

Health and Holism: The Vagus Nerve and Yoga

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It is well known that yoga improves strength, flexibility and balance. Less well known is its ability to improve the strength, flexibility and balance of the nervous system, and how important this is for health and happiness. Clinical research on yoga has started to shed light on the mystery of how yoga works on the body and mind, proving its ability to heal both psychological and physiological disorders. Numerous studies show that yoga and related practices are highly effective at dampening the stress response through stimulation of the vagus nerve. Investigating the function of the vagus nerve therefore provides an understanding of the mechanisms by which yoga works in the body. By supporting and enhancing the natural functions of the vagus nerve, yoga uses a highly effective combination of practices to integrate systems, improve self awareness, and self-regulate autonomic, emotional and behavioural responses, giving the body the tools it needs to resist stress, combat disease, and optimize well-being.

Integration, or unity, is both the aim of yoga, and its method. Similarly, the vagus nerve has the same integrative function in the human body. Latin for “wandering”, the vagus nerve is the longest cranial nerve. Interweaving throughout the face, neck, heart, lungs, diaphragm and visceral organs, its many branches communicate between all the systems of the body, including the involuntary autonomic system, which further breaks into sympathetic (stress response), parasympathetic (rest and renew) and enteric (digestion) (Yuan and Silberstein: “Vagus Nerve: Part I” 71). The vagus nerve thus unites the systems so that it can better function as an integrated whole.

Learning to pay attention to internal sensations and slow down the processes within the body – both voluntary and involuntary, conscious and unconscious – is an important part of yoga practice, and another important function of the vagus nerve. Akin to what in yoga might be called a gut feeling, intuition or extrasensory perception, the vagus nerve allows for instantaneous and unconscious

responses to the environment through a process called neuroception (a neural process distinct from and faster than normal perception) (Porges 5). In a bottom-up process, afferent nerve fibers sense a variety of interoceptive stimuli from the visceral organs to the brain – such as pain, pressure, temperature, stretch, and inflammation, while efferent fibers carry top-down messages that apply the brake to the sympathetic nervous system, regulating the heart rate, respiration and digestion (Yuen and Sander 105). The practices of yoga mirror these bottom-up and top-down internal processes: physical postures stimulate greater self-awareness, while slow breathing, mindful attention and relaxation techniques moderate the stress response.

Another correlation lies between the yogic teachings of the three *gunas* (constituents of nature being principles of inertia, activity and clarity) and the three functions of the polyvagal theory outlined by Porges' (Sullivan et al 11). Porges (2009) postulates a complex three-tiered system (two distinct vagal pathways plus the sympathetic nervous system) based on three evolutionary strategies for coping with environmental challenge: immobilization, mobilization, and restoration/social engagement (3). The dorsal vagal pathway is the most primordial, and controls inertia or immobilization (the freeze response) in near-death situations, as in reptiles. The sympathetic nervous system evolved later, to activate or mobilize in response to stress or danger (the fight or flight response). The ventral vagal pathway is the most evolved and puts a dampener on the sympathetic stress response to enable clarity, rest, restoration, digestion and socialization – all which strengthen the ability of the nervous system to find homeostasis. Similar to the ancient teachings of the *gunas*, Porges' polyvagal theory explains how three autonomic responses interact in hierarchical fashion, with each level inhibiting or combining with lower-level strategies to maintain a delicate balance and promote adaptive strategies for survival in increasingly complex contexts.

The polyvagal theory also connects autonomic responses to emotional and social behaviour – essential limbs in traditional yogic teachings. Porges' (2009) theory predicts that dangerous or stressful

states can limit appropriate responses and behaviors to the system that is currently active (eg. fight, flight or freeze), making skills in the higher systems inaccessible (such as focused attention, social engagement cues, etc.) (6). When the afferent fibres sense safe conditions (such as familiar people with pleasing vocal and facial expressions), the ventral vagal pathway activates the parasympathetic nervous system to produce neurochemicals that stimulate healing, mitigate pain, heighten mood and promote social bonding (Sullivan et al 3). Stress or perceived threat will withdraw the vagal brake and activate the sympathetic system; stress hormones are released and emotions such as fear or anger predominate, with corresponding self-protective behaviour. If fight or flight does not effectively deal with the danger, the dorsal vagal pathway takes over to immobilize the body's functions as a last defense. Sullivan et al (2018) further explain that high vagal or parasympathetic tone keeps the ventral pathway active under higher levels of stress, allowing the system to better regulate mood and responses, while maintaining controlled access to lower levels and blended states for more complex responses such as creative play and intimacy. The polyvagal system thus senses and communicates the level of safety in the environment to support optimal physical and psychological well-being and adaptive behaviour. Corresponding to this role, the philosophy, psychology and meditative practices in yoga aim at providing a safe space for the practitioner to flourish, regulate thinking patterns, improve mood, reduce anxiety and guide positive social interactions.

Just as yoga tones and strengthens the muscles in the body, vagal tone – and corresponding parasympathetic responsivity – can also be targeted and strengthened, as measured through heart-rate variability or respiratory sinus arrhythmia. High vagal tone allows for increased interoception (the ability to detect state changes within the body), self-regulation (the ability to consciously alter autonomic responses to perceived threat), focused attention, positive emotions, and better access to social cues and positive behavioural responses, even in times of stress (Gard et al 1; Sullivan et al 4). Conversely, low vagal tone can contribute to an increased allostatic load (the cumulative cost of stress

overloading the body's sympathetic responses), emotional reactivity, defensive behaviour, mood disorders, plus a variety of diseases that affect the heart, lungs, digestive system, and nervous system (Streeter et al 575). Many of these issues are directly induced or exacerbated by stress and can often present as co-morbid, complicating treatment protocols (Streeter et al 576). Pharmaceutical interventions are sometimes ineffective, and often come with side effects, contraindications and/or unfavourable interactions. Yuan and Silberstein demonstrate that electrical stimulation of the vagus nerve (neuromodulation) is effective for treating epilepsy, depression, migraines and chronic pain, and shows potential for treatment of rheumatoid arthritis, fibromyalgia, inflammatory bowel disease, asthma and stroke recovery. Although generally very safe, treatment may prove cost-prohibitive at \$700 per month to rent the device (Hamilton). Long-term use of neuromodulation shows a lasting positive affect on the immune system by affecting neurotransmitters and key immune organs, and reducing inflammation, pain levels and conditioned fear responses (Yuan and Silberstein: "Vagus Nerve: Part III" 480). These studies prove that direct and repeated stimulation of the vagus nerve enhances vagal tone and is highly effective in dealing with the body's maladaptive reactions to increasing levels of stress in the environment.

Scientific research is proving yoga's efficacy in a multitude of areas, and also confirms that it strengthens vagal tone from several angles at once. One short-term study concluded that autonomic balance tilts towards parasympathic dominance after just one month of yoga practice (Vinay et al 1). Timothy McCall (2019) recently updated his index validating yoga's effectiveness on 117 health conditions. Yoga based practices showed more increase in vagal or parasympathetic tone than aerobics, walking, relaxation, or mindfulness-based practices alone, and that specific aspects such as gentle movement, resistance training, stretching, mindfulness, slow breathing, chanting, and intermittent fasting all contribute to those benefits (Khattab et al; Schmalzl et al; Streeter et al; Yuen and Sender). Tiffany Field (2011) reviewed studies focused primarily on physical postures and found positive effects

on parasympathetic tone, cardiovascular health, cognitive functions and sleep, as well as decreased anxiety, depression, pain, inflammation, cortisol levels, and oxidative stress. It has been speculated that stimulation of pressure receptors in both the somatic and respiratory systems, via the vagus nerve, may constitute an important underlying mechanism (Field 6; Streeter et al 573). Many researchers conclude that yoga directly engages the vagal system through its rich combination of movement, breathing and attention components, and they recommend an integrated approach to ameliorate its benefits, rather than extricating individual components (Gard et al; Schmalzl et al; Sullivan et al; Yuen and Sender). Reflective of the function of the vagus nerve itself, yoga works best as a synergistic system to promote integrated functioning of the autonomic system and holistic healing.

The yogic synthesis of physical postures, breathing and meditation techniques is a comprehensive method for integrated and self-sustaining health, but the West's tendency to compartmentalize, and its resultant abatement of yoga into a merely physical form of exercise, has undermined the potential for yoga's full efficacy to be recognized. The polyvagal theory provides a solid scientific and neurologically based understanding of how yoga mirrors the nervous system to directly support and strengthen its natural functions through a combination of processes that promote self-awareness, dynamic balance, self-regulation and resilience in times of stress, and develop strong, flexible and integrated interactions between systems – body and mind, conscious and autonomic, sympathetic and parasympathetic, individual and environment. Under the guidance of this theoretical understanding, future research is sure to further prove that yoga, in its traditional form, is ideally suited to improve overall health and well-being in a world rife with chronic stress and heal the modern plague of allied disorders and diseases. This understanding should also solidify – for yoga practitioners, teachers, programmers and therapists – how imperative it is that the more subtle aspects of this ancient wisdom tradition are kept intact.

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