Defensive freezing and the evolutionary origins of human meditation

David S. Black, Ph.D.[1] & Phil Reed, D.Phil.[2]

[1]University of Southern California, Keck School of Medicine, Los Angeles, CA, USA

[2]Swansea University, School of Psychology, Singleton Park, Wales, UK

Corresponding author: David Black, Department of Population and Public Health Sciences, Keck School of Medicine, University of Southern California, Los Angeles, CA, USA; email: davidbla@usc.edu

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Abstract

The biological origins of meditation in humans remain underexplored, despite extensive scholarship on its cultural history and health effects. We present a theoretical account that traces the origins of meditation to evolutionarily conserved mechanisms of defensive freezing. We propose that this ancient survival response—characterized by motoric immobility, reduced overt reactivity, heightened vigilance, narrowed attentional focus, and bradycardia—provided a behavioral and physiological substrate upon which operant reinforcement and social learning could act. Over evolutionary time, these response components may have been co-opted and selectively reinforced within early human social environments, giving rise to complex, structured behavioral repertoires resembling modern sitting and slow-movement meditative practices embedded within various cultural systems of teaching. Rather than viewing meditation as a purely spiritual orpsychological   cultural innovation intentionally designed to alleviate suffering, we suggest it represents a culturally refined expression of an ancestral survival strategy, maintained and elaborated through reinforcement, mimicry, and verbal practices. In this view, meditation's modern influence on human stress response is not incidental but reflects its evolutionary inheritance from survival-driven physiological states,now transformed through cultural canalization into a deliberate practice of self-regulation with anticipated therapeutic benefits.

Keywords: Meditation, evolutionary biology, adaptive selection, stress response, defensive freezing, theory, framework

Introduction

The modern practice termed *meditation* appears to be either unique to humans or far more elaborated and commonly practiced in humans than in other species although the ways in which it is enacted vary considerably across cultural traditions (Bhatnagar & Sood, 2021)). The term commonly refers to religious or cultural practices involving sustained attention, concentration, and contemplative awareness deriving from the Latin *contemplationem* ("the act of looking at")) and Old French ("religious musing"). In contemporary Western therapeutic settings, meditation practices are also used as a self-regulatory technique to support wellbeing and alleviate suffering.. Thus, meditation encompasses cultural psychological, and scientific domains. Yet, despite extensive historical and empirical scholarship in these domains less is known about how mediation emerged as a widespread human practice, and what biological precursors may have contributed to it origin.

The major religious traditions associated with meditation appear to have arisen relatively recently in human history: approximately 3,500 to 5,000 years before present (BP) for Hindu traditions (Neale, 2023), around 2,000 BP for Buddhist traditions (Roerich, 1971; Wynne, 2007), and roughly 1,700 BP for Christian contemplative practices (Johnson, 2010) variants. However, mediation-like responses almost certainly predate these formalized religious and cultural systems (O'Laughlin, 2018; Rossano, 2007). Rossano (2007) suggests that the earliest precursors to meditation may extend to the late Palaeolithic era (i.e., 150,000 to 200,000 BP), when conscious-altering rituals, often structured around fire as an orienting stimulus,, may have supported the development of behavioral self-control, sustained attention to focal objects or bodily sensations, and introspective awareness.Such accounts imply that cultural meditation practices were layered onto more ancient forms of attentional and behavioral regulation.

Narratives within many traditions describe original founders who, facing personal suffering or existential concern, engaged in intentional reflection on consciousness itself and ethical conduct, seeking novel ways of being that reduced harm to self and others (e.g., Roerich, 1971; Wynne, 2007). At the same time, meditation engages complex neural and endocrine circuits (Bhatnagar & Sood, 2021; Newberg & Iversen, 2003), many of which are conserved across species (Jurjewicz, 2017; Roelofs, 2017), suggesting that behaviors sharing core features with meditation may be grounded in ancestral adaptive responses found throughout the animal kingdom. Although some authors have speculated about meditation-like stillness in other social species, such as bees (Moore & Kosut, 2014), the deep evolutionary divergence between insects and humans makes such similarities more likely examples of convergent behavioral evolution than of homology. What these observations do suggest; however, is that the underlying substrates for meditation may have roots in much older organismic response systems shaped in deep evolutionary time

Given that meditation is uniquely elaborated and culturally codified in humans, an account is needed to explain how human behavioral repertoires diverged from those of other species.. One possibility is that meditation originated from "first-instance" responses—basic, evolutionarily conserved behavioral and physiological patterns shared across species but selectively shaped in early human environments. Such responses may have been repurposes, extended, and socially reinforced in ways that ultimately contributed to human cognitive development (Bruner, 2024; Bruner & Colom, 2022; Rossano, 2007). Form this view, meditation would not represent a completely novel behavioral category, but rather a culturally elaboarted form of a pre-existing response repertoire.

