiences often begin with the perception of a stimulus, which can be external (e.g., seeing a loved one) or internal (e.g., recalling a memory).

This aforementioned research indicates that the heart gives signals to the brain via the vagus nerve to analyze the information (data) and commands to the concerned organs or parts of the body. On the other hand, we may consider a two-way dialogue between the heart and the brain. Traditional views on heart-brain communication often focus on the autonomic nervous system's efferent pathways regulating heart. However, it's often overlooked that the vagus nerves primarily consist of afferent fibers, with a significant portion dedicated to conveying information from the heart to the brain. Recent studies emphasize the complexity of neural interactions between heart and brain, revealing that heart communicates more information to brain than vice versa.[48–50]

According to modern science, the hypothalamus receives information from various sense organs and commands to autonomic nervous system. The autonomic nervous system stimulates the SA node to generate an electrical signal to stimulate heart cells. The heart generates an electromagnetic field that is transferred by the vagus nerve via the medulla, hypothalamus, thalamus, and amygdala and then to the cerebral cortex. The hypothalamus once again commands autonomic nervous system to maintain homeostasis (Figure 1).

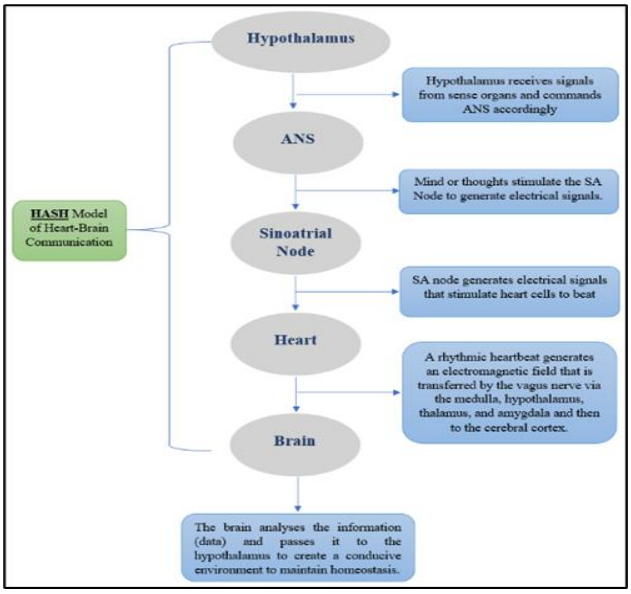

Figure 1: The modern perspective of the heart-brain communication.

According to Eastern philosophy, the conglomeration of thoughts is the mind, plays a pivotal role in modulating the heart and brain. Several texts explain that the mind has immense vrittis or modification which directly influences the heart via the SA node. After getting electrical signals from the SA Node, the heart generates an electromagnetic field. The vagus nerve receives signals from the heart and transmits them to the brain. The brain analyzes the signal and takes appropriate action to maintain homeostasis in the body (Figure 2).

According to Shim Ju Shin Ji (heart and brain) theory, the heart regulates the brain functions. It has been explained that the heart may be considered as a mind which regulates the functions of the brain. According to contemporary research, the heart uses the vagus nerve to send information from sense organs to the brain with each heartbeat. The tenth cranial nerve, the vagus nerve in the heart regulates various essential bodily functions such as the parasympathetic nervous system, digestion, immune system, heart rate, and heart rhythms.[51] This process transpires through the afferent pathway, sending information to the brain.[52] As a result, the afferent neural pathway enables the integration of heart-related information received from the vagus nerve in the nucleus solitarius of the brainstem. Integrated afferent input from the nucleus solitarius travels to the cerebral cortex via the limbic thalamus, hypothalamus, and amygdala. The cerebral cortex receives information that is subsequently processed in the brain before being sent through the efferent pathway to the heart and other main organs. After receiving the information from the brain, the heart governs the sympathetic and parasympathetic nervous systems to maintain the homeostasis of the body.[53]

