

Polyvagal Theory and the Gunas

A Model for Autonomic Regulation in Pain

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This chapter looks at the relationship of autonomic nervous system dysregulation and the experience of pain. Polyvagal theory will be explored to elucidate the connections between physiology, emotion and behavior stemming from underlying autonomic nervous system platforms. A translatory language between the neurophysiology of polyvagal theory and foundational yoga concepts will be considered to describe yoga practices for regulation and resilience of the autonomic nervous system for the cultivation of wellbeing and the mitigation of the experience of pain.

Background: the autonomic nervous system provides a flexible response to the environment

The autonomic nervous system (ANS) is broadly divided into two branches—the sympathetic (SNS) and parasympathetic (PNS) nervous systems. The SNS is responsible for the mobilization of the systems of the body (e.g. cardiovascular, respiratory, endocrine) to meet any demand. This includes any response to real or perceived dangers or stressors in both the internal and external environment and is often referred to as the “fight or flight” response. The PNS is the counterpart to this mobilizing force, as it seeks to conserve resources, rebuild energy reserves and set the system for growth, healing and restoration. This system helps in processes of homeostasis and is often termed the “rest and digest” response. If, in the face of threat, the fight or flight is perceived to not be viable, an adaptive excess of PNS activity may occur and is often referred to as the “freeze” response.

While the accelerating (SNS) and decelerating (PNS) effects on target organs may seem to be contrary to one another, they are not antagonistic nor dichotomous. Rather, they interact to create a nuanced and complex response to inner and outer stimuli. Through their co-operation and co-mingling they offer a spectrum of strategies in response to stimuli ranging from optimal states

of co-activation to either a withdrawal or increased activation of one of these branches for a continuum of control of the target organ.¹

The heart demonstrates this variety of activation between the SNS and PNS, including: simultaneous activation of the SNS and PNS; reciprocal activation/inhibition of each branch; co-inhibition of both.² This complexity allows for a fine tuning of response and ability to adjust to the various circumstances of the individual.³

A more general and systemic example of this interaction of the SNS and PNS can be illustrated through the image of driving your car and having another car turn in front of you in an intersection. You can feel your heart “jump” on and start to race. You put on the brakes, swerve and avoid a collision. Phew! Gradually, with some breathing, your heart slows as the SNS deactivates and the PNS reactivates. Had you actually had a collision, it is likely that in that moment, both high SNS and PNS were activated, called a “freeze” response, and if really severe, PNS may then exceed SNS and put you into complete “collapse” and loss of consciousness.

The ANS as a systems-wide communicator for self-regulation and resilience

The ANS is key for systems-wide communication between the body and brain. It serves to both mobilize and restore the systems of the body with its vast connections to many bodily systems including: cardiovascular, respiratory, endocrine, digestive and immune. Consequently, the ANS is uniquely situated to assess, integrate and create a unified response for both mobilization and a return to restoration to help regulate the system in response to inner and outer stimuli.⁴

The idea of regulation, and more accurately self-regulation, indicates the conscious ability to maintain stability of the system by managing or altering responses to threat or adversity.⁵ The ability to self-regulate is often described as *bidirectional* with both top-down (neurocognitive-focused) and bottom-up (somatic-focused) processes vital in moving from activation to restoration in response to inner and outer stimuli in a healthy manner.⁶

ACTIVITY

Sitting or lying down, either close your eyes or create a soft focus. Notice the sensations in your body—places where there may be tension, tightness, stress, relaxation or openness. Notice your thoughts and emotions—the quality, speed, intensity.

Top-down (neurocognitive-focused) example: Bring a visualization or word that brings a sense of ease, peace, comfort. Focus on that image or word and even begin to notice where you might feel the sensations in your body—what is the texture, form, color or effect of that intention? As you allow the energy of this intention to move into and through you, notice what happens to what you had felt in your body earlier—how does this interact with the places of tension, tightness, stress, relaxation or openness? How does this alter the quality of thoughts or emotions?

Bottom-up (somatic-focused) example: Find a movement that brings into your body something that is needed or wanted—it could be something that soothes or relaxes the body or something that invigorates or grounds. It can be a single movement, a rhythmic flowing movement, a standing posture or a relaxing posture—that would fit your intention, needs or qualities that you want to cultivate. Practice that movement or posture for a few moments. Notice how this may alter the sensations of stress, tension or tightness in the body. Notice how this may alter the quality of thoughts and emotions.