The neuropsychology of meditation has been examined extensively, , and several reviews documentits behavioral and physiological correlates (Afonso et al., 2020; Bhatnagar & Sood, 2021; Jurjewicz, 2017; Lenfesty & Morgan, 2019; Newberg & Iversen, 2003; Roelofs, 2017; Rossano, 2007). These correlates suggest that meditation may recruit evolutionarily older brain systems. Behaviorally, meditation involves enhanced attenional orienting and reduced peripheral physiological arousal (Holzel et al., 2011; Mather & Thayer, 2018; Petrocchi & Cheli, 2019). Neurologically, meditation engages regions of the default mode network (medial prefrontal cortex, posterior cingulate cortex, angular gyrus), associated with self-referential processing, and the salience network(anterior insula, dorsal anterior cingulate cortex), associated with monitoring salient internal and external cues(Sim et al., 2024; Treves et al., 2024). Notably, similar brain systems also participant in the primitive freeze-response—a preparatory, parasympathetically dominated state characterized by stillness, heightened vigilance, and attentional narrowing in the face of distant threat (Horn et al., 2014; Peters et al., 2016; Roelofs, 2017; Roelofs & Dayan, 2022). This correspondence suggests that freezing has deep evolutionary roots (Garfinkel and Critchley,2014)), although differences between freezing and meditation responses indicate that additional biological and socialcontingencies haveshaped this system over long periods of time.

Modern and ancient literatures describe meditation as a set of practices transmitted by verbal communities and reinforced by individuals in those communities who maintain both the practices and the language surrounding them (Wynne, 2007). The evolution of the neural circuitry associated with mediation from more basic physiological processes has been widely speculated upon (Bracha, 2004; Jurjewicz, 2017). It has been proposed that the development of meditation practices and rituals from basic physiological responses, mediated through cultural and verbal means, could support enhanced cognitive capacities viaa Baldwinian evolutionary effect, whereby genetic change follows recurrent, adaptive somatic changes (Rossano, 2007). On such accounts,individuals who displayed meditation-like behaviors might have have gained selective advantages. thereby creating new selection pressures.. Consistent with this possibility, meditation has been shown to produce changes to brain regions involved in attention and working memory (Bruner & Colom, 2022; Rossano, 2007). Over evolutionary time, induced neural changes mayhave become not only socially heritable through cultural practices and social instruction, but also partially canalized through gene-culture coevolution processes.Individuals whose possessed traits (e.g., the genes/physiology) favored meditation-like behavior may have been more likely to benefit from, and transmit such practices..

While these accounts offer valuable historical and physiological perspectives on meditation within verbal communities and document many of its attributes and effects for for individuals, they do not yet explain what might have served as the prerequisite response repertoire for the first of meditators. A biological theory of meditation—one that identifies plausible “first-instance” responses and traces how they could be shaped into the complex repertoires observed today-- could inform our understanding of both historical processes and modern uses. To develop a more complete scientific account, it may be helpful to speculate about the origins of meditation in terms of a common organism response, perhaps shared across species and rooted in evolutionary biology, while acknowledging the critical impact of culture and social mimicry on its maintenance. A novel framework would allow exploration of cross-species divergences from shared behavioral and neurological origins, and help further characterize the features of meditation observed in modern life.

Defensive freezing as an early response repertoire serving meditation

Meditation presents a theoretical challenge when tracing its origins in evolutionary terms, because it often appears to be a ‘nonresponse’ (in the sense of minimal overt action) to eliciting stimuli in the environment.. Nonetheless, a plausible candidate for a “first-instance” precursori to meditation is the defensive freezing response, which could have served as an ancestral response platform for later meditative practices in humans (Bracha, 2004; Rossano, 2007). Definesive freezing is widely discussed in accounts of the phylogeny of behavior (Bolles, 1970; Fanselow, 1994) and provides a well-characterized model of an evolutionarily conserved, adaptive response system.

