**Fight or Flight Theory and the Autonomic Nervous System**

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*“All models are wrong but some are useful.” - George Box, 1976*

The *fight-or-flight* response, first described by Walter Cannon (1915/1929), introduced a concise and intuitive framework for understanding physiological reactions to perceived threats, attacks, or survival challenges. Cannon’s theory was groundbreaking for its time, as it identified the body’s rapid mobilization of resources in response to danger. Key physiological changes associated with the fight-or-flight response include an increased heart rate and blood pressure to prepare for rapid action, enhanced adrenal gland activity to heighten alertness and energy levels, redistribution of blood flow to vital organs (e.g., the heart and lungs) to maximize physical performance, and temporary suppression of non-essential functions such as digestion. *[S*ee McCarty, 2016, for further discussion].

When the fight-or-flight response is activated, the brain prioritizes survival over higher cognitive functions. Activity in the prefrontal cortex – which governs abstract thinking, problem-solving, strategic planning, and social behavior – decreases, while the amygdala and brainstem assume control, promoting instinctive, reflexive responses. This neural activation pattern aligns with MacLean’s (1955) *limbic system* model, where primitive brain structures dominate under conditions of extreme stress, danger, and life threat. Consequently, decision-making becomes impaired, communication skills decline, and attentional focus narrows to immediate threats rather than long-term outcomes.

**The Autonomic Nervous System**

The fight-or-flight response is now widely recognized as being mediated by the *autonomic nervous system* (ANS), a term first defined by John Newport Langley (1898; 1921). Langley’s foundational work on the anatomical divisions of the ANS continues to shape our understanding of physiology and neurobiology today. Knowledge of the ANS has become increasingly relevant across various professional fields, including medicine, sports, counseling, wellness, and forensic applications such as credibility assessment (e.g., polygraph testing). *[See Handler and Honts (2007; 2008) for a more detailed discussion of the role of fight-or-flight theory, and the role of emotion, cognition, and behavioral conditioning during polygraph testing.]*

Detailed knowledge of the nervous system is often traced back to Charles Sherrington (1906), whose work laid the foundation for modern neuroscience. [See Burke, 2007, and Levine, 2007, for further discussion of Sherrington’s contributions.] Sherrington is credited with advancing many key concepts in contemporary neuroscience (Levine, 2007), including the *neuron doctrine*, which established that neurons are individual cells rather than components of a single or continuous network as assumed in the older reticular theory. He also introduced the term *synapse* to describe neuronal connections and coined the term *proprioception* to refer to the body's ability to sense position, movement, and tension.

Sherrington’s research on *spinal reflexes* – the simplest form of neural activity – led to the understanding of the *reflex arc* (i.e., receptor, afferent neuron, integration center, efferent neuron, effector). His work contributed to our understanding of how complex behaviors emerge, demonstrating that the nervous system strengthens neural connections (synapses) through experience and repetition. These processes, mediated by short-term and long-term potentiation, serve as the basis for learning and memory formation.

The ANS governs involuntary bodily functions and consists of three major components. The *sympathetic nervous system* (S/ANS) activates the body’s fight-or-flight response, increasing heart rate, dilating pupils, and releasing stress hormones to prepare for action. The *parasympathetic nervous system* (PS/ANS) balances and regulates autonomic activity, facilitates rest, slows the heart rate, and stimulates digestion to promote relaxation and energy conservation. The *enteric nervous system* (E/ANS) regulates gastrointestinal function and operates semi-independently, though it interacts with both the S/ANS and PS/ANS. Despite its importance, the E/ANS is often overlooked in simplified discussions of the ANS. [For more in-depth information on the ANS and the nervous system, readers may consult standard textbooks such as Fink (2010, 2016), Kandel et al. (2013), and Purves et al. (2018).]

Together, these systems maintain physiological stability by constantly monitoring internal and external conditions and adjusting responses to maintain homeostasis. Whereas homeostasis refers to the maintenance of an optimal balance or setpoint, changes in physiology in response to continuously changing circumstances, with or without a known or optimal setpoint, are referred to as *allostasis*. *[See Handler et al. (2008) for discussion homeostasis and allostasis in the practical context of polygraph testing.]* This continuous regulation ensures survival, adaptation, and overall well-being.