The idea of self-regulation includes working with and managing the various components of the individual's response to psychophysiological challenges or adversity such as ANS activation, thoughts, emotions or behavior.⁷ Working to improve self-regulatory strategies is thought to improve health and wellbeing in diverse conditions such as: irritable bowel syndrome, neurodegenerative conditions, chronic pain, anxiety, depression and post-traumatic stress disorder (PTSD).⁸

This chapter will focus on the regulation of the ANS and its concomitant effects for physical, psychological and behavioral health. Regulation of the ANS involves balancing activation of the SNS and PNS such that the person can meet challenges and return to a state of homeostasis for healing, growth and restoration.⁹ Resilience is significant to the discussion of regulation, as it signifies a timely response to challenges such that the individual's physical and psychological resources are conserved.¹⁰ Resilience includes a unified response to stress that includes regulation of psychophysiological and biobehavioral components.¹¹ It is thought that ANS dysregulation plays a part in compromised resilience.¹² Additionally, compromised resilience has been linked to diminished management of chronic pain.¹³

ANS dysregulation and pain

Before we move into a more detailed discussion of the ANS, it is helpful to look at the clinical picture of the relationship between chronic pain and ANS dysregulation. Here are some current understandings.

- Autonomic dysregulation can mean: excessive *or* insufficient sympathetic *or* parasympathetic dominance—meaning any state of relative imbalance, especially if prolonged.
- Imbalance between the SNS and PNS is considered to play a role in chronic pain conditions as it represents a dysregulated system with loss of adaptive function.¹⁴
 - There are possible associations between ANS dysregulation and nervous system sensitization.¹⁵
 - ANS dysregulation has been associated with pain intensity.¹⁶
- Chronic pain conditions such as fibromyalgia, rheumatoid arthritis, headache and irritable bowel syndrome include various expressions of autonomic dysregulation.
 - Fibromyalgia patients have demonstrated persistent ANS hyperactivity at rest and hyperactivity during stress.¹⁷

Autonomic dysregulation in chronic pain may be a part of the pathogenesis, a biomarker or a combination of the two.¹⁸ It may be that chronic pain is the stressor leading to ANS dysregulation and diminished resilience or that ANS dysregulation itself contributes to the development of chronic pain through diminished resilience (see Figure 6.1).¹⁹ Yet as shown in this diagram, the interactions are complex and bidirectional.

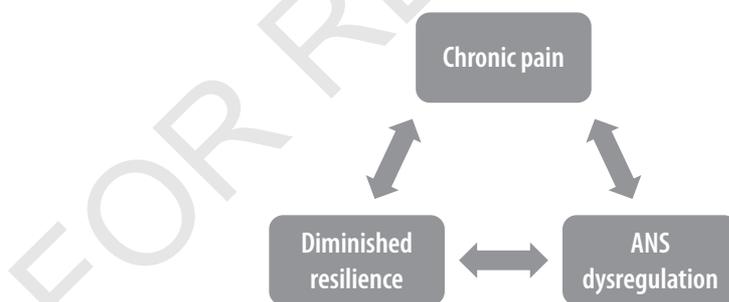


Figure 6.1 Cyclical relationships between pain, autonomic nervous system, resilience

Connectivity and interdependency between nociceptive, visceral and autonomic input

There are many places within the nervous system structures where nociceptive, visceral and ANS input converge and may interact for the modulation, integration and response to inner and outer stimuli. In addition, it is suggested that a central network may assist in the unified autonomic, affective, motor and behavioral

response to nociceptive, visceral and ANS input.²⁰ Places of convergence and possible interactions include:²¹

- spinal and trigeminal horns
- brainstem
- hypothalamus
- amygdala
- thalamus
- insular cortex.

The vagus: an important link in pain?

The role of the vagus nerve as both a link between and way to affect change in the body, mind and behavior is not new. The writing of pioneers such as Darwin, Bernard, Cannon, James and Pert represent an evolution in thought and science that has viewed the vagus nerve as an important pathway in understanding the larger neurophysiological connectivity between physiology, psychology and behavior.

Some important considerations about the vagus and pain include the following.

- The vagus nerve carries sensory (afferent) and motor (efferent) fibers for both visceral and somatic tissues.
 - Approximately 80 percent of vagal fibers are sensory and are responsible for carrying information about the internal bodily state to the brain.²² Information from the vagus nerve arrives at and is processed by the hypothalamus, the central structure responsible for regulating ANS activity—largely outside of conscious awareness. Due to bidirectional cortical communications with the thalamus (which is responsible for sensory integration, motor integration, arousal levels, pain modulation, emotion, memory and behavior) as well as with regions associated with self-referential processes (conscious awareness, pre-frontal cortices), portions of this afferent vagal information can be brought into the field of conscious attention—especially with training in body awareness.
 - Approximately 20 percent are motor and are responsible for transmitting the parasympathetic response of the heart, respiration, digestion and inflammation as well as somatic control of muscles related to hearing, voice control, swallowing and breath control.