The freezing response involves a coordinated set of systems that react to threat or novel challenge and and produce a state of immobility, hypervigilance, orienting of attention, non-reactivity, and parasympathetically dominated autonomic activity (Roelofs, 2017; Roelofs & Dayan, 2022). Rather than representing passive shutdown, this state is thought to facilitate improved assessment of the situation and more adaptive decision making and action preparation (Klaassen et al., 2021) (Gozzi et al., 2010). In this way the physiology of freezing creates conditions in which the organism comes into contact with a broader range of stimuli, and , and which subsequent actions can be brought under more appropriate control as demanded by the local environment. These These features bear functional similarity to several elements observed in cultural practices of meditation, such as immobility, sustained attention, and altered reactivity to environmental stimuli. (Jurjewicz, 2017).

Defensive freezinge satisfies several criteria for a plausible “first-instance” of the meditation. First, it is expressed across many species. Second, it constitutes a relatively distinct response class defined by characteristic postural, autonomic, and attentional changes that can be selected and modified by consequence, including social reactions made by conspecifics. Third, it I sassociated with a partially distinct set of physiological processes whose overlap with those in meditation is empirically testable. Finally, freezing is elicited under conditionsthat, in some respects, resemble circumstancesin which meditation may be useful such as situations of potential threat, uncertainty or conflict, thereby satisfying Staddon’s (1988) concerns about identifying the environmental conditions under which “first-instances” are emitted.. The uniqueness of mediation in humans may arise from t the development of language about subjective consciousness (including the use of nouns referring to the self as an experiencing agent) , which allows freezing-like states to be verbally labelled, recounted, and instructed to others in relevant social contexts(Roerich, 1971; Wynne, 2007).

TThreatening stimuli can evoke a cascade of defensive responses that vary across species and individuals (Bolles, 1970; Fanselow, 1994; Gozzi et al., 2010).There are five identified responses to threat, which, along with freezing, include: fight, flight, collapse, and attach (Rothschild, 2021), and the evolutionary origins of this response spectrum have been examined (Bracha, 2004). Defensive freezing itself is conserved across a wide range of vertebrate species, and in some invertebrates and is characterized by a state of reduced musculo-skeletal movement, hypervigilance, attention orienting and bradycardia in the presence of distant or ambiguous threat (Fanselow, 1994; Gozzi et al., 2010) (Blanchard et al., 2001; Bolles, 1970). In this sense, freezing arises in contexts where heightened situational awareness is advantageous—contexts that contexts that partially overlap with those in which meditation may be used to alter one's relation to perceived threat, even though meditation is not necessarily tied to immediate danger.

The freezing response depends on an interplay between prefrontal and limbic regions, the autonomic system's sympathetic and parasympathetic branches, and endocrine systems (Roelofs, 2017). This adaptive, unlearned response reduces detectability by predators (Lang & Davis, 2006), increases readiness for rapid action, and maintains a high-vigilance state optimized for selecting an appropriate defensive strategy (Roelofs & Dayan, 2022). Behaviorally, freezing involves inhibition of gross movement (often felt as stiffness or numbness in limbs and general heaviness), a tense body posture with increased muscle tone, and the organism also is hypervigilant to stimuli, and shows increased orienting, and heightened orienting to internal and external cues (Garfinkel & Critchley, 2014; Roelofs, 2017). Thus, increased muscle tone and hypervigilance, together with motor inhibition, set the organism prepared for subsequent action if needed (Klaassen et al., 2021; Roelofs, 2017). This response pattern distinguishes freezing from states of rest or tonic immobility associated with exhaustion or helplessness, such as when an organism is pinned by a predator.

Experimental work in humans has identified quantifiable indices of freezing.Reductions in body sway and heart rate have been observed in response to physical and social threats, including threatening faces (Roelofs & Dayan, 2022), and these objective measures correlate with subjective anxiety. (Blanchard et al., 2001; Roelofs et al., 2010) Gladwin et al. (2016), for example, interpret bradycardia and reduced body sway as markers of an active preparatory state rather than passive waiting, emphasizing that freezing is part of action preparation Crucially, because freezing is observable, it is also potentially modifiable by the social environment: other group members may respond to, reinforce, or punish specific patterns of freezing, thereby shaping both the response and its associated private events over time.