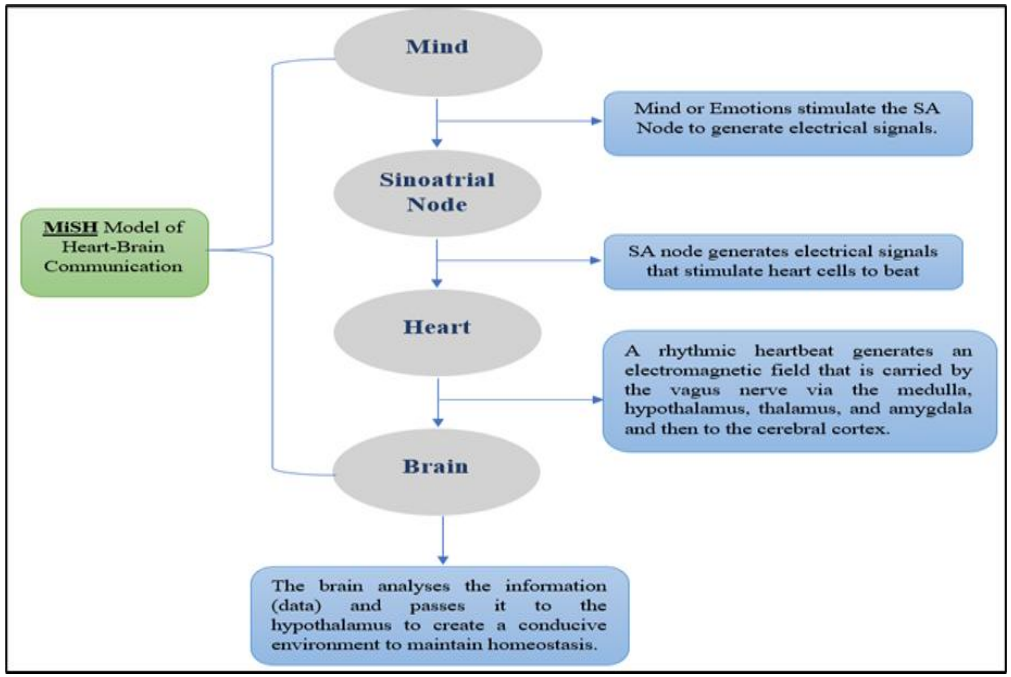

Figure 2: The Eastern perspective of the heart-brain communication.

Table 1: The seven chakras system and its corresponding elements.

Name	Region	No. of petals	Color	Tattva	Tattva Beej	Beej vaahan	Devata	Loka	Guna	Devi Sahkti, Yantra	Gyaan indriyas	Karm indriyas	Uplabdhi
Muladhara	Anal and genital	4	Blood-red	Prithvi	Lam	Airavat Hasti	Brahma	Bhu	Gandh	Daakini, Chaturbhuj	Naasika	Anus/Anal	Rog nivritti
Swadhishtana	Pelvic	6	Crimson	Jal	Vam	Makar	Vishnu	Bhuva	Taste	Raakini, ardhachandra	Tongue	Genitals	Creativity/ yog prapti
Manipura	Naval	10	Yellow	Agni	Ram	Mesh	Vriddh rudra	Svaha	Sight	Lakini, trikon	Eyes	Legs	Vidya, confidence, will power
Anahata	Heart	12	Blue	Vayu	Yam	Mrig	Ishan rudra	Maha	Touch	Kakini, hexagon	Skin	Hands	Vivek prapti, Ishattva
Vishuddhi	Throat	16	Violet	Aakash	Ham	Hasti	Panch vakra rudra	Jana	Shabd	Shakini, circle	Ears	Tongue	Jnana, purity
Aajna	Eyebrow centre	2	Silver	Mahat	Aum	Naad	Linga	Tapa	-	Bhakini, lingakar	-	-	Vaak siddhi, intuition
Sahasrara	Brain	1000	-	Tattvatita	Visarga parama shiva	Bindu	Para Brahma	Satyam	-	Mahashakti, Nirakar purnachandra	-	-	Mukti, liberation

CONCLUSION

The difference between the Eastern and Western perspectives of information processing is laid out in the current study. In these traditions, the mind plays a crucial role in regulating Prana (life force) and influencing the Anahata Chakra (heart center). Modern scientific research is beginning to support the Eastern perspective, demonstrating the heart's extensive communication with the brain via the vagus nerve. Studies on heart rate variability (HRV) and heart coherence provide evidence for the impact of emotions on cognitive function and overall well-being. Further research into the cardiac plexus and its role in heart-brain communication may lead to a greater understanding of this complex relationship and offer new avenues for addressing cognitive and mental health.

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