**Immobilization (Freezing or Fainting)**

Cannon (1915/1929) laid the foundation for later research in stress physiology and psychology, including the study of on the nervous, endocrine, and immune systems. Although the fight-or-flight response provided a simple and intuitive framework, it was soon recognized as an incomplete explanation of how humans respond and adapt to stress, danger, and life-threatening situations. In extreme conditions, humans and other mammals – as well as other vertebrates – may exhibit immobilization behaviors, commonly referred to today as freezing or fainting. While Cannon may not have explicitly used these terms in the way they are understood today, descriptions of this response can be found in early literature.

*Immobilization* is a more descriptive term than the traditional “freeze” metaphor, as it encompasses a range of behavioral and physiological responses. At a mild level, this response may involve holding still, hiding, or moving slowly. In contrast to the fight-or-flight theory, which involves an active response and a reduction of higher cortical functions, immobilization may sometimes involve increased cognition, via attention and vigilance, through a *behavioral inhibition system* (BIS) – involving both the S/ANS and PS/ANS – which regulates choice prior to action <>(Gray, 1976; 1982; Gray & McNaughton, 2000). Gray (1987) differentiates fear and anxiety. Fear activates the sympathetic nervous system (S/ANS) and leads to immediate action through the fight-or-flight response. Anxiety, in contrast, activates the Behavioral Inhibition System (BIS), resulting in inhibition, vigilance, appraisal, and risk assessment in response to goal conflict situations where both the fight-or-flight response and the Behavioral Approach System (BAS) – also referred to as the Behavioral Activation System in Gray’s earlier work – are simultaneously engaged. *[See Handler and Honts (2008) for an introductory discussion of the BIS and other concepts in the applied context of polygraph testing.]*

More extreme manifestations of the immobilization response include a state of physiological and psychological shutdown, marked by a sharp decrease in metabolic activity, heart rate, and muscle tone (regulated by the *cerebellum*). In mammals, particularly humans, where the cerebral cortex has high energy demands, reduced cerebral perfusion can lead to temporary loss of consciousness. Alternatively, the immobilization response can result in a sudden, fear-driven inability to think or act effectively, where the individual remains conscious and experiences sensations of terror. Understanding immobilization responses has been particularly important in clinical work with trauma survivors, many of whom experience shame or stigma when they perceive their inability to fight or flee during a traumatic event as a failure to respond appropriately.

*Vasovagal syncope* (VVS) – commonly referred to as *fainting – i*s medical term for stress-induced temporary loss of consciousness. VVS, sometimes referred to more simply as *syncope*, can be triggered by a range of factors, including sudden postural changes, cardiac abnormalities, neurological conditions (such as seizures), hyperventilation, and extreme emotional stress. VVS is linked to vagus nerve activity (the 10th cranial nerve), which extends from the brainstem through the neck, thorax, and abdomen (Kenny & Bordoni, 2022). This paired nerve plays an important role in parasympathetic regulation, influencing heart rate, digestion, respiration, and other autonomic functions (Benditt *et al.*, 1998; Dietz, Joyner & Shepherd, 1997; Fedorowski *et al.*, 2023; Jeanmonod *et al.*, 2023; van Lieshout *et al.*, 1991; Wieling *et al.*, 2016). Although the vagus nerve includes efferent (motor) fibers that carry regulatory information from the CNS to the organs, a majority of the vagus nerve consists of afferent fibers that permit the visceral organs to inform the CNS of their activity and state.

VVS is often understood as a reflex arc involving two phases. In the first phase, a triggering event causes a sudden increase in cardiac stroke volume, leading to insufficient venous return to the atria. Simultaneously, afferent signals from the heart travel to the CNS, producing sensory and cognitive experiences. In the second phase, the vagus nerve and PS/ANS send efferent signals that dramatically slow the heart rate while S/ANS activity is suppressed. This results in vascular relaxation (vasodilation), further reducing venous return to the heart and causing a drop in blood pressure. If cerebral perfusion drops too low, the individual loses consciousness. Although VVS is generally not dangerous, it can lead to injury if fainting occurs while standing, driving, or operating heavy machinery.

Some individuals may experience autonomic dysregulation – sometimes referred to as presyncope, or near-syncope – without a complete loss of consciousness (Kapoor, 2000). These episodes can occur when the PS/ANS overcorrects in response to S/ANS activation. Symptoms may include sweating, blurred or tunnel vision, dizziness, bradycardia, and vasodilation. Some individuals may also experience heart palpitations (slow, rapid, irregular, or forceful heartbeats) as the ANS attempts to regulate circulation before complete vasovagal collapse.

