International Scholars Journals

International Journal of Anatomy and Physiology ISSN 2326-7275 Vol. 15 (7), pp. 001-012, July, 2026. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Perspective

Stochastic Fascia: The Ionic Fabric of Consciousness - A Clinical Anatomist's Perspective

John Sharkey

Irish College of Osteopathic Medicine (ICOM), National Training Centre (NTC), Ireland. Email: john.sharkey@ntc.ie

Abstract

Received 30 June; Revised 12 July, 2026; Accepted 13 July, 2026; Published 22 July, 2026

Years of fascia-focused dissection make it impossible to regard the body as an assembled machine. Dissection reveals that there are no levers in the body and no 'layers' whereby skin is the youngest deposit and bone the oldest. In geology, layers form sequentially according to the Law of Superposition, where the deepest layer is the oldest and the most superficial is the youngest. Embryology does not work in that way. Unlike a machine, the body grows its coherence across a spectrum from softness to hardness, yet mechanistic metaphors persist: the heart as pump, the brain as computer, the tendon as pulley. Such language has profoundly influenced science, culture, and contemporary thinking around consciousness. This paper draws upon embryology, clinical anatomy, extracellular matrix biology, mechanotransduction, bioelectric signalling, autonomic physiology, and contemporary theories of biological coherence to propose that continuity precedes anatomical differentiation and persists throughout life, despite the descriptive boundaries imposed by anatomical nomenclature. Fascia is considered as a continuous, developmentally grounded, ionically active biological continuum extending throughout the organism, providing a primary component of the biological environment through which structural organisation, physiological adaptation, mechanosensation, and embodied awareness are integrated across multiple spatial and temporal scales. This paper distinguishes established anatomical and physiological evidence from theoretical interpretation and advances the hypothesis that the fascial continuum participates in the biological conditions through which embodied awareness becomes possible. Concepts including stochastic development, emergence, bioelectric morphogenesis, extracellular matrix dynamics, and multiscale biological coherence are considered within a single developmental framework that emphasises relationship over reductionism and becoming over assembly. This perspective argues that consciousness is not the spark of a biological machine but the dynamic coherence of a body that continually forms and reforms itself, with fascia providing the biological substrate through which local sensation contributes to global awareness.

Key words: Fascia; consciousness; embryology; developmental biology; extracellular matrix; bioelectricity; mechanotransduction; stochasticity; emergence; embodiment; connective tissue; ionic coherence

Author's Note

This article is presented as a scientific perspective. Established anatomical, embryological, and physiological observations are distinguished from the theoretical framework proposed by the author. Where hypotheses are advanced concerning fascia and embodied consciousness, these are intended to stimulate experimental investigation.

1. Introduction

1.1 Man as Machine

What is it 'like to be' a machine? For centuries, anatomists have held on to the metaphor of bones as levers, muscles as motors, and the heart as a pump. This view of the human body was drawn not from what anatomists witnessed in living tissue but from the excitement surrounding each new mechanical invention [1]. When engineers perfected pistons and pumps, the heart naturally became a pump. When hinges and gears filled the workshops of Europe, the skeleton was recast as a system of levers and pulleys. The metaphors of the age crept quietly into medicine [1,2].

By the seventeenth century, the Cartesian world of mechanism and the Newtonian clockwork of physics had combined to give us the enduring image of man as machine [2,3]. Anatomy was increasingly reduced to an inventory of parts. Physiology became the study of those parts in motion, while later developments in cognitive science encouraged further comparisons between the brain and computational machinery [4].

