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Review

Physicality of Spirituality: The Interplay of the Autonomic Nervous System, Prefrontal Cortex, and Spiritual Life in Light of Galatians 5:16-25

Rodrigo Alvaro Brandão Lopes-Martins [1, 2, *], Patrícia Sardinha Leonardo [2], Kevin Mannoia [3]

1. Hospital do Câncer de Muriaé, Fundação Cristiano Varella, Muriaé, MG, Brazil; E-Mail: rodrigo.martins@uniredentor.edu.br
2. Faculdade de Medicina UniRedentor, AFYAAvenida Presidente Dutra, nº 1155, Cidade Nova, Itaperuna, RJ 28300-000, Brazil; E-Mail: patricia.sardinha@uniredentor.edu.br
3. President, International Council for Higher Education and Former Dean of Theology, Azusa Pacific University, 901 E Alosta Ave, Azusa, CA, USA; E-Mail: kwmannoia@gmail.com

* **Correspondence:** Rodrigo Alvaro Brandão Lopes-Martins; E-Mail: rodrigo.martins@uniredentor.edu.br

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Abstract

This article examines the complex relationship between the autonomic nervous system, the prefrontal cortex, and spiritual life, providing an interdisciplinary analysis in light of Galatians 5:16-25. Through a combination of theological reflection and insights from neuroscience, it explores how spiritual practices, such as meditation and prayer, influence emotional regulation, impulse control, and overall well-being. Studies in neuroscience have shown that regular spiritual practice can lead to measurable changes in the brain, such as increased cortical thickness in the prefrontal cortex, enhancing self-control and emotional resilience. Building on these scientific findings, the article introduces the concept of the "spirituality of physicality," which affirms the deep connection between bodily health and spiritual well-being. Drawing parallels between the regulation of the sympathetic and parasympathetic nervous systems and the struggle between the flesh and the Spirit described by Paul, the

article suggests that spiritual growth and physiological health are intricately linked. It highlights how cultivating a balanced spiritual life influences both the body and mind, promoting virtues such as self-control, patience, and peace. The article concludes by emphasizing the importance of further research on the connection between physical health and spiritual practices, offering a fresh perspective for theological and scientific communities. This holistic view challenges traditional dichotomies between body and spirit, presenting a vision of integrated human flourishing through the harmony of faith, neuroscience, and physiology.

Keywords
Autonomic nervous system; prefrontal cortex; spirituality; Galatians 5:16-25; physicality

1. Introduction

The human body is a complex and fascinating structure, composed of various interdependent systems that work harmoniously to maintain homeostasis. Among the many systems of the body, the autonomic nervous system (also known as the neurovegetative system) stands out for regulating vital functions involuntarily, such as heartbeats, respiration, and metabolism. This system is subdivided into two main branches: the sympathetic nervous system, responsible for stress and emergency responses ("fight or flight"), and the parasympathetic nervous system, which promotes relaxation and recovery ("rest and digest"). These two divisions, though opposites, cooperate to ensure the body's equilibrium in both routine and challenging situations [1].

In the spiritual realm, we find a similar concept in the biblical text of Galatians 5:16-25, where the apostle Paul contrasts the desires of the flesh with the fruits of the Spirit. In this passage, Paul presents the ongoing tension between the natural inclination of humans to act according to their carnal impulses and a life lived in obedience to the Holy Spirit, which produces virtues such as love, peace, patience, and self-control.

One of the most fascinating aspects of reflecting on the book of Galatians, written by the apostle Paul, is that it was composed nearly two millennia ago, in an era when modern biological, neurological, and scientific knowledge was scarce. Back then, there was no detailed understanding of the human body's functions, let alone the complex interaction between the autonomic nervous system and behavioral responses. Yet, the analogies presented by Paul in contrasting the desires of the flesh and the fruits of the Spirit reveal a wisdom that resonates deeply with modern discoveries about how the human brain and body operate.