Neurologically, freezing is associated with increased activation in the anterior cingulate cortex, which supports attention, conflict monitoring, decision-making, and impulse control and in the insula, which participates in interoceptive awareness initiate and, via top-down feedback, ultimately constrain its own activity. Direct projections from the amygdala to parasympathetic pathways facilitate the emission of the freezing response (Garfinkel & Critchley, 2014). Projections to the ventrolateral periaqueductal grey in the brainstem mediate freezing by activating vagal pathways that increaseparasympathetic tone and reduce heart rate (Roelofs, 2017). During freezing, the force of cradiac contractions increases even as heart rate slows (bradycardia), supporting readiness for action. Projections to the dorsolateral periaqueductal grey help fight-or-flight responses, in part via cholinergic mechanisms (Gozzi et al., 2010; van der Zee et al., 1996), while connections to the rostral ventral medulla inhibit movement by modulating premotor neurons projecting to the spinal cord (Garfinkel & Critchley, 2014; Roelofs, 2017).

These regional activations occur within broader functional networks. Structures such as the medial prefrontal cortex, posterior cingulate cortex, and angular gyrus participate in the default mode network which is engaged in self- referential processing (Horn et al., 2014), which is engaged in self- referential processing, whereas the anterior insula anddorsal anterior form a core of the salience networ, which detects and prioritizes salient internal and external cuers (Peters et al., 2016). Both networks have been implicated in meditation(Sim et al., 2024; Treves et al., 2024), suggesting some overlap between the neural systems engaged during defensive freezing and those involved in meditation. However, the precise patterns of DMN and SN activation and connectivity differ across tasks and meditation styles, and the relationships between these networks during freezing remain an active area of investigation.

The hypothalamus-pituitary-adrenal (HPA) axis is also involved. Activation of this axis leads secretion of corticotrophin-releasing hormone (CRH), adrenocorticotropin hormone, and cortisol. CRH stimulates behavioral responses to threat, particularlywithin amygdala and related regions, thereby facilitating freezing (Gozzi et al., 2010). Cortisol, in turn, influences the functional coupling between limbic strcutures and prefrontal cortex (Veer et al., 2012), and can contribute to down-regulation of amygdla responses over time (van der Kolk, 1994). Similar modulatory patterns—such as changes in amygdala reactivity and HPA-axis activity—have been reported in some forms of meditation, including evidence that meditation can reduce cortisol levels in at-risk samples (Koncz et al., 2021) and alter amygdala activation (Treves et al., 2024). Taken together, these findings provide prima facie evidence that the freezing response has characteristics compatible with a potential “first-instance” repertoire from which meditation could have evolved.

, Garfinkel and Critchley (2014) note that note that the “fear matrix” engaged in freezing is also implicated in attentional orienting, mental planning, interoceptive mapping, bodily feeling, novelty detection, motivational learning, behavioral prioritization, and autonomic control. This breadth of function underscores how a system originally tuned for immediate survival could be co-opted for more abstract, self-regulatory purposes. To develop this suggestion further, however, it is necessary to examine freeze-related behaviors and mechanisms systematically in relation to the full range of meditation practices, and to clarify points of convergence and divergence at behavioral, physiological, and neural levels.
(e.g., Bhatnagar & Sood, 2021; Jurjewicz, 2017; Newberg & Iversen, 2003).
Neuroimaging and neurophysiological studies of meditation have expanded considerably since early work summarized by Newberg and Iversen (2003), with more recent reviews cataloguing   changes across corticol and subcortical systems (Bhatnagar & Sood, 2021; Jurjewicz, 2017; Roelofs, 2017; Afonso et al., 2020). Of particular interest, in the light of what is known about freezing, meditation and

mindfulness training has been associated with greater engagement of anterior cingulate cortex, insular cortex, and prefrontal regions involved in attention and self-regulation as well as reduced amygdala reactivity over time (Treves et al., 2024; Wheeler et al., 2017). As with freezing, meditation appears to involve dynamic interactions among brain regions that coordinate attention, interoception, and autonomic regulation.

At the network level, meditation is associated with increased connectivity within and between the 'default mode network' and the 'salience network' (Sim et al., 2024; Treves et al., 2024). The default mode network is typically more active during self-focused and internally-oriented mentation, whereas the salience network supports detection of salient cues as in vigilance. Both are relevant to freezing and meditation, though in different ways. In freezing, salience and self-relevant processing are engaged in the context of potential threat; in meditation, similar systems may be recruited under conditions of safety to modulate how internal and external stimuli are processed. Current evidence suggests that these networks do not show a single, uniform pattern of change across all meditation styles; instead, the direction and extent of DMN–SN modulation vary by practice type and analytic approach (Sim et al., 2024; Travis, 2020).

While there are several striking behavioral and neurological similarities between freezing and meditation, important differences also emerge. For example, For example, meditation is often associated with long-term decreases in amygdala reactivity and reductions in basal cortisol among at-risk individuals (Koncz et al., 2021; Treves et al., 2024; Wheeler et al., 2017), whereas acute freezing typically involves transient amygdala activation and HPA-axis engagement in response to threat (Gozzi et al., 2010). Potentially beneficial would be a mapping of physiological mechanisms, and neurological underpinnings involved in freezing and their presence (or not) in meditation. For example, the roles of the default and salience networks, as well as some behavioral responses are very similar (Peters et al., 2016; Roelofs, 2017; Roelofs & Dayan, 2022; Sim et al., 2004; Treves et al., 2024). However, the role of the amygdala (cf. Garfinkel & Critchley, 2014; Wheeler et al., 2017), and cortisol (cf. Gozzi et al., 2010; Koncz et al., 2021) appear to differ. These differences may provide critical clues about the selective pressures and cultural contingencies that transformed a defensive response into a deliberate practice of self-regulation.

Even if a clear parallel could be established between freezing and meditation, such similarities would not by themselves demonstrate similar functions as convergent nueral or behavioral patterns can arise from distinct selection histories.. Travis (2020), for example, notes that identified neural correlates of meditation depend heavily on how practices are defined and grouped, and (Sim et al., 2024) highlight that different meditative states show distint neural signatures Systematic mapping of behavioral, physiological, and neural features of freezing and other defensive responses onto different forms of meditation could help corroborate, refine, or falsify the current hypothesis that freezing provides the primary first-instance repertoire for meditation. In this sense, comparative analysis of response patterns across meditation types and threat responses may prove especially informative for a phylogenetic account of meditation.**Consequential shaping of freeze-responses into meditation**

If freezing does provides the basic response units from which meditation evolved, then the processes by which thse units were shaped into complex repertoires need to be specific Two related processes are particularly importantFirst is the initial elaboration of a primitive stimulus-evoked freeze response into goal directed culturally structured practices of meditation, a process that likely unfolded over 150,000 and 4,500 years before present from the late Palaeolithic through the emergence of formal religious traditions (; Wynne, 2007, Rossano 2007, walsh et al 2019). Second is the subsequent cultural transmission and maintenance of these practices once they became integrated action patterns or behavioral units,possibly canalized within particular traditions (see the case for creativity with Walsh et al., 2019) It is improbable that each individual learns meditation de novo from a first instance of freezing in the face of terror; rather, individuals typically encounter practices that are already shaped and socially supported.The analysis that follows, grounded in Skinner's work on phylogeny and ontogeny (1953; 1966),primarily address the first process, although similar principles can be applied to the second.

Although the advantages of freezing for attending to relevant stimuli in the environment, flexibly switching between possible responses,, and recovering from threat have been documented (Gozzi et al., 2010; Roelofs, 2017), and would explain its continued emission for individuals, Skinner's (1966) view of the ontogenic development of phylogenetically transmitted responses implies that the shaping of the first-instance responses also involves social continencies and a verbal community (*verbal* does not necessarily involve language). Ontogenic selection can occur through an organism's direct exposure, during their lifetime, to one or more of a range of contingencies. These include direct exposure of the organism to stimulus-response-consequence (three-term) contingencies that involve freezing (both its behavioral and neurological aspects). In addition to direct exposure to the situation, individuals can learn about the utility of freezing by observing others in their social group encountering similar contingencies. Under both conditions, generalization processes may expand the range of situations that evoke freezing. However, these mechanisms alone are unlikely to account for the emergence of meditation as a culturally elaborated and symbolically rich practice.