Yet the moment one stands in a dissecting room, the metaphor begins to lose much of its explanatory power. Years of fascia-focused dissection increasingly reveals the body as a continuous, adaptive biological architecture [5]. Flesh does not hinge or pivot, it yields, deforms, adapts, and flows. No pin-joints, pulleys, or rigid columns are found within the human construct. Flesh does not hinge or pivot, it yields, deforms, and flows. No pin-joints, pulleys, or rigid columns are found within the human construct. Sherrington saw this clearly when he wrote that "the body is more than a concatenation of machines" [6]. Vesalius and Falloppio, working with extraordinary precision, were nevertheless constrained by the religious, philosophical, and technological frameworks of their time [8]. Later, the adoption of engineering language, tendon as cable, bone as beam, muscle as motor, further encouraged the study of living form through mechanical abstraction. Modern textbooks continue to echo this inheritance through descriptions of motor units, first, second and third-class levers, and cellular engines [9]. Such models undoubtedly retain pragmatic value. Biomechanics, orthopaedics, prosthetic design, and surgical planning all depend upon useful abstractions that reduce biological complexity to measurable forces, moments, and vectors. Interestingly, even engineering itself has progressively moved beyond rigid machine analogies. Ingber's concept of cellular tensegrity illustrates how living systems achieve stability through continuous dynamic relationships [7]. A lever may provide a useful approximation of movement, but no anatomical lever exists independently of the continuous living tissues through which forces are generated, distributed, and adapt.

This model undoubtedly retains pragmatic value. Biomechanics, orthopaedics, prosthetic design, and surgical planning all depend upon useful abstractions that reduce biological complexity to measurable forces, moments, and vectors. The problem arises when the model is mistaken for the organism it was designed to describe. A lever may provide a useful approximation of movement, but no anatomical lever exists independently of the continuous living tissues through which forces are generated, distributed, and adapted. Mechanical models are not rejected here as analytical tools. What is questioned is their ontological overreach and the assumption that because the body can be modelled as a machine, it is fundamentally a machine. The persistence of such language has helped preserve the mechanistic metaphor beyond the explanatory limits for which it may have been originally intended. If the machine metaphor provides an incomplete ontology of living form, an alternative starting point is required. Embryology offers that starting point. The embryo reveals the organism before anatomical description divides it into parts, systems, layers, and regions. Embryology demonstrates that living form is not assembled from pre-existing components. It develops through continuous processes of migration, differentiation, folding, growth, tension, fluid movement, and adaptation [12-15]. Embryology offers a fundamentally different way of understanding what an organism is.

1.2 Embryology and the Ontology of Becoming

Embryology, by its nature does not proceed in straight lines. The developing body is not assembled from pre-existing components. It folds, migrates, condenses, differentiates, and reorganises through continuous interaction between cells, tissues, fluids, forces, and the surrounding physicochemical environment [10, 12, 13]. Development is better understood as a relational process than as a sequence of parts added to an increasingly complex structure. The term *emergence* is commonly used to describe properties that arise through interactions among simpler components. Consciousness, for example, is frequently described as an emergent property of neural complexity. Yet emergence is often interpreted through an implicitly bottom-up logic in which higher-order phenomena arise from lower-order components. Denis Noble has proposed the alternative term *amergence* to describe biological causation as multidirectional and not exclusively upward [11]. In the present context, amergence refers to the continuous unfolding of biological organisation through reciprocal interactions operating across multiple spatial and temporal scales. Cells influence tissues, tissues influence cells, organisms influence environments, and environments participate in shaping organisms. No single level of biological organisation can be granted permanent causal priority [11,29].

This concept is particularly relevant to embryogenesis. Fascial tissues do not appear as prefabricated structures awaiting assembly [12-15]. They differentiate within mesenchymal continuity through changing relationships among cellular behaviour, fluid dynamics, local tension, extracellular matrix organisation, and the surrounding developmental milieu [12]. No two trapezius muscles are identical because development is not the execution of an engineering blueprint. Form arises through constrained variability, historical contingency, and continuous biological adaptation. It is in this sense that *stochasticity* becomes central to the present argument. Stochastic describes probabilistic variation occurring within constraints. Gene expression, cell migration, molecular interactions, extracellular matrix organisation, and responses to environmental conditions all exhibit elements of stochastic variation. [13,14]. Yet coherent form emerges. The organism is neither genetically predetermined in every detail nor randomly assembled. It develops through constrained biological possibilities. The developing ionic environment is integral to this process. From the earliest stages of embryogenesis, cellular behaviour is influenced by membrane potentials, ion channels, bioelectric gradients, extracellular hydration, and physicochemical interactions. Experimental studies of bioelectric morphogenesis demonstrate that ionic gradients do more than support cellular metabolism. They participate in the regulation of cell proliferation, migration, differentiation, tissue patterning, and large-scale anatomical organisation [32,33]. And so the developing embryo is an electrical and ionic environment in continual transformation. Within this environment, mesenchymal tissues provide an early connective continuity from which many specialised tissues subsequently differentiate. Within this environment, mesenchymal tissues provide an early connective continuity from which many specialised tissues subsequently differentiate [12–15]. The present paper proposes fascia as a developmentally early connective tissue continuum existing before neural, muscular, or vascular development.