This realization underscores the importance of reevaluating biblical texts through the lens of contemporary science. The spiritual dynamics described by the apostle Paul in Galatians resonate deeply with current understandings of neurobiology and human behavior. By exploring the analogy between the struggle of "flesh versus Spirit" and the balance between sympathetic and parasympathetic nervous systems, this article seeks to bridge theology and neuroscience in a coherent and interdisciplinary dialogue.

Recent findings in neuroscience suggest that both spiritual practices, such as meditation, contemplative prayer, and mindfulness, and physical exercise contribute to long-term neuroplastic

changes. These include structural modifications in the prefrontal cortex, increased connectivity in the default mode network, and enhanced regulation of the limbic system. For instance, studies using neuroimaging techniques [2, 3] have demonstrated that regular engagement in such practices leads to measurable improvements in cognitive flexibility, emotional regulation, and sustained attention. These findings strengthen the analogy proposed in this article, reinforcing that the physiological mechanisms underlying self-regulation mirror the spiritual process described by Paul in Galatians 5:16-25.

This article aims to establish a parallel between the functioning of the autonomic nervous system and the spiritual conflict described in Galatians, suggesting that just as the sympathetic and parasympathetic nervous systems regulate bodily responses, the Holy Spirit aids in balancing human desires and emotions, promoting spiritual harmony.

2. Methods

This article adopts a theoretical and interdisciplinary approach, combining elements of neuroscience, theology, and psychology. The methodology is based on an integrative literature review and conceptual analysis, aimed at drawing parallels between neurophysiological mechanisms and biblical-spiritual principles as outlined in Galatians 5:16-25. Peer-reviewed scientific studies and theological sources were selected to support a reflective framework that explores the interplay between spiritual life and physical processes. No primary data were collected, and the study does not involve human participants.

3. Theoretical Foundation

The autonomic nervous system is responsible for controlling various involuntary bodily functions, including the regulation of heart rate, digestion, blood flow, and respiration. It is divided into two main subdivisions: the sympathetic nervous system and the parasympathetic nervous system. The sympathetic system prepares the body for emergencies or stressful situations by activating the well-known "fight or flight" response, while the parasympathetic system acts oppositely, promoting recovery and maintaining bodily functions during moments of rest [4].

This constant interaction between the two systems reflects a dynamic balance that is essential for the organism's survival and health. The sympathetic system, for instance, increases heart rate and blood pressure in response to stressful situations. In contrast, the parasympathetic system works to slow down these processes, restoring the body to a state of calm. The Sympathetic Nervous System prepares the organism for situations of stress, anger, fear, and also sexual instincts related to reproduction and species perpetuation. In addition to increasing heart rate and strength, it induces bronchodilation to improve oxygen supply during moments of exertion, dilates pupils to allow more light to enter even in dim environments, and performs other actions. On the other hand, the parasympathetic nervous system exerts opposite functions, aimed at balancing the body and returning it to a basal state of calm and relaxation, thereby restoring the body's homeostasis. Essentially, these two divisions work together to maintain the organism's balance and functionality [4].

While often described as opposites, the sympathetic and parasympathetic nervous systems function in dynamic interplay. Most daily activities require both systems to cooperate in fine-tuning the body’s responses. For example, during a meal, the sympathetic system helps regulate alertness

and initial salivation, while the parasympathetic system governs digestion and nutrient absorption. Similarly, when preparing to speak in public, sympathetic activation may cause an increased heart rate and alertness, while parasympathetic modulation helps maintain composure and control of breathing. These real-life examples illustrate how emotional regulation—and, by extension, spiritual regulation—is rooted in the physiological cooperation of both systems, rather than one system suppressing the other.

In Eastern culture, this balance is represented by the symbol of Yin and Yang. Yin and Yang are principles of Chinese philosophy, where yin and yang are two opposite and complementary energies. Yin represents darkness, symbolized by the black-painted side, while yang symbolizes brightness. Light, which is a luminous energy, manifests intensely in yang, while weak light is associated with yin.