- » The motor component stems from two brainstem nuclei—the dorsal motor nucleus (DMN) and the nucleus ambiguus (NA)—with two different functions, as will be discussed below in the “Framework for connecting physiology, emotion and behavior: polyvagal theory” section.
- Vagal afferents play a part in the facilitation or inhibition of nociceptive input as they converge with nociceptive input along the path of the spinal cord and brain structures.²³
- The vagus nerve may modulate and affect pain through projections sites to the insula, thalamus, amygdala and prefrontal cortex.²⁴
- The vagus nerve may also modulate and affect pain through anti-inflammatory and immune effects.²⁵
- The psychological impacts and interpretation of pain are a significant component of the pain experience. The vagus nerve has been shown to have influence on attention modulation and emotion regulation.²⁶
- Vagal nerve stimulation has demonstrated an anti-nociceptive effect via its influence on the nucleus tractus solitarius, locus coeruleus and raphe nuclei and their ability to activate descending inhibitory neurons in the spinal cord, and influence on neuropeptides such as GABA, serotonin and endorphins and their receptors.²⁷
- Greater vagal regulation of the heart—measured through heart rate variability as an index of parasympathetic control of the heart—has been shown to correlate with higher resilience to stress; differential activation in brain regions that regulate responses to threat appraisal; interoception (defined below); emotion and attention regulation; greater flexibility to respond to challenges.²⁸ Yoga practices for greater vagal regulation will be described later in the chapter. Other practices such as slow rhythmic/paced diaphragmatic breathing, humming, chanting and meditation have also been found to have an effect on enhancing vagal regulation or parasympathetic control of the heart.
- A close association has been found between lower vagal regulation and poor self-regulation; less behavioral flexibility; adverse health outcomes including increased mortality in diseases such as lupus, rheumatoid arthritis and trauma; chronic pain conditions such as fibromyalgia, musculoskeletal pain (including low back, neck, shoulder, pelvic), irritable bowel syndrome (IBS), headaches and rheumatoid arthritis.²⁹

The unique make-up of the vagus

The vagus nerve serves as a structural and functional bidirectional channel of communication between the viscera and the brain. This visceral awareness influences and is vital to the expression of emotions as well as for the concept of intuition. Along with the above-mentioned convergences with other neural processes, such as nociception, the vagus can be conceptualized as a vital link in the interdependence between body-wide physiology, emotions and behavior.³⁰

The concept of interoception is significant to understanding the role of the vagus in regulation, resilience and the experience of pain. As mentioned above, the majority of the fibers comprising the vagus nerve are sensory. Therefore, the vagus is responsible for the transmission of much of the interoceptive input that is received by the brain from the body.

Interoception includes: the process of conveying information from the viscera; the receiving and integration by brain structures and connections; the pathways that enact a response by the human system; the emotional and cognitive perceptions of the individual.³¹ This process of receiving, interpreting and responding to information—including bodily sensation, emotions and thoughts—can help us to clarify and refine our understanding of the relationship between sensation, emotion and autonomic state.³² As a person becomes more accurate in sensing, interpreting and processing bodily and affective states, the greater their adaptability, capacity for self-regulation and resilience in restoring a state of homeostatic balance.³³

With such an extensive and multifaceted capacity, the vagus is well situated to assist in the broad goal of regulation and resilience of the system, including in pain states.³⁴ Influencing the underlying autonomic neural state of the individual through vagally mediated pathways may contribute to altering the individual's experience of and response to physical and emotional stimuli including both nociception and the pain experience itself.

Framework for connecting physiology, emotion and behavior: polyvagal theory

The vagus nerve, as a conduit for both interoception and the formation of an integrated motor response, is central to polyvagal theory (PVT).³⁵ PVT describes the connections between physiological state, processes of the mind and behavioral attributes emerging from the establishment of underlying ANS platforms.³⁶ As a result, the capacity to shift physiological state, including ANS “platforms” (which is a simplified construct for core ANS circuits and relative patterns of activation) enables the accessibility and emergence of different psychological and behavioral attributes.³⁷

Neuroception, described as the subconscious detection of safety or danger in the environment, influences underlying ANS platforms with its concomitant and integrated effect on physiological, psychological and behavioral states.³⁸ Interoception can be seen as part of the process of neuroception as it takes into account information from the viscera. This detection of safety or danger in the internal and external environment is important in the pain experience, as it affects physiological response—including homeostatic processes influencing self-regulation and resilience—as well as healthy, adaptive psychological and behavioral responses to inner and outer stimuli.