This distinction is important. The argument concerns developmental continuity and biological precedence, not the retrospective projection of adult anatomical categories onto the embryo. Fascial development may consequently be understood as an emergent process. Form unfolds through reciprocal relationships among cells, extracellular matrix, hydration, ionic gradients, tension, fluid flow, and environmental influence. These relationships do not produce a structure that later becomes biologically active. They constitute the activity through which structure continually becomes. This developmental perspective challenges the assumption that biological organisation must be explained by identifying ever smaller component parts. Rather than the embryo first constructing independent organs and subsequently connecting them, organs differentiate within an already continuous developing body [12=15]. The heart, liver, brain, blood vessels, muscles, and connective tissues acquire specialised identities without becoming biologically independent of the continuity from which they arose. The same principle persists after birth. The organism is never a completed anatomical product. Growth, repair, adaptation, ageing, learning, and disease continue to reshape the relationships among cells, extracellular matrix, fluids, ions, tissues, and organs. Living form remains a process of becoming. Within the theoretical framework proposed in this paper, consciousness must also be considered in relation to this developmental continuity. This does not require the claim that fascia causes or produces consciousness, only that it contributes to it. Also, we need to ask a more fundamental question, if consciousness is embodied, through what biological conditions does local sensation become integrated into the experience of a whole organism?

This paper proposes that fascia deserves consideration as a unique component of that biological condition. Its continuity, sensory innervation, extracellular matrix dynamics, hydration, ionic regulation, mechanotransduction, and capacity for adaptation position it at the interface between local biological events and organism-wide physiological integration. Fascia is proposed as a biological continuum through which the conditions supporting embodied awareness may be organised. From this perspective, consciousness does not suddenly emerge from an otherwise unconscious biological machine. Nor is it necessary to locate consciousness exclusively within a single tissue or organ. The question becomes one of biological coherence across scale. How does a continuously forming organism integrate molecular, cellular, tissue, neural, fluidic, ionic, and environmental events into the unified experience of being alive?

Embryology has not yet answered that question. It does, however, change the conditions under which the question is asked. It directs attention away from assembly and towards becoming, away from isolated components and towards relationships, and away from fixed anatomical structures towards the continuous processes through which living form arises and persists. If consciousness is an expression of the coherent living organism, then understanding consciousness may require beginning with the body's capacity to form, sense, and continually reorganise itself through relation. Fascia is proposed here as the principal tissues of that relation. So, while embryology may not answer the question of consciousness, it changes the conditions under which the question is asked.

1.3 Fascia: The Tissue of Relation

In the dissecting room, fascia presents itself as something more than an isolated anatomical structure. Dissection reveals the connective tissue continuity within