A further step may involve the development and use of symbols that signal when afreezing-type response is likely to be effective and lproduce beneficial outcomes, Such symbols could be supported by covert verbal behavior—for example, naming antecedents, responses, and/ consequences-- which allow some degree of self-control over when t to initiate freezing (Epstein, 1997). Naming can also support the formation of equivalence classes among stimuli, responses, and outcomes, facilitating the transmission of adapted freeze-responses across a culture (e.g., Albright et al., 2021). The implication is that a community is necessary for the development and maintenance of such verbal-social practices, and that this community may modify the symbols for freeze response basic units so that it could be evoked in situations where no immediate physical threat is present. Imagine an experienced hunter telling others to say silent and still even if there is the drive to run away. One pathway through which such verbal processes may enhance the use of freeze-derived responses is storytelling(Hineline, 2018). Together, these contingencies could accountfor both the initial shaping and the cultural transmission via stories of canalized meditative practices.

Inherited responses such as freezing, are likely to be communicated within a verbal community because of their reinforcing effects on environmental control (i.e. not being detected or harmed by a predator). This can be observe in nonhuman communication under threat. For instance in communities of vervet monkeys,individuals engaged in other behavior such as foraging can rapidly shift into vigilance and freezing postures upon hearing alarm calls that signal predators, even when they do not directly perceive the threat themselves (Hauser, 1988). Such socially mediated responses are then maintained by the contingencies operating within the group.

Social contingencies can thus reinforce both specific and general freezing behaviors in a verbal community, in the presence or absence of an immediate environmental threat. Given a repertoire of raw freeze-related behavioral units, verbal communities are positioned to generate social practices involving mimicking, storytelling, confirming and other forms of communication (Rossano, 2007; Skinner, 1971). These practices can initially develop and then sustain the response across the community, preserving both its direct safety benefits, and the associated advantages of enhanced focus and decision-making (Klaassen et al., 2021).

Considering the social contingencies that may shape an initial freeze response into meditation helps address two related questions. First, how can a response that is initially aversive and associated with acute threat come to be maintained and even sought out, given that prolonged, unmodified freezing is associated with stress-related anxiety disorders?(see Schmidt et al., 2008), Second why does a relatively simple freeze-response sometimes develop into elaborate meditative rituals, while in other cases it may remain more individually focused and less florid? One possible answer lies in the development of verbally mediated ritual and practice, especially through storytelling. Within the behavior-analytic tradition, drawing on Skinner's analysis of verbal behavior, storytelling has been conceptualized within a speaker–listener paradigm(Hineline, 2018)Pohl et al., 2020). In this view, a story can function as a mand—a request or prompt—for the listener to emit a particular pattern of behavior. The listener's performance of the requested act then reinforces the speaker's behavior, while the outcomes of the act reinforce the listener.As Detrich (2018) notes, storytelling is often most effective when the request is implicit rather than overt. Such dynamics create a social environment in which freeze-derived practices can be encouraged, repeated, and elaborated.

Sugiyama (2017) has used storytelling asa model of knowledge and behavior transferin foraging societies, providing an analysis that paralells Skinner's (1986) account of how verbal behavior can "evolve" from phyogentic precursors behaviorsApplying similar analyses to the development of meditation suggests that verbally transmitted stories can articulate and highlight the longer-term benefits of freeze-derived behaviors (e.g., increased attention, self-control, insight), thereby maintaining performance of what might initially be aversive acts. Storytelling also supports the enculturation and elaboration of basic responses into recognizable meditative traditions.

Why, then, do meditative practices so often become elaborate? Skinner (1966) and others have noted that many ritualized behaviors across social species involve responses from the speakerthat are especially striking or noticeable. Esch's (1967) analysis of bee communication, for example, shows that more elaborate movements tend to elicit stronger social responses, which in turn further shape and reinforce those movements. Elaborate displays are more likely to provokeresponses from a 'listener',which then reinforce and refine the behavior of the 'speaker'. It is interesting that bees also are a subject of speculation regarding mindfulness (see Moore & Kosut, 2014). This model of elaboration leading to noticeability and reinforcement has been applied to the development of complex linguistic skills in humans (Pohl et al., 2020), and it can be extended to rule-governed instructional language in the lineage of meditation. In this light, the elaborate and often vivid stories and instructions associated with meditative practices serve to attract attention, sustain interest, and support transmission.Certainly, the elaborate stories associated with cultural practices of meditation would fit this description, as has been noted bySimms (2014):

"*Since the time of the Buddha, more than 2600 years ago, meditation instruction has been given as an oral transmission. Hence, the freshness and relevance of the experience is offered in the present and retained...Knowledge and trust is embodied and felt by the student. The "teacher" or "guide" understands the difference between accessing the natural and unconditional nature of mind from the thought about or concept of a "calm" mind. For a storyteller…this increasing discernment is essential. It renders engaged storytelling fresh and penetrating, in the way that an oral transmission is appreciated. Otherwise we perform or work with others by rote or according to what we have learned. The meditation practice renders all of our activities alive in direct response.*" – Simms (2014)

On this account, making a freeze-derived response more elaborate may increase its likelihood of being maintained and transmitted via social contingencies. When a freeze-response is developed into a ritual, that ritual is more likely to contact social reinforcement and to reoccur under similar conditions. Over time, such responses can become discriminated, rule-governed, and canalized as "meditation," with transmission increasingly guided by explicit and implicit instructions about when and how to apply the practice. A remaining unanswered question is the evolutionary timescale required for freezing to be co-opted into meditation: within an individual lifespan, this shaping occurs over years or decades, whereas the development of the underlying neurophysiology and species-typical behaviors supporting meditation would have unfolded over deep evolutionary time.

The ways in which first-instance responses are shaped will depend on a variety of factors that are themselves constrained by local environments. Distinct clusters of responses may be selected into complex repertoires of language and rule-based instruction, forming traditionsin the various practices of meditation (e.g., Hesychasm, Theravada, Tibetan, Zen) Modern typologies describe both commonalities and differences across these traditions (Bhatnagar & Sood, 2021; Laughlin, 2018). These traditions diverge as a function of the specific environments that shaped and transmitted them, much as physical traits diverge across geographic regions.

Such considerations may help explainwhy particular forms of meditation develop and persist in certain cultures. Once a set of freeze-derived behaviors has been elaborated into a meditatitive ritual and maintained by social contingencies, that ritual becomes the practice most likely to be reinforced by that group. Burke et al. (2017) report differential use of spiritual, mindfulness, and mantra meditation,among adults in the United States, highlighting the role of institutional and cultural support in sustaining particular practices. Complementary population-level data show substantial growth in meditation use over recent decades (Davies et al., 2024), underscoring the importance of contemporary social and health-care structures in reinforcing certain forms over others.

The impact of a culture on individual behavior has been critical to Skinner's writings on society (1953; 1971), althoughas Watts' (1975) notes, the precise manners by which groupsexert influence are not always fully specified.Nevertheless, in terms of developing verbal practices it is straightforward to imagine that behaviors (including rituals) followed by more frequent or more potent reinforcement will occur at higher rates than those that contact less reinforcement. This appears to be true for many forms of verbal behavior, although with some caveats (Borrero et al., 2007). Recent work also suggests that conformity with majority opinions can be more easily reinforced than conformity with minority positions, and that prior reinforcement for expressing majority views can make later adoption of minority views more difficult (Angelo & Andery, 2024). Such findings, though preliminary in this context, may help lay the groundwork for a more detailed analysis of how cultural differences shape variation in meditative rituals.

Another aspect meriting comment is that, in the contemporary United States, meditation practices associated with Buddhist and Hindu traditions have gained substantial visibility and uptake, often through secular mindfulness and yoga programs, while explicitly Christian contemplative practices may be less conspicuous despite strong institutional roots (Davies et al., 2024). From a behavioral perspective, more conspicuous, publicly promoted, and clinically endorsed practices are likely to be differentially reinforced, thereby gaining wider currency. This suggests that any account of human meditation must incorporate the role of social and verbal contingencies in determining which forms become most prevalent.

(Burke et al. (2017) Davies et al., 2024).

These considerations raise plausible and testable hypotheses about how freeze-responses could be transformed into meditation by social communities and about why some forms of meditation spread more widely than others. They also point to the possibility that other threat responses could underlie additional forms of meditative practice.