PVT moves beyond a bimodal construct of the ANS with the PNS and SNS. PVT describes three distinct “neural platforms” and five global states arising from their co-mingling and co-activation with integrated physiological, emotional and behavioral characteristics.³⁹ These neural platforms are hierarchically activated in response to perceived threat or safety in the environment and are named for their characteristic behaviors.

The experience of pain is inherently based on the psychobiological construct of threat, fear or danger and the organism’s drive for safety and survival. PVT presents a theoretical view of these behavioral drives that can aid understanding pain as an adaptive, protective defense mechanism. The addition of yogic theory assists in moving beyond the necessary reduction of the complexity of pain to any one neural structure, while still underscoring the importance of these biological substrates.

Three neural platforms and five global states

1. Social communication/the ventral vagal complex (VVC)

This neural platform includes the vagus nerve, along with the motor components of the glossopharyngeal nerve, spinal accessory nerve, trigeminal nerve and facial nerve. This integrated network slows the heart to a resting state and controls the muscles of the head, face, middle ear, pharynx and bronchi.

This neural platform is named social communication, as it connects visceral state, facial expressivity, receptive and expressive domains of communication and mechanisms for monitoring external and internal conditions. It is theorized to be associated with optimum functioning in the presence of the detection of safety where prosocial behaviors and positive psychological states fostering human connection and engagement, such as compassion and love, are suggested to be more likely to emerge. In addition, this state of optimal functioning may provide a stronger physiological foundation for a flexible and adaptive response to stress, including regulation and resilience of the system.⁴⁰

2. Defensive mobilization/sympathetic nervous system (SNS)

This neural platform is the aforementioned SNS, “fight or flight” response. When the VVC fails to detect safety in the environment and/or threat is perceived, mobilization of this protective system is initiated. This sets the stage for responding to real or perceived danger in the environment and toward the goals of safety and survival.

The emotional and behavioral attributes most likely to emerge from this neural platform are related to fear, anger or anxiety as the person orients to real or perceived threat in the environment—such as the experience of pain.

3. Defensive immobilization/dorsal vagal complex (DVC)

This neural platform represents the component of the vagus nerve responsible for a dramatic slowing and inhibition of the systems to the least amount necessary for survival. This pattern of activation is proposed to arise from the detection of immense danger or terror and, while adaptive like the SNS, may be considered the most primitive or passive response to stress.

The emotional and behavioral attributes associated with this neural platform include a spectrum of immobilization, shutdown or disembodied and dissociative states including death-feigning, collapse, “freeze” and loss of consciousness.

4. Safe mobilization/co-activation of VVC and SNS

This state is proposed to arise from the co-activation of the VVC and the SNS. It is termed safe mobilization, as it is present in circumstances such as play, dance, exercise and creative thinking. The VVC creates a foundation of safety, while the SNS mobilizes the body’s resources for healthy and desirable demands.

The emotional and behavioral attributes associated with this co-activation include those of creativity and activity where the system is mobilized while maintaining positive emotional and prosocial states. This safe mobilization is important in fostering regulation and resilience. Yoga practices that utilize active postures while promoting calm states, experiences of connection and calm breath are an example of this state.

5. Safe immobilization

This state is proposed to arise from the co-activation of the DVC and VVC. It is termed safe immobilization, as it is present in circumstances such as childbirth, conception and nursing where the VVC promotes a foundation of safety while the DVC generates a safe immobilization of the system. It has been shown that the

same circuits may be co-opted for different purposes in the presence of different neurotransmitters, for example oxytocin in this example, versus vasopressin in an adaptive freeze response to threat.⁴¹

In response to perceived threat or safety in the environment, one of these neural platforms is activated with its concomitant and connected physiological, emotional and behavioral attributes.⁴²

When safety is perceived, a unified state of physiological restoration may be fostered. Positive emotions such as peace or calm and behaviors of connection and compassion are made more accessible or likely to emerge. When the defense strategy of the SNS is activated, an integrated physiological, emotional and behavioral strategy for the mobilization of resources to respond to demand emerges. When the defensive immobilization strategy of the DVC is implemented, the combined physiological, emotional and behavioral strategies for active responses are inhibited.⁴³