Immobilization responses can be understood as protective adaptations to extreme stress or life-threatening situations. While the fight-or-flight response is and active response driven by increased innervation by the S/ANS, fainting and other immobilization responses are passive defensive responses (Smith, 2006) that are now known to involve PS/ANS activation along with withdrawal of S/ANS innervation. Under normal conditions, the S/ANS and PS/ANS work in tandem to regulate physiological activity, dynamically adjusting to social and environmental demands to maintain homeostasis and function without necessitating a loss of consciousness.

**Fight, Flight or Freeze**

From both theoretical and practical perspectives, discussion of the ANS, the fight-or-flight response, or the S/ANS will be an incomplete discussion of human stress responses and human behavior unless some awareness and attention are given to the immobilization response and the PS/ANS. Although often taken literally, *fight* and *flight* are best understood as metaphors. Most individuals encounter stressors daily without physically fighting or fleeing. Instead, these terms describe autonomic changes related to activation and readiness, rather than predicting actual behavior in most situations. These terms serve to describe the autonomic changes and states of activation and readiness, without portending that these behaviors actually occur in most situations. Some situations do, undoubtedly, escalate to violence, or to a need to rapidly escape violence, though most do not. Nonetheless, metaphors can remain useful only as long as they are recognized as such, and are not taken literally.

Similarly, the *freeze* response is also metaphorical. Unlike actual freezing, which involves a reduction in temperature and kinetic energy in a substance, this term refers to a behavioral and physiological state rather than a literal physical process. Although *freeze* is less likely to be misinterpreted than fight-or-flight, discussions involving this term often lack clarity regarding the range of behavioral expressions and underlying neurobiological mechanisms.

Incorporating both the fight-or-flight and freeze responses expands the discussion from a narrow focus on the S/ANS to a more comprehensive understanding of how the ANS functions in stress regulation, homeostasis and the allostatic changes in physiological activity that serve to maintain homeostasis. [*For more information on the relationship between homeostasis and allostasis readers are referred to Schulkin (2003), Sterling (2004), and Sterling and Eyer (1988). For a discussion of the practical application of these concepts in polygraph testing see Handler et al. (2008).]<>*

**Rest and Digest - Parasympathetic Regulation of Autonomic State**

When the body is not engaged in a fight-or-flight reaction, and the S/ANS is not actively dominating the regulation of autonomic state and behavior, a range of vital functions related to rest, physiological repair, and growth take place. These processes are governed by the PS/ANS and are collectively referred to as the *rest-and-digest* response. This system counterbalances the S/ANS, regulating physiological functions that support recovery, energy conservation, and homeostasis. Whereas the fight-or-flight response prepares the body for immediate action and survival, the rest-and-digest response helps mitigate the physiological wear and tear of chronic stress, reducing the risk of stress-related degeneration and disease.

The rest-and-digest system becomes dominant during states of safety and relaxation, facilitating the normal functioning of essential bodily processes. For example, the PS/ANS slows heart rate, stimulates the salivary glands to aid digestion, and increases intestinal activity to optimize the absorption and assimilation of nutrients. It also signals various organs to initiate restorative processes, which are essential for energy conservation and tissue repair, particularly following periods of elevated stress.

Unlike the fight-or-flight response, which has been explicitly attributed to Walter Cannon (1915/1929), the rest-and-digest metaphor does not have a single known origin but has evolved over time through the collective understanding of PS/ANS function. It has become a widely used concept for describing the role of the PS/ANS role in restorative processes, and for illustrating its importance in maintaining long-term homeostasis – the stable and balanced state of physiological systems, which is essential for survival, adaptation, and overall well-being.

Beyond its physiological role, the rest-and-digest response plays a fundamental role in many behavioral and emotional aspects of human life, including emotional regulation, social engagement, and attachment. When PS/ANS activity is dominant, individuals are more likely to exhibit calm and cooperative behaviors, engage in effective communication, and maintain strong social bonds. Higher-order cognitive functions, such as planning, abstraction, and complex problem-solving, are also enhanced during relaxed autonomic states. Furthermore, PS/ANS activity fosters empathy and compassion, both of which are essential for social connection and cooperation. The PS/ANS is also involved in sexual arousal and preparatory functions related to reproductive activities, leading some medical professionals to humorously refer to it as the *feeding and breeding* system. This nickname illustrates the role of the PS/ANS beyond stress regulation.