Lenfesty and Morgan (2019) for example, emphasize prestige-based and attachment-like processes in the evolution of cooperation and religion, which could be related to an “attach” response rather than freezing per se. Such mechanisms may be particularly relevant to highly institutionalized religious systems, whereas freezing may offer more flexibility as an initial repertoire for survival-related behavior and, by extension, contemplative practices.

Further questions follow from the current hypothesis. For instance, do cultural variations in meditation practices reflect differences in propensities to express particular threat responses (assuming such differential propensities exist)? If some genotypes or developmental histories favor freezing over attachment, then cultures in which freezing is more common might more readily elaborate meditative practices derived from freezing. At the individual level, propensities to freeze may interact with the capacity to benefit from meditation following psychological trauma.

Traumatic memories are often fragmented and difficult to integrate(Rothschild, 2021; van der Kolk, 1994). There is evidence that meditation, especially mindfulness, can support recovery from the fragmented sense of self associated with post-traumatic stress disorder (PTSD), although outcomes are mixed(Creswell & Lindsay, 2014; Lang, 2017)(Banks et al., 2015). One possibility is that mindfulness-based practices may sometimes restore aspects of the original threat-response state, effectively reinstating the contextual conditions under which trauma learning occurred. Such reinstatement could facilitate context-dependent recall (Unsworth et al., 2012), allowing traumatic material to be processed in a currently safe environment.. If so, mindfulness might be most effective when it partially re-creates conditions similar to those present during the initial fear state. This remains speculative, but it follows naturally from viewing meditation as an adaptation of a threat response—specifically, freezing.

Addressing these questions will require systematic empirical work. A particularly useful next step would be a detailed review comparing the neurological, physiological, and musculoskeletal features of the freeze-response with those observed across different meditative rituals, as well as with other threat-response systems used as controls. Such data would help clarify the extent to which meditation can plausibly be viewed as a culturally elaborated descendant of defensive freezing, and where important divergences point to additional shaping forces.

Conclusions on defensive freezing as an origins account of meditation

This article has advanced a biological account of meditation's origins, proposing that its core features arise from an evolutionarily conserved defensive freezing response shared across species. Drawing on previous theoretical work of human behavior (Skinner, 1966) indictingthat behavior must first emerge for reasons independent of its later consequences before it can be refined by reinforcement, we further suggest that early humans likely exhibited states of immobility, hypervigilance, and attentional narrowing—hallmarks of defensive freezing—that were subsequently co-opted, elaborated, and ritualized for spiritual and therapeutic purposes. Once embedded within social and verbal communities, this early repertoire of response units provided a foundation for the structured practices recognized today as meditation.

The central challenge of tracing meditation's origins lies in disentangling minimal, unlearned response patterns shared across species from those uniquely elaborated in humans. Because the relevant contingencies operated deep in evolutionary time, our account is necessarily inferential. Nonetheless, it yields a coherent framework that invites systematic testing through comparative behavioral studies, cross-species neurobiology, and careful mapping of physiological and neural overlaps between freezing and meditative states. By treating meditation as an emergent expression of survival-based response systems, rather than as a purely spiritual or psychological innovation, this perspective links ancestral adaptive strategies with contemporary practices of self-regulation

This framework also recasts meditation as an evolved modulation of stress- and threat-related responses, shaped and maintained through cultural reinforcement, storytelling, and ritual. It suggests concrete lines of inquiry: comparative analyses of threat responses across species; investigation of how verbal communities and institutional structures canalize particular meditative forms; and examination of both convergences and divergences in the neural circuitry of freezing and meditative absorption. Additionally, it highlights the importance of attending not only to shared mechanisms—such as autonomic and network-level changes—but also to points of divergence, which may reveal the selective pressures and cultural contingencies required to transform an acute defensive state into a stable practice of contemplative self-regulation.

We do not claim that all meditative practices derive exclusively from freezing, nor that structural similarity entails functional identity. Rather, we offer defensive freezing as a plausible “first-instance” repertoire from which at least some forms of meditation may have evolved, alongside potential contributions from other threat responses such as attachment. By integrating evolutionary, behavioral, and cultural perspectives, this origins theory moves toward a more comprehensive understanding of meditation as both a biological and cultural phenomenon—one that underscores the deep continuity between ancestral survival strategies and the modern contemplative practices through which humans seek clarity, safety, and flourishing.

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