Understanding how the underlying neural platforms relate to and are a part of concurrent physiological, emotional and behavioral characteristics—and the influence of vagal regulation on these processes—offers a novel approach to exploring both the contributors and possible interventions for pain conditions. Through learning to identify and shift autonomic states we may be able to affect an underlying component of pain as has been proposed in conditions such as IBS or fibromyalgia.⁴⁴

Yoga and regulation of the ANS

A growing body of research supports yoga practices for autonomic regulation, positive influence on ventral vagal nerve activity, interoceptivity and positive psychological and behavioral states. These findings include yoga's effect on the following.

- ANS regulation has been demonstrated as a result of yoga with various populations—including individuals experiencing pain. This has been measured through heart rate variability as an index of increased PNS activation on the heart.⁴⁵
- Improvement in interoception—including the construct of body awareness.⁴⁶
- Improved psychological resilience, and self-concept, and lessening of dysfunctional coping mechanisms.⁴⁷
- Combined effects that benefit attention, affect and ANS regulation.⁴⁸
- Emergence of attributes such as compassion and eudaimonic wellbeing.⁴⁹

Theoretical mechanisms describe yoga as a comprehensive framework that includes both top-down (neurocognitive-focused) and bottom-up (somatic-focused) practices that cultivate self-regulation and resilience for physiological and psychological health and wellbeing.⁵⁰

Philosophical context of yoga for ANS regulation and resilience

The Self is the source of abiding joy.

Taittiriya Upanishad

To understand the application of yoga for ANS regulation and resilience, it is essential to look at the philosophical perspective and worldview that forms its context. Yoga teaches the realization of awareness from which the individual experiences attributes such as tranquility, unwavering connection and equanimity. The person in pain can discover an aspect of their experience whereby they encounter the rising and falling of bodily sensation, thoughts, emotions, beliefs and worldly stimuli without overly identifying with them.

The recognition of an underlying abiding equanimity amidst the fluctuating stimuli of the body, mind and world can create a broadening of the field of attention and a larger context for the experience of, and reaction to, sensation. Learning to shift attention and focus to the various sensations that are present in any moment and are concurrent with the experience of pain may help the individual in the alleviation of their suffering.

The systematic methodology of yoga practices orients the person toward this realization of awareness with its concomitant equanimity. Thus, it is important that yoga practices are undertaken within the whole of this cohesive and synergistic framework that they arose from.

Vital to this realization is the discrimination between those aspects of experience that are constantly changing from those that are unchanging and immutable. A methodology of inquiry is taught to differentiate these concepts of the changing from the unchanging. Prakriti is the term that encompasses all malleable and fluctuating components of the body, mind and environment. Purusha represents an aspect of the unchanging experience of awareness through which unwavering equanimity arises. Purusha may be conceptualized as the “Observer of the observed,” the Self or source of being and consciousness itself. An essential step of the yogic process is this differentiation between prakriti—that which is constantly changing—and purusha—that which is constant and unchanging.

To understand prakriti, and separate it from purusha, three substrates known as gunas are defined that combine and work together to create the various manifestations of body, mind and world. These are termed sattva, rajas and

tamas, and each is responsible for the emergence of physiological, psychological and behavioral attributes as follows.

- **Sattva:** Clarity, illumination, calmness.
- **Rajas:** Activity, mobilization, agitation.
- **Tamas:** Form, stability, inertia.

Everything that is prakriti is comprised of these gunas in varying proportions, including each individual's body and ego (personality, psychological content, "self"). As such, the person can step back and inquire into any stimuli of the body, mind or world to explore the gunas of which it is comprised. This determination of sattva, rajas and tamas assists in the understanding of the aspects of experience that are impermanent—prakriti—from those that are unchanging—purusha.

When the gunas are in balance, healthy body and mind states are supported. Sattva provides vitality, health, contentment and ease; rajas provides enthusiasm, motivation and mobilization of systemic processes such as digestion; tamas provides stillness, stability, focus and strength.

Rajas and tamas are taught as the most likely potential sources that obstruct one from the realization of awareness and the concomitant unwavering equanimity. Rajas when unbalanced by the other gunas underlies and promotes states of activation such as fear, anxiety and anger. Tamas when unbalanced underlies and promotes states of delusion, obscuration, numbness, depression and fatigue. Sattva can also manifest in unbalanced forms as unhealthy detachment and avoidance and "addicts one to joy" (*Bhagavad Gita* 14.9).⁵¹

EXPERIMENT: JOURNAL AND MEDITATION

Sitting or lying down, take a few moments to settle in and bring your attention to the breath. Create an intention—visual image, word, affirmation—that brings a sense of safety or calm.