which every organ, vessel, nerve, muscle, and bone develops, exists, and maintains relationship with its surroundings. Every incision creates separation to facilitate anatomical observation, yet the living body does not present itself pre-divided into the discrete structures, layers, and systems described in anatomical text books. The anatomist necessarily creates boundaries in order to study continuity. Fascia does not end where a named structure begins. Its continuity extends across anatomical regions and between tissues conventionally classified as separate entities. Under magnification, the intra-tissue endoscopic observations of surgeon Jean-Claude Guimberteau (See fig 1) reveal a hydrated, fibrillar architecture in continual deformation and reorganisation [17]. Filaments, fibres, cells, vessels, and extracellular fluids participate in an irregular and dynamic architecture. They do not conform to the fixed geometries suggested by conventional anatomical illustrations (Fig. 1). The significance of these observations lies in recognising that differentiation occurs within continuity (Fig 2 and Fig 3). Throughout the body, fascial tissues exhibit remarkable variability in stiffness, elasticity, hydration, and organisation (Fig 3). These properties continually adapt in response to loading, movement, ageing, injury, physiological state, and disease. Such adaptation occurs within an extracellular environment in which collagen, elastin, water, ions, cells, and matrix molecules remain in constant biological dialogue. Hydration, in this context, means more than the presence of water. Biological water exists in relationship with charged macromolecules, dissolved ions, extracellular matrix components, and cellular membranes. Changes in ionic concentration, molecular architecture, and matrix composition influence tissue behaviour across multiple spatial and temporal scales. Fascia may be better understood as a dynamically regulated physicochemical environment. This perspective provides the basis for the central proposition of this paper. If fascia participates in mechanosensation, interoception, nociception, extracellular signalling, fluid regulation, and adaptation, might it also contribute to the biological processes through which local events become integrated into organism-wide experience? The question is deliberately framed as a hypothesis and not a conclusion. Observations provide the biological basis for the central question explored in this paper. If fascia participates in mechanosensation, interoception, nociception, extracellular signalling, fluid regulation, and continual adaptation, might it also contribute to the biological conditions through which local physiological events become integrated into organism-wide embodied awareness? In this model, fascia is considered the indispensable component of a wider biological architecture that includes the nervous, vascular, immune, endocrine, and other physiological processes through which the organism senses and regulates itself.

The example of wide-awake surgery illustrates both the potential and limitations of this hypothesis. During procedures performed under local anaesthesia, a region of otherwise sensate tissue can be rendered temporarily insensible while the patient remains globally conscious and aware. This observation illustrates that sensory participation in experience can be regionally altered using local fascial blocks, without eliminating organism-wide awareness. Local anaesthesia consequentially offers a useful conceptual model. A normally sensate region can temporarily cease contributing its usual afferent information to the wider organism where consciousness persists. This raises the possibility that embodied awareness depends upon the continual integration of distributed local signals and not the activity of a single anatomical location.

Within this theoretical framework, fascia may participate in the modulation and integration of such signals through its sensory innervation, extracellular matrix dynamics, cellular activity, and continuity with other tissues. This observation raises a fundamental question concerning the biological necessity of experience itself. Much of physiological regulation could, in principle, occur without conscious awareness. Falling energy availability, or reduced glucose levels could initiate food-seeking behaviour, ingestion could restore metabolic balance, and satiety signals could terminate feeding without the organism necessarily experiencing hunger, taste, pleasure, or satisfaction. Yet, biological regulation in conscious organisms is accompanied by experience. Food is not simply ingested, it is tasted and enjoyed. Injury does not merely initiate protective behaviour, it can also cause pain or changes in sensation. Movement is not only executed, it can be felt. Regional anaesthesia provides a striking anatomical illustration of this distinction. Motor intention and execution may remain intact while conscious sensory awareness of the affected region is profoundly diminished. The organism can act through a part of the body without experiencing that part in the usual way. Biological function and conscious experience, although normally intimately associated, are not identical.

This distinction returns the discussion to Nagel's question of "what it is like to be." Why should physiological regulation be accompanied by experience at all? Why does the organism not simply regulate itself through unconscious feedback? The present paper does not claim to answer this problem. It proposes, however, that any biological account of embodied consciousness must consider the tissues and processes through which local physiological events acquire sensory significance and contribute to the experience of the organism as a whole. Within this framework, fascia becomes relevant because it participates in the continuous biological environment through which the organism senses itself. Its sensory innervation, extracellular matrix dynamics, ionic organisation, hydration, mechanotransduction, and anatomical continuity position fascia within the distributed processes through which biological function may acquire an experiential dimension.