In the spiritual context, the passage from Galatians 5:16-25 presents a similar scenario of tension between two opposing forces: the flesh and the Spirit. The "flesh" represents human desires that lead to impulsive and destructive behaviors, such as hatred, envy, and a lack of emotional control. On the other hand, the "Spirit" symbolizes divine guidance, which leads the individual to live according to the fruits of the Spirit, such as love, patience, kindness, and self-control.

The apostle Paul describes the conflict between flesh and Spirit as a continuous struggle for the human soul, where the flesh seeks immediate gratification. At the same time, the Spirit calls the believer to resist temptations and cultivate virtues that reflect God's nature. Just as the autonomic nervous system regulates and maintains physical balance, the Holy Spirit works to balance spiritual life, promoting virtues that lead to inner peace and harmony.

3.1 Cultural and Social Influences on Autonomic and Spiritual Regulation

Emotional and physiological regulation is not shaped solely by biology, but is deeply influenced by cultural, social, and educational factors. In modern society, habits such as excessive screen time, instant gratification, and high consumption of processed foods create an environment of chronic sympathetic stimulation. Technology-driven urgency and overstimulation can dysregulate the autonomic balance, leading to stress-related disorders and emotional exhaustion.

Similarly, cultural models of success and productivity often promote reactive, impulsive behavior, reinforcing sympathetic dominance while neglecting reflective and restorative practices. These patterns mirror the spiritual struggles described in Galatians, where “the flesh” seeks immediate gratification, while “the Spirit” calls for restraint and inner peace.

Religious traditions, particularly Christianity, have long employed spiritual disciplines—such as fasting, prayer, silence, and contemplation—not only as spiritual tools but as practices that promote physiological balance. These disciplines cultivate parasympathetic activation, emotional regulation, and neuroplasticity, reinforcing the integration of spiritual and biological self-regulation.

4. Practical Everyday Examples and Primitive Instincts

In the contemporary world, marketing professionals and the media frequently leverage our primitive instincts to capture and hold our attention. For instance, neuromarketing leverages responses to survival, fear, and sexual attraction to influence consumer behavior. Advertising campaigns create a sense of urgency and scarcity with phrases like "limited-time offer," activating

survival instincts and prompting automatic action responses. Moreover, the use of physically attractive individuals in commercials triggers sexual instincts, fueling attention and consumer desire.

In news broadcasts, the emphasis on tragic and violent events triggers the sympathetic nervous system, activating emotional reactions such as fear and heightened alertness. This manipulation of attention, by focusing on events that appeal to our survival instincts, demonstrates how the media, whether consciously or unconsciously, can exploit our primitive reactions to maintain viewership.

These practical examples illustrate how, in daily life, we often react impulsively to stimuli that tap into our basic instincts, while rational and spiritual control can help moderate these responses.

5. The Role of the Prefrontal Cortex in Behavior Regulation

While the autonomic nervous system is responsible for instinctive and primitive responses, such as fear, aggression, and sexual impulses, the prefrontal cortex plays a role in the conscious regulation of these reactions. This brain region, situated at the front of the cerebral lobe, is responsible for higher cognitive functions, including planning, decision-making, impulse control, and social behavior. In other words, the prefrontal cortex acts as a "brake" that allows an individual to assess the consequences of their actions and choose more rational and appropriate responses. This capacity for control and moderation can be seen as analogous to the role of the Holy Spirit in the Christian's spiritual life, as described in Galatians 5:16-25. The apostle Paul speaks of "walking in the Spirit" as a way to resist the desires of the flesh, which can be likened to the instinctive reactions controlled by the sympathetic nervous system. Just as the prefrontal cortex regulates instinctive impulses of the nervous system, the Holy Spirit guides believers to moderate their carnal desires and cultivate the fruits of the Spirit, such as self-control, patience, and peace.

Just as the prefrontal cortex regulates instinctive impulses of the nervous system, the Holy Spirit guides believers to moderate their carnal desires and cultivate the fruits of the Spirit, such as self-control, patience, and peace. This physiological-spiritual interplay is visually summarized in Figure 1, which illustrates the progression from sympathetic-driven impulses to conscious modulation and, ultimately, to spiritual transformation as described in Galatians 5:16-25.