Then bring your attention to a bodily sensation, thought, emotion or life situation—something that you want to inquire into or are working with.

As you bring your attention to this—notice any bodily sensations, thoughts, emotions, beliefs, awareness of relationship with others or life in general that emerge. Notice if you can bring your attention here and still stay connected to the intention of safety or calm.

Begin to look at and tease apart the aspects of your experience in the body, mind, relationship to others or life that are made up of the qualities of:

- **sattva:** clarity, calm, illuminating

- **rajas:** activity, activation, agitation
- **tamas:** stability, obscurity, fatigue.

What aspects of bodily sensations, thoughts, emotions, beliefs or relationships are clear and calm; agitated or activated; stable, dull or fatigued?

Notice how these three qualities of experience of the gunas rise and fall—fluctuate—from moment to moment. Also notice the potential to experience an underlying or overarching abiding and steadfast equanimity that can simultaneously observe, allow and experience.

The importance of sattva and of mastering the gunas

Sattva is emphasized at the beginning of a practitioner's practice as it offers a glimpse into the experience of what arises from realization of awareness. This is of particular importance to working with the person experiencing pain. Offering an experience of equanimity, tranquility, peace, ease or connection alongside the experience of pain has the potential to shift and broaden the individual's perspective and to create a different relationship to sensation. These sattvic experiences are key to helping people in pain find renewed capability and inspiration for wellbeing.

While sattva is a positive experience, it is still a guna and part of prakriti, which will inherently change—it is a fleeting occurrence. As such, yoga teaches that beyond sattva is a steadfast joy and unwavering equanimity that comes from being firmly established in awareness. This realization of awareness enables the person to experience the rise and fall of the gunas and the shifting phenomena of the body, mind and world and stay connected to a sense of peace within. It is this understanding that enables access to equanimity within the pain experience.

as the mountainous depths of the ocean are unmoved when waters rush into it, so the man unmoved when desires enter him attains a peace that eludes the man of many desires... (Bhagavad Gita 2.70)⁵²

In the *Bhagavad Gita*, Krishna explains that the person who “transcends” the gunas finds a capacity for unwavering equanimity without preference for any guna (14.21). Being situated in the recognition of awareness, the person is able to watch the movement of the gunas without becoming overwhelmed or misidentified with them. The person finds the capacity to be content amidst the variable and opposite realms of experience such as suffering/joy; blame/praise; honor/disgrace (14.22–27).

It is this equanimity beyond the gunas that creates a resilience to life. Being able to watch the gunas without becoming them enables the person to remain

at peace and develop a healthy relationship to the ever-changing stimuli of the body, mind and world.

This is of particular importance in working with pain. As one aspect of pain self-management, the person in pain learns to find access to equanimity through *sattva* and then to remain firmly established in that peace or ease alongside their pain. From this vantage point, the person can inquire into how to change their relationship to pain and to the physical sensations, emotions, thoughts and circumstances that co-mingle and contribute to the experience of pain. The person becomes able to explore the *gunas* that underlie the experience of pain and to experience the myriad fluctuations of body, mind and world while connected to equanimity.

Relationship of the *gunas* and neural platforms

Both PVT and yoga provide a framework from which to understand the connection of physiological, emotional and behavioral processes. Through affecting these underlying neural platforms (PVT) or *gunas* (yoga), there is potential for unified shifts within the interconnected domains of physiology, emotion and behavior. For the person experiencing pain, yoga serves as a guide for exploring the connectivity and relationships between physiological states, the physical and social environment, emotions, cognitions and behavior—while simultaneously teaching powerful tools for regulation and resilience.

The *gunas* and neural platforms can be conceptualized to share certain attributes. As such, it is suggested that the *gunas* and neural platforms can influence the accessibility, likelihood and/or activation of one another. When a *guna* predominates (such as *sattva*), certain neural platforms are likely to become activated (social communication–VVC). Likewise, when a neural platform is activated (social communication–VVC), certain *gunas* may become predominant (*sattva*). While this explanation is reduced as a way to break the concepts apart, in reality the relationship between the *gunas* and neural platforms as synchronous and parallel processes is likely more accurate.

This relationship is further described as follows:

1. Social communication/sattva guna

The behavioral and emotional attributes that are described as emergent from this neural platform and *guna* include: connection; steadfast peace, happiness or joy; compassion; equanimity; contentment.

2. Safe mobilization (SNS and VVC)/ rajas in balance with sattva and tamas

Just as the SNS provides a mobilizing and activating force within the container of the VVC for play and creativity, raja guna promotes activity and excitement within a base of sattva for clarity and tamas for stability. These co-activated states (of neural platforms and/or gunas) allow the person to experience the mobilization needed for creativity and right action within a container of clarity and stability. In other words, rather than the SNS or rajas overwhelming and creating disturbance to the system, they are positive, motivating forces for change, action and creativity.

3. Defensive mobilization (SNS predominance)/raja predominance

The description of what emerges from this neural platform and guna includes fear, anxiety, or anger as the person orients toward safety and responds to real or perceived threat or danger. This neural platform, or guna, provides a continuum of mobilization from well-adapted responses to threat in the environment to maladaptive reactions—such as ANS dysregulatory states of SNS predominance with its adverse effects on the systems of the body.

4. Safe immobilization (VVC and DVC)/ tamas in balance with rajas and sattva

Just as when the VVC and DVC co-activate, there is the emergence of bonding and intimacy—tamas guna promotes stability and stillness within a container of mobilization of body and mind resources (rajas) and insight (sattva). This integration of tamas with the other gunas enables the discipline needed to notice habitual patterns that contribute to the pain experience, as well as the focused work needed for change. In addition, the container of the VVC can ensure that tamas or DVC does not overwhelm the system into dissociative states or shutdown.

5. Defensive immobilization (DVC)/tamas predominance

The description of what emerges from this neural platform and guna includes delusion, inertia, obscurity and fatigue. While this can be a well-adapted response to extreme threat, it can also become maladaptive when it overwhelms the system or is maintained for prolonged times. In a recent theory paper, Kolacz and Porges looked at the plausibility of this neural platform held over time as a contributor to chronic disease states such as IBS and fibromyalgia.⁵³

With these shared emergent attributes, it is plausible that by cultivating one (neural platform or guna), the other becomes more accessible or apparent. Sattva predominance would help enable VVC activation and VVC activation would enable sattva predominance.

As such, yoga practices can be oriented to influence the gunas and their neurophysiological correlates as conceptualized in relationship to the PVT platforms. Moreover, yoga teaches the capacity to experience the continuously shifting platforms and gunas while continuing to connect to unwavering equanimity through the realization of awareness. This construct has implications for influencing the mind-body relationship to the pain experience.

Yoga model for regulation and resilience in pain management

A paper that we recently published presented this theoretical convergence of the gunas with PVT to demonstrate yoga as a model for regulation and resilience.⁵⁴ This theory can similarly be understood and applied to helping manage or mitigate the experience of pain with emphasis on the following.

- Importance of helping to downregulate the SNS by facilitating sattva guna and the VVC neural platform. This may help strengthen the capacity for the person to discover calm, restorative states of the body and mind.
- Facilitating capacity to move between neural platforms and guna states, as well as fostering the ability to return to sattva and the VVC. This can assist learning to shift from distressing states within the pain experience toward states of ease more readily. Through repeated practice of accessing sattva or VVC, the client is empowered in their ability to relax their body and find calm states of mind.
- Widening the range of safe mobilization and safe immobilization by increasing the accessibility to sattva guna and VVC neural platforms amidst the experience of pain. This can facilitate a capacity to experience both pain and equanimity simultaneously. By becoming situated in sattva and VVC, clarity and insight into habitual ways of responding to body, mind and worldly stimuli that perpetuate pain may be discovered. For example, the person may discover chronic tensions, ways of holding their postures, reactions to bodily sensations, thoughts or emotions that contribute to their pain. This insight may empower the client to create healthier and more adaptive responses to physical sensations, thoughts, beliefs and life situations such that pain is alleviated or lessened. Resilience of the system is built as the person is able to more adeptly respond to stimuli and return to states of physical and mental restoration.

- Working with the idea of “transcending” the gunas and the impermanent and continuously shifting neural platforms whereby a foundation of unwavering equanimity emerges. Ultimately, this can enable the client to reduce identification with the embodied experience of pain, see it as both a teacher and a catalyst for transformation and thus cultivate a greater sense of stability, purpose or meaning. The person learns to nonjudgmentally observe and experience the gunas and neural platforms while connected to this equanimity. What emerges is a different way to be in relationship with pain itself and the very phenomena of life which may perpetuate pain. Over time, it also becomes possible for the client to shift the interpretation of sensations such that the perception of pain changes and the person is able to maintain equanimity within a pain experience.