At the cellular level, fibroblasts and other stromal cells respond to loading, extracellular matrix deformation, biochemical signalling, and changes within their surrounding ionic environment. Intercellular calcium

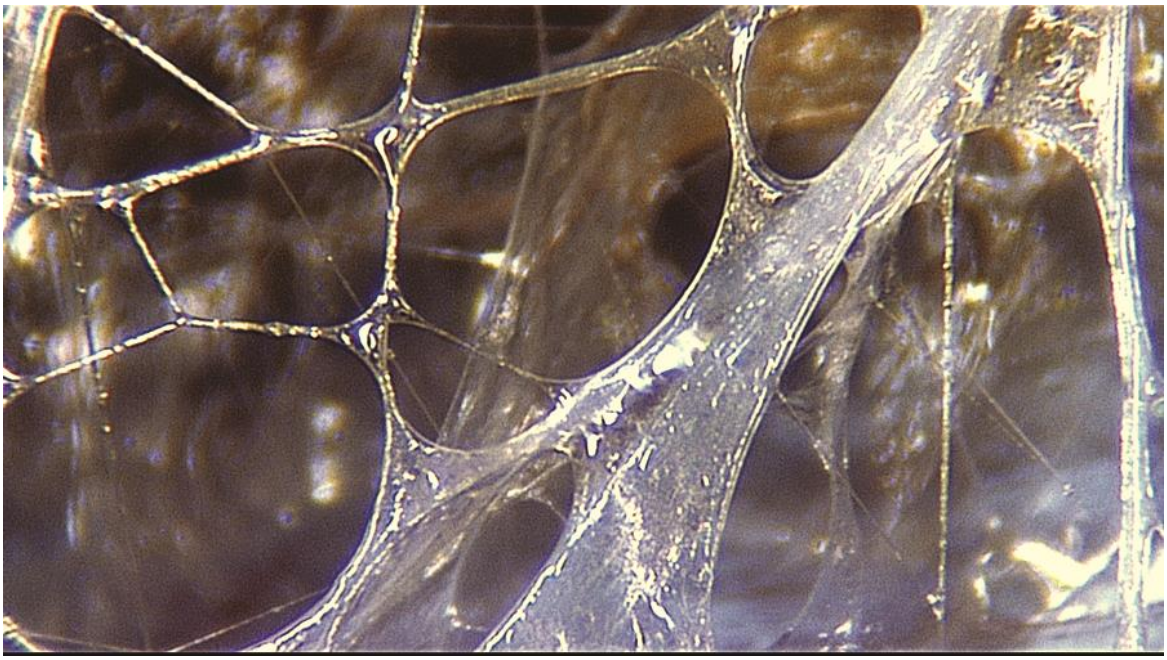

Fig. 1. Intra-tissue endoscopic observations by surgeon Jean-Claude Guimberteau demonstrate the irregular fibrillar organisation and continuity of living connective tissues. Magnification reveals a hydrated and dynamically adapting architecture with no fixed anatomical partitions. Image reproduced with permission from endovivo.com.