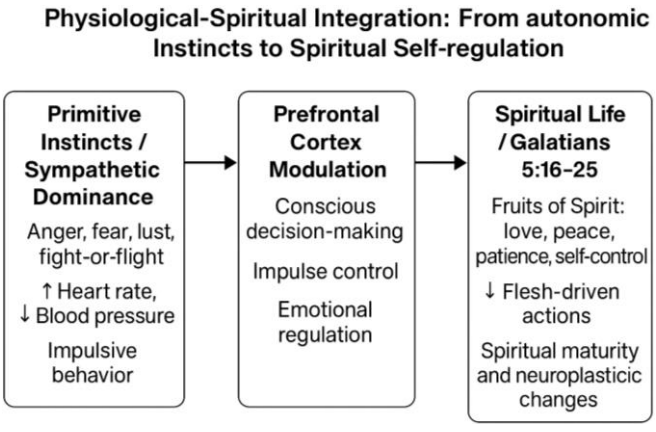

Figure 1 Conceptual diagram illustrating the physiological and spiritual progression from autonomic instincts to spiritual self-regulation. The left block represents primitive sympathetic responses (e.g., anger, fear, and impulsivity), which are modulated by the prefrontal cortex through conscious regulation and impulse control. This process

culminates in the development of spiritual maturity, as described in Galatians 5:16-25, characterized by the manifestation of the fruits of the Spirit and neuroplastic changes.

In addition to its role in executive control, the prefrontal cortex interacts closely with the limbic system, especially the amygdala and hippocampus, in modulating emotional responses. Spiritual practices such as contemplative prayer and meditation have been shown to activate these interconnected networks, promoting emotional balance and resilience [5, 6]. This interaction highlights how spiritual self-regulation is not purely cognitive, but also deeply emotional and embodied.

This relationship is central to the field of **neurotheology**, an emerging interdisciplinary approach that studies the neurological basis of religious and spiritual experiences. Neurotheology offers a framework for understanding how faith-based practices can lead to measurable changes in brain structure and function, particularly in regions associated with emotion, memory, empathy, and moral judgment. Integrating neurotheological perspectives strengthens the bridge between theology and neuroscience, reinforcing the article's proposal that spiritual formation engages both the brain and the soul in dynamic and reciprocal ways.

6. Expansion of the Spiritual Aspect: The Role of the Fruit of the Spirit

The fruit of the Spirit, as outlined by Paul in Galatians 5:22-23—love, peace, patience, self-control, among others—serve as spiritual counterparts to the instinctive responses governed by the autonomic nervous system. Notably, *self-control* functions as a bridge between primitive impulses and deliberate, regulated behavior. Just as the prefrontal cortex inhibits automatic reactions, the Holy Spirit empowers individuals to overcome flesh-driven tendencies and cultivate a virtuous life.

Peace and *patience* are particularly relevant when compared to the calming effects of the parasympathetic nervous system. While this system restores physiological balance after stress, the Holy Spirit fosters "spiritual homeostasis," enabling individuals to remain centered amid adversity. Patience, in this light, becomes a spiritual capacity to endure difficulty without yielding to emotional reactivity.

Thus, as the body requires balance between sympathetic and parasympathetic activity, the spiritual life demands a similar regulation between human instincts and Spirit-led responses. The fruit of the Spirit can be viewed as a form of *spiritual modulation*, shaping emotional and behavioral patterns toward harmony and flourishing.

7. Discussion

Neuroscientific research is increasingly supporting the idea that spiritual practices, such as prayer and meditation, influence brain function, particularly in areas related to emotional regulation and executive control. For instance, Lazar et al. [7] demonstrated that regular mindfulness meditation increases cortical thickness in the prefrontal cortex, an area responsible for impulse control and decision-making. These findings suggest that spiritual engagement can lead to measurable structural adaptations in the brain that enhance behavioral regulation.

Koenig et al. [8] also highlighted the role of spirituality in psychological resilience, showing that individuals with strong religious or spiritual involvement tend to cope better with stress. This effect

mirrors the modulatory functions of the prefrontal cortex, which tempers sympathetic nervous system responses during emotional or survival-based challenges.

Newberg et al. [6], using SPECT imaging in experienced Tibetan Buddhist meditators, found increased cerebral blood flow in the medial and orbital regions of the prefrontal cortex—areas involved in focus and emotional regulation. Simultaneously, the study observed reduced activity in the superior parietal lobe, aligning with subjective reports of transcendence and spatial detachment during deep meditative states. These physiological changes reinforce the association between spiritual experiences and altered states of consciousness.

In a complementary line, Kang et al. [2] found that meditation enhances both functional and structural neuroplasticity. Increased cortical thickness in the medial prefrontal cortex and related frontal areas correlates with improved attention and emotional regulation. In contrast, reductions in posterior cortical regions suggest a shift away from sensory reactivity toward reflective processing.

Gupta et al. [9] further compared the effects of spiritual practices and physical exercise on brain function. Spiritual practitioners exhibited enhanced connectivity in the left precuneus, which is linked to introspection and the default mode network. In contrast, those who exercised showed increased activation in regions associated with motor planning. Notably, the spiritual practice group demonstrated improved emotional regulation and increased perfusion in frontal regions, the frontal areas associated with executive function.

Together, these studies provide a scientific basis for the analogy drawn in this article: that spiritual practices not only transform inner life but also actively shape brain function. They support the idea that cultivating spiritual disciplines—like prayer, meditation, and worship—has tangible neurophysiological outcomes, reinforcing the parallel between biblical concepts of self-control and modern neuroscience's understanding of behavior modulation.

8. The Spirituality of Physicality: A Theological Perspective

The interconnection between physical embodiment and spiritual well-being is a concept often underappreciated in both theology and science. Historically, certain traditions—such as Gnosticism—have emphasized the separation of body and spirit, influencing modern thought to overlook the body's role in spiritual formation. However, this article affirms that the human body is not a mere vessel, but an active participant in spiritual life.

The notion of a *spirituality of physicality* invites us to understand how physiological processes—especially those involving the nervous system—interact with spiritual experience. Advances in neuroscience suggest that practices like prayer and meditation influence neuroplasticity, modulate the autonomic nervous system, and engage the prefrontal cortex. These changes are not just neurological, but also reflect spiritual transformation, supporting the idea that sanctification involves both the mind and body.

Paul's teachings in Galatians 5:16-25 resonate with this holistic view. The struggle between flesh and Spirit is not merely symbolic; it mirrors the physiological tension between sympathetic impulses and higher-order executive control. In this sense, walking in the Spirit involves not only moral choice but also the cultivation of neural pathways that sustain virtues like patience, self-control, and peace.

For the Church, this insight calls for a broader approach to spiritual formation—one that honors the body's role in shaping character and holiness. Spiritual practices should not be seen in isolation from physical health, but as a means of integrated transformation. By embracing this theological-

anthropological vision, we affirm that flourishing as a human being involves the alignment of biological integrity with spiritual maturity.

Beyond immediate physiological modulation, spiritual practices may contribute to long-term personal transformation that integrates biology and transcendence. Christian theology teaches that life in the Spirit not only produces virtues in this life but also prepares the believer for eternal life. From this perspective, practices such as prayer, worship, and fasting not only promote neuroplastic changes and emotional regulation but also embody a more profound spiritual reorientation toward divine purposes.

This concept resonates with the theological understanding of sanctification as an ongoing process that affects the whole person—mind, body, and soul. The neurobiological effects of spiritual disciplines may serve as tangible evidence of the internal renewal described in Romans 12:2 and 2 Corinthians 4:16. By uniting the language of neuroscience with the promise of spiritual immortality, we begin to glimpse how the transformation of the believer is not merely moral or behavioral, but incarnational and holistic—pointing toward a destiny that transcends the material.