Practices of yoga

The practice of yoga provides both a lens through which we can explore pain and its interconnections with neural platforms and gunas, and a process through which to influence neural platforms, gunas and pain.

This reciprocal relationship through which gunas and neural platforms affect one another offers a lens through which yoga therapy practices can help to regulate systemic and integrated physiological systems, facilitate resilience and change the experience of pain. When yoga is practiced as a comprehensive system—movement, breathing, meditation, ethical principles—it combines both top-down (neurocognitive-focused) and bottom-up (somatic-focused) processes through yama/niyama, pranayama, asana and meditation.⁵⁵ When practiced as this cohesive system, yoga can be oriented toward the influencing of gunas and neural platforms for concurrent effect on physiological, psychological and behavioral health and wellbeing.

It is important in this perspective that yoga practices are not broken apart where asana is performed for “musculoskeletal imbalance,” pranayama for “ANS downregulation” or meditation for “attention or focus.” Rather, the practices are combined to optimize the relationships within the gunas and neural platform, such as strengthening the VVC and sattva guna while also creating a stronger therapeutic container to work with the spectrum of rajas/tamas and SNS/DVC. The result is a potential for healthier navigation of mind-body states which may contribute to pain and thus the possible alleviation or mitigation of pain.

These core practices of yoga will be described separately to help illuminate their effect on neural platforms and gunas. Despite this descriptive separation, they are best viewed, implemented and experienced as part of a unified approach to lifestyle as opposed to being discrete from each other.

Yama and niyama

Yama and niyama serve as ethical intention setting through which the practitioner can begin to investigate how to strengthen sattva and the VVC. Using attributes such as non-harming or contentment, the person can investigate how their emotions, actions and behaviors either build or diminish sattva and VVC states.

These ethical intentions can be used to facilitate mind-body awareness and build sattvic or VVC experiences to create a foundation of ease, peace, safety, connection or restoration. In addition, these qualities can be utilized to change the relationship to other neural platforms or gunas that are part of the pain experience. The person learns to bring the experience of contentment, patience or non-harming to that of fear, pain, anxiety or depression. The potential to both notice the stimuli that activate these other gunas and neural platforms with their physiological, psychological, behavioral attributes and change the relationship to such stimuli can be learned.

The yamas and niyamas are key to this exploration of the habits of body, mind and behavior that perpetuate pain. The person learns to refocus attention to engage with the natural dynamism of life through a different perspective. This practice of deep listening, thoughtful sharing and enacting compassion for self and other in relationship is seen as supportive of VVC-related prosocial processes including cultivation of resiliency.⁵⁶ Ultimately, the person becomes able to experience rajas/tamas and SNS/DVC while simultaneously working with the intentions to experience sattva/VVC and/or the equanimity of awareness.

Asana and pranayama

Pranayama such as alternate nostril breath or elongated exhales have been found to activate the PNS, facilitating VVC control of the heart.⁵⁷ This downregulation of the ANS promotes VVC/sattvic foundations as well as helping to widen the range of safe mobilization to safe immobilization.

Asana, including restorative practices or gentle flowing sequences, may also help to downregulate the ANS. The person in pain can work with a yoga therapist to find the unique postures or movements that build VVC and sattva.

Asana and pranayama can help the person cultivate sattva/VVC states, as well as building facility with moving in and out of these neural platforms and guna states by changing postures or breath patterns. The yoga mat serves as a “laboratory.” For example, certain postures may facilitate learning to activate SNS/rajas while simultaneous use of the breath and yama/niyama balances that activation through accessing VVC/sattva. Such experiential learning enables the client to “train” the system unique to their patterns and needs, including capacity to be present to a wider spectrum of rajas/tamas or SNS/DVC, while still maintaining sattva/VVC; ultimately, the experience of abiding equanimity within.

Meditation

Meditation practices include additional ways to support regulation and resilience of the system and change the relationship to pain. Awareness-building practices, affirmations, mantras, chanting for vocal toning and the exercise of prosody, and visualizations may all be used to support states of calm, equanimity and eudaimonia amidst the pain experience. In addition, yoga helps with resiliency building for future pain, stress, demand or any imbalanced states that may arise through the simultaneous practices of experiencing challenging postures while maintaining breath control, intention and a meditative state.

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