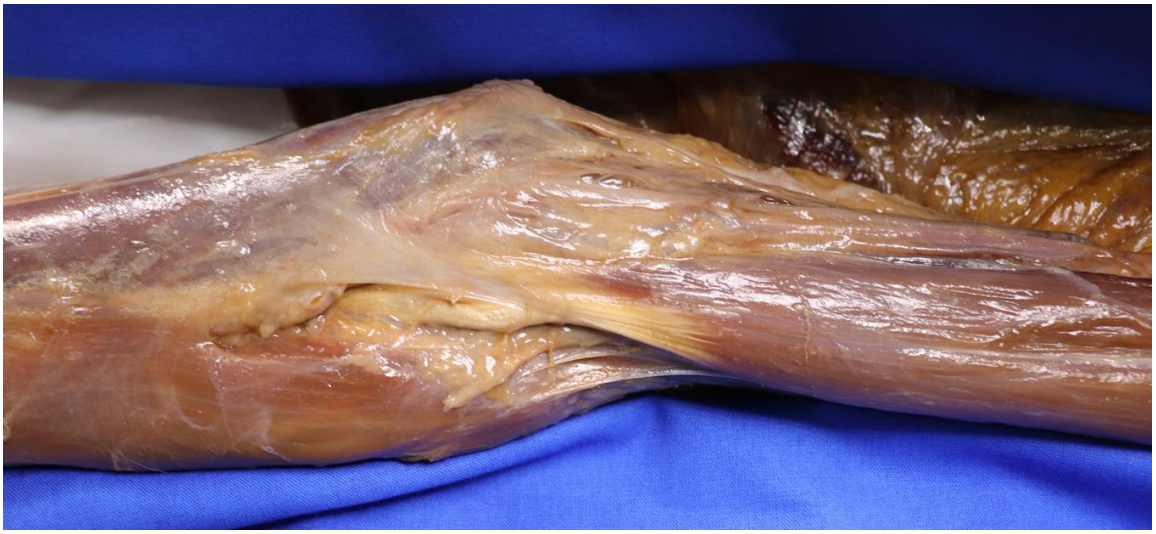

Fig 2. Dissection of the upper limb demonstrating connective tissue continuity between the neurovascular sheath and surrounding muscular envelopes of the forearm. The apparent free edge of the lacertus fibrosus results from removal of the skin and tela subcutanea during dissection. Image: Sharkey J, 2019.

signalling provides one mechanism through which cellular responses may propagate beyond an individual cell. Telocytes have likewise been proposed to participate in forms of long-range intercellular communication through their extensive cellular processes and relationships with surrounding tissues.

These observations provide established biological grounds for considering fascia as an active communicative environment. Beyond established mechanisms of cellular and extracellular communication lies a more speculative field of investigation. Ultra-weak photon emission has been reported in biological tissues, while hypotheses concerning structured interfacial water, coherent oscillation, photonic

Fig 3: Fascial tissues of the upper limb demonstrating variations in tissue hydration and optical appearance following dissection. The image illustrates the heterogeneous and continuous nature of connective tissue architecture. Image: Sharkey J, 2024.

conduction, and quantum-compatible biological behaviour remain under investigation and debate. Such phenomena should not be presented as established mechanisms of consciousness.

They nevertheless raise questions relevant to the theoretical framework developed here. Could forms of biological communication exist across scales not adequately described by conventional models of neural transmission alone? Could the physicochemical organisation of connective tissues contribute to forms of coherence extending from cellular activity towards organism-wide integration? What experimental evidence would be required to demonstrate or falsify such propositions?

These questions remain open.

At the cellular level, fibroblasts and telocytes, within the extracellular matrix, sense micro-strain while continuously responding to changes in their ionic environment. Intercellular calcium waves, fluctuations in extracellular ion concentrations, together with the physicochemical properties of the surrounding matrix provide a dynamic medium for long-range cellular communication. Fibroblasts and telocytes engage in long-range communication, including intercellular calcium waves and oscillations; ultra-weak photon (biophoton) emission has also been reported in biological substrates (including DNA) and neural tissue [20]. These networks may display quantum-compatible behaviour, coherence of oscillation, rapid field-level signalling, and photonic conduction through ordered water layers. While many of these theories remain speculative and controversial in mainstream biology / physics, emerging empirical work by some authors propose that such

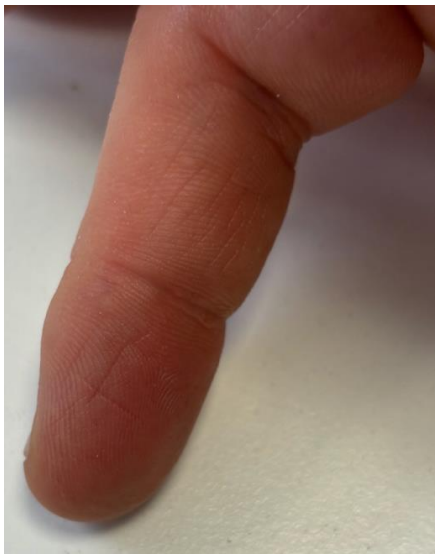

Fig 4. A small scar on the index finger provides a visible example of biological history expressed through connective tissue remodelling. The scar does not contain a stored representation of the original event but demonstrates how previous injury can persist as altered tissue architecture. Image: Sharkey J, 2026.

networks could exhibit quantum-compatible coherence and field-level signalling, potentially influenced by bio-interfacial (“structured”) water, though these hypotheses remain under active investigation and debate [21]. Here they are referenced with due care, positioning them as proposals or models.