This theological reflection opens fruitful avenues for future interdisciplinary research and invites a renewed understanding of sanctification as a process that is deeply embodied, spiritually guided, and physiologically supported.

9. Conclusion

This article has explored the interplay between the autonomic nervous system, the prefrontal cortex, and spiritual formation, offering a conceptual bridge between neuroscience and theology. By drawing parallels between the sympathetic-parasympathetic balance and Paul's contrast of flesh versus Spirit in Galatians 5:16-25, we have argued that spiritual development is both a physiological and theological process.

Scientific evidence supports the notion that spiritual practices, such as prayer and meditation, can impact brain structure and function, particularly by modulating emotional responses and enhancing self-regulation. These findings reinforce the biblical view that walking in the Spirit cultivates virtues such as self-control, patience, and peace.

The proposed concept of a *spirituality of physicality* affirms that human flourishing involves a harmonious integration of body, mind, and spirit. Rather than viewing the physical and spiritual as separate domains, this perspective invites an embodied understanding of sanctification—one in which the physiological self participates actively in spiritual transformation.

This integrative approach opens new pathways for dialogue between scientific and theological communities, encouraging further research into the embodied nature of faith and the neurobiological foundations of spiritual life.

10. Future Research Directions

As neuroscience continues to explore the physiological foundations of spiritual experience, several promising directions for future research emerge. One potential avenue involves the use of advanced neuroimaging technologies, such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), and electroencephalography (EEG), to examine how specific spiritual practices (e.g., individual prayer, collective worship, or fasting) affect brain activity in real

time. These methods could provide greater granularity in identifying the neural correlates of spiritual states such as peace, surrender, awe, or transcendence.

Another area worth exploring is the application of transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS) to study causal relationships between brain regions involved in morality, compassion, or impulse control and the lived experience of faith. Research may also investigate the long-term biological effects of sustained spiritual practice, including its impact on stress biomarkers, neuroendocrine function, inflammation, and epigenetic markers of resilience.

Ultimately, interdisciplinary collaborations among theologians, neuroscientists, psychologists, and ethicists could open up new paradigms for understanding human flourishing, not merely as a medical or behavioral outcome, but as a spiritually grounded and biologically integrated process.

11. Practical Applications and Spiritual Reflection

The integration of neuroscience and theology invites not only academic reflection but also practical application in daily life. Spiritual practices, such as contemplative prayer, meditation, fasting, and worship, can serve as intentional strategies for enhancing emotional regulation, resilience, and inner peace. These practices stimulate neurophysiological mechanisms associated with self-awareness, empathy, and stress reduction—benefits increasingly recognized in the fields of psychology and mental health.

For individuals struggling with anxiety, impulsivity, or emotional dysregulation, the cultivation of a disciplined spiritual life may offer complementary pathways for healing and flourishing. Faith-based communities can also play a significant role in promoting holistic health by creating spiritual environments that encourage a balance between the mind, body, and spirit.

In light of this, we invite readers—whether scholars, practitioners, or spiritual seekers—to reflect personally and communally on the implications of this integration. How might our spiritual disciplines be shaped by the knowledge that they also transform our brains and bodies? How can our communities support practices that promote not only doctrinal fidelity but also neurobiological well-being? The answers to these questions may help forge new paths for holistic discipleship and human flourishing.

Author Contributions

Rodrigo Alvaro Brandão Lopes-Martins: Conceptualization; Writing – Original Draft; Theological Integration; Neurophysiological Framework; Literature Review; Supervision. Patrícia Sardinha Leonardo: Methodology; Writing – Review & Editing; Scientific References Management; Theoretical Support in Neuroscience. Kevin Mannoia: Theological and Philosophical Review; Spiritual Contextualization; Writing – Review & Commentary; Critical Revision for Theological Accuracy.

Competing Interests

The authors have declared that no competing interests exist.

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