**Tend and Befriend**

Shelley Taylor and colleagues (Taylor *et al.*, 2000) introduced the *tend-and-befriend* model as an evolutionary adaptation of the traditional fight-or-flight response to stress. According to this model, in addition to fighting, fleeing, or freezing, humans have evolved to engage in caregiving behaviors (tending) and to seek social support (befriending) as an adaptive way to cope with stress and danger. More broadly, this function of the autonomic nervous system (ANS) can be understood as part of a *social engagement system*.

The social engagement response is primarily associated with the PS/ANS and is influenced by hormones such as oxytocin, which promote friendship, social bonding, and attachment. This highlights the role of social connection and attachment in managing both routine stress and immediate danger. It also underscores the innate human need for social bonds and affiliative relationships as an essential coping mechanism. During everyday stress, seeking social support and engaging in prosocial behaviors helps with emotional regulation and enhances overall well-being. In threatening situations, the tend-and-befriend model suggests that turning to social networks for protection and assistance is an adaptive response rooted in evolutionary history.

The social engagement response also provides insight into the range of behavioral reactions to trauma and abuse. In situations where maintaining social bonds or avoiding conflict is necessary for safety, individuals may adopt appeasing or people-pleasing behaviors as a protective strategy. This response, sometimes referred to as *fawning* (credited to Walker, 2003; 2014), involves submissive behaviors intended to reduce conflict or avoid harm. Common fawning behaviors include difficulty setting boundaries, fear of rejection, low self-esteem, conflict avoidance, and disconnection from authentic self. Fawning behaviors can emerge in childhood or adulthood and are thought to be learned through social conditioning. This pattern is often more noticeable in childhood, where individuals may appease caregivers to avoid retaliation for protesting mistreatment or abuse. Over time, fawning can become an ingrained response, reinforcing compliance and conflict avoidance as survival strategies.

**Limitations of the Fight-or-Flight Theory**

Although the fight-or-flight theory remains an important foundation for understanding human stress responses, it fails to fully represent the complexity of ANS. The metaphorical language it employs can sometimes obscure scientific understanding, particularly when taken literally. This model underemphasizes the role of cortical activity, neglects social dynamics, and oversimplifies immobilization and trauma responses. Despite these limitations, discussions about stress responses often remain centered on the fight-or-flight paradigm and the S/ANS, leading to an underrepresentation of the parasympathetic nervous system (PS/ANS) in responses to stress, danger, and life-threatening situations.

Recognition of the immobilization responses has expanded our understanding of stress and danger reactions. Whereas fighting and fleeing are well-established S/ANS-mediated responses, immobilization is a PS/ANS function. Attempting to condense these distinct responses into a single response system, such as the FFF model, oversimplifies the interplay of the CNS with the ANS and social behavior. This reductionist approach fails to account for the full range of stress responses observed in both short-term and long-term survival scenarios.

Alternative frameworks, such as rest-and-digest, tend-and-befriend, or feed-and-breed, emphasize the role of the PS/ANS in stress regulation. While these models offer important insights, they fail to fully capture the complexity of ANS responses. Additionally, they have had limited success in advancing practical discussions on neurobiological and social responses to stress, danger, and life-threatening situations. Developing a more comprehensive framework requires acknowledging the omnipresence of stress in human life and appreciating the intricate interplay between the ANS, CNS, and social behavior in both immediate and long-term survival contexts.

Since the introduction of the fight-or-flight theory, our understanding of the ANS – including the roles of the S/ANS and PS/ANS, as well as the regulatory functions of the *hypothalamus*, the *hypothalamic-pituitary axis*, and the *endocrine system* – has advanced considerably. These interconnected systems regulate a broad spectrum of physiological and behavioral functions that extend far beyond the S/ANS responses to stress and danger. Human stress responses often involve affiliation, friendship, cognitive, communicative, and socially coordinated strategic reactions to threats – all of which are overlooked by simplistic models such as fight-or-flight or fight-flight-freeze. Additionally, higher cognitive and psychological processes, including planning, abstraction, strategizing, self-monitoring, and metacognition – all CNS functions – can actively downregulate the ANS and S/ANS activity, while promoting PS/ANS states in stressful and dangerous situations.

**Summary and Conclusion**

Over the past century, our understanding of the ANS, and the nervous system as a whole, has evolved substantially, building upon foundational work by pioneers like Charles Sherrington (1906). The *fight-or-flight* response, introduced by Walter Cannon (1915/1929), has been instrumental in shaping both discussion and research on stress, physiology, and the ANS. Although it has provided a foundational platform for psychophysiological research, clinical applications, and the development of a substantial knowledge base on the ANS and social behavior, this model remains incomplete. A primary limitation of the fight-or-flight model is its predominant focus on the S/ANS, potentially leading to potential misconceptions that immobilization responses are attributable to S/ANS activation. The expanded *fight-flight-freeze* model reminds us that regulation of both autonomic state and behavior is necessarily a dynamic process involving both the S/ANS and the PS/ANS.

Over time, researchers and practitioners have further expanded the fight-flight-freeze model to include additional ANS-mediated stress responses such as tend-and-befriend, and rest-and-digest. These additions highlight the complexity of the ANS and the important role of the PS/ANS, alongside the S/ANS, in regulating a range of social behaviors in addition to their role stress, survival, and recovery processes. When considering the broader regulatory functions of the ANS – including gastrointestinal activity, social engagement, and reproductive processes, all of which are reduced during periods of intense stress – a more comprehensive model may be conceptualized as the 6F (FFFFFF) response system, including fighting, fleeing, freezing, feeding, fostering social bonds (friendship), and procreation.

A deeper understanding of stress and survival responses requires moving beyond oversimplified metaphors like fight-or-flight. The inclusion of vasovagal syncope (fainting), restorative and growth processes (rest-and-digest), appeasement behaviors (fawning), and social engagement responses (tend-and-befriend) underscores the intricate interplay between the S/ANS, PS/ANS, and E/ANS in human and mammalian stress responses. A more comprehensive framework for understanding the ANS should move beyond metaphorical labels and instead integrate the full spectrum of neurological, physiological, cognitive, and social/behavioral responses that contribute to both immediate survival and long-term well-being. In the near future, the fight-flight-or-freeze model will likely persist as a widely used metaphor for understanding the dynamic interactions of the S/ANS and PS/ANS in response to stress, danger, and life-threatening situations.

Future research should continue to explore the role of higher-order brain structures, particularly the prefrontal cortex, in regulating behavior and modulating ANS responses to stress and danger. Research should also continue to explore the BIS and BAS, along with the septo-hippocampal system – which plays a role in behavioral inhibition in the context of uncertainty, risk and potential punishment. Top-down regulation of autonomic state facilitates strategic decision-making, cognitive flexibility, and social adaptation in response to stress and danger – processes largely absent from early fight-or-flight models. Understanding these mechanisms is essential for advancing our understanding of human resilience and developing more comprehensive frameworks that integrate neurobiological, cognitive, and social mechanisms that promote both immediate survival and long-term well-being in world that will likely always present stressors and challenges.

**References**

Benditt, D. G., Fabian, W., Iskos, D., & Lurie, K. G. (1997). Review article: heart rate and blood pressure control in vasovagal syncope. *Journal of interventional cardiac electrophysiology : an international journal of arrhythmias and pacing, 2(1),* 25-32.

Burke, R. E. (2007). Sir Charles Sherrington’sThe integrative action of the nervous system: a centenary appreciation. *Brain, 130,* 887-894.

Cannon, W. B. (1915/1929). *Bodily Changes in Pain, Hunger, Fear and Rage: An Account of Recent Researches Into the Function of Emotional Excitement.* New York: D. Appleton and Company.

Dietz, N. M., Joyner, M. J., & Shepherd, J. T. (1997). Vasovagal syncope and skeletal muscle vasodilatation: the continuing conundrum. *Pacing and clinical electrophysiology, PACE, 20(3 Pt 2),* 775-780.

Fedorowski, A., Kulakowski, P., Brignole, M., de Lange, F. J., Kenny, R. A., Moya, A., Rivasi, G., Sheldon, R., Van Dijk, G., Sutton, R., & Deharo, J. C. (2023). Twenty-five years of research on syncope, *EP Europace, 25(80).*

Fink, G. (2016). *Stress: Concepts, Cognition, Emotion, and Behavior.* Academic Press.

Fink, G. (2010). *Stress Science: Neuroendocrinology.* Academic Press.

Gray, J. A. (1976). *The behavioral inhibition system: a possible substrate for anxiety.* In M.P. Feldman & A.M. Broadhurst (Eds.). *Theoretical and Experimental Basis of Behavior Modification.* London: Wiley, 3-41.

Gray, J. A. (1982). *The Neuropsychology of Anxiety: An Enquiry into the Functions of the Septo-Hippocampal System.* Oxford University Press.

Gray, J. A. (1987). *The Psychology of Fear and Stress, 2nd edition,* Cambridge: Cambridge Press.

Gray, J. A., & McNaughton, N. (2000). *The Neuropsychology of Anxiety: An Enquiry into the Functions of the Septo-Hippocampal System.* Oxford University Press.

Handler, M. D., & Honts, C. R. (2007) Psychophysiological mechanisms in deception detection: a theoretical overview. *Polygraph, 36(4)*, 221-232.

Handler, M., & Honts, C. (2008) You can run, but you can't hide: a critical look at the fight or flight response in psychophysiological detection of deception. *European Polygraph, 2*, 193-207.

Handler, M., Rovner, L., & Nelson, R. (2008) The concept of allostasis in polygraph testing. *Polygraph, 37(3),* 228-233.

Jeanmonod, R., Sahni, D., & Silberman, M. (2023). Vasovagal Episode. In *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing. Retrieved July 17, 2023, from <https://www.ncbi.nlm.nih.gov/books/NBK470277/>

Kandel, E. R., Schwartz, J. H., Jessell, T. M., Siegelbaum, S. A., & Hudspeth, A. J. (2013). *Principles of Neural Science (5th ed.).* McGraw-Hill.

Kapoor, W. N. (2000). Syncope. *The New England Journal of Medicine, 343(25)*, 1856–1862.

Kenny, B. J., & Bordoni, B. (2022). Neuroanatomy, cranial nerve 10 (vagus nerve). In *StatPearls* [Internet]*.* Treasure Island (FL): StatPearls Publishing. Retrieved July 17, 2023 from <https://www.ncbi.nlm.nih.gov/books/NBK537171/>

Langley, J. N. (1898). On the union of cranial autonomic (visceral) fibers with the nerve cells of the superior cervical ganglion. *The Journal of Physiology, 23(3),* 240-270.

Langley, J. N. (1921). *The Autonomic Nervous System, Part 1.* Cambridge : W. Heffer & Sons, Ltd.

Levine D. N. (2007). Sherrington's “The Integrative action of the nervous system”: a centennial appraisal. *Journal of the neurological sciences, 253(1-2)*, 1-6*.*

Maclean, P. D. (1955). The limbic system ("visceral brain") and emotional behavior. *Archives of Neurology and Psychiatry, 73,* 130-134.

McCarty, R. (2016). The fight-or-flight response: a cornerstone of stress research. In: G. Fink (Ed.) *Stress: Concepts, Cognition, Emotion, and Behavior.* Academic Press.

Purves, D., Augustine, G. J., Fitzpatrick, D., Hall, W. C., Lamantia, A., Mooney, R. D., Platt, M. L., White, L. E. (2018). *Neuroscience. (6th Ed*.). Sinauer Associates.

Sherrington, C. S. (1906). *The Integrative Action of the Nervous System.* Yale University Press.

Smith, E. N. (2006) *Passive Fear: Alternative to Fight or Flight.* New York: iUniverse Inc.

Schulkin, J. (2003). *Rethinking Homeostasis, Allostatic Regulation in Physiology.* Cambridge, MA: The MIT Press.

Sterling, P. (2004). Principles of allostasis: optimal design, predictive regulation, pathophysiology and rational therapeutics. In Schulkin, J. (Eds.). *Allostasis, Homeostasis, and the Costs of Adaptation.* Cambridge, MA: Cambridge University Press.

Sterling, P., and Eyer, J. (1988). Allostasis: a new paradigm to explain arousal pathology. In: Fisher, S., Reason, J. (Eds.) *Handbook of Life Stress, Cognition and Health.* New York, NY: J. Wiley and Sons.

Taylor, S. E., Klein, L. C., Lewis, B. P., Gruenewald, T. L., Gurung, R. A. R., & Updegraff, J. A. (2000). Biobehavioral responses to stress in females: Tend-and-befriend, not fight-or-flight. *Psychological Review, 107(3),* 411–429.

van Lieshout, J. J., Wieling, W., Karemaker, J. M., & Eckberg, D. L. (1991). The vasovagal response. *Clinical Science, 81(5)*, 575–586.

Walker, P. (2003). *Codependency, Trauma and the Fawn Response.* Pete Walker, MA, MFT.

Walker, P. (2014). *Complex PTSD: From Surviving to Thriving.* [Author]

Wieling, W., Jardine, D. L., de Lange, F. J., Brignole, M., Nielsen, H. B., Stewart, J., & Sutton, R. (2016). Cardiac output and vasodilation in the vasovagal response: An analysis of the classic papers. *Heart Rhythm, 13(3),* 798–805.