That said, such behaviour would reinforce the concept of fascia as a stochastic coherence field, translating molecular vibration into macroscopic awareness. Therefore, fascia could be viewed as both the anatomical and experiential fabric of relation, a continuously adapting physicochemical continuum in which mechanical loading, ionic organisation, hydration, and cellular signalling are inseparable. While not suggesting that trauma is stored as a static object or data deposited in connective tissues, fascia seems to hold the memory of movement, old insults and the potential for adaptation (see Fig 4). It is here, within this continuous, self-sensing, and ionically regulated matrix, that consciousness finds embodiment as the harmonic coherence of a living field. The observable reality of manual therapists, osteopaths, neuromuscular therapists, massage therapists is that traumatic experience alters the organism across multiple interacting domains simultaneously, including autonomic regulation, endocrine activity, immune behaviour, breathing patterns, posture, affective processing, interoception, and broader physiological adaptation over time.

Fascia is proposed as a biological participant in the processes through which distributed local events contribute to the coherence of the organism as a whole. Its continuity, sensory innervation, cellular responsiveness, extracellular matrix dynamics, hydration, and ionic organisation make it relevant to questions concerning how biological information is integrated across spatial and temporal scales. This perspective also requires clarification of what is meant when tissues are said to “remember.” Trauma, injury, or experience is not proposed to be stored within fascia as a static object, or data stored or encoded awaiting release. Biological history is expressed through altered structure and function. Scarring, extracellular matrix remodelling, changes in tissue stiffness, inflammatory processes, altered sensory signalling, autonomic regulation, posture, movement, and behavioural adaptation can all reflect previous events. If consciousness is embodied, fascia cannot reasonably be excluded from the biological conditions through which embodiment is experienced.

Adaptive Pulling: Gravity, Autonomic Regulation, and Fascial Adaptation

Pulling is the essential utility on a planet governed by gravity, itself the one environmental constant shared by every terrestrial organism. Life on Earth has evolved to enter into relationship with gravity [11]. The human form, uniquely poised between stability and movement, has refined this relationship through the evolution of temporally responsive tissue, muscles, tendons, ligaments, and fascia, each a specialized condensation within a continuum that spans from the delicate softness of the leptomeninges to the mineral hardness of bone. These tissues act as participants in a continuous dialogue of pulling, tension, release, hydration, and ionic exchange, forming an ever-adjusting field of dynamic equilibrium. In this sense, motion is the orchestration of relationship where the body resists any attempt at lengthening. Gestures, from the subtlest ocular movement to the movement of a limb, represents a nego-

tiation with gravity, a distributed act of pulling within the fascial continuum. Within the human organism, muscles, tendons, ligaments, fascia, cartilage, and bone represent specialised condensations within a continuous connective tissue continuum extending from the delicate softness of the leptomeninges to the mineral density of bone. These tissues continually exchange force, fluids, ions, and biological information through an integrated extracellular environment. Movement is perhaps better understood as the orchestration of relationships, a responsive, self-sensing matrix capable of modulating its stiffness, elasticity, tone, hydration, and ionic organisation across multiple temporal scales, sometimes instantly or over hours, days, weeks, or months. Through mechanotransduction, extracellular matrix remodelling, and tensegral adaptation, fascia enables the body to sustain coherence under variable load. Biological architecture is constructed because of gravity through which mechanical loading becomes biological adaptation. From a neurophysiological perspective, this capacity for adaptive pulling is inseparable from the regulation of safety and affective state.

One physiological framework relevant to understanding this adaptive capacity is Dr. Stephen Porges' Polyvagal Theory [19]. Instead of viewing autonomic regulation as a simple balance between sympathetic and parasympathetic activity, Polyvagal Theory proposes a hierarchical organisation in which ventral vagal, sympathetic, and dorsal vagal states continually interact according to perceived safety or threat. Although developed within neuroscience, this framework provides a useful context for considering how changing physiological states are expressed throughout the body. Whatever autonomic model is adopted, changes in physiological state are necessarily embodied. Breathing pattern, heart rate, vascular tone, muscle activity, posture, facial expression, tissue hydration, and movement all vary with autonomic regulation. These adaptive responses occur within the continuous connective tissue environment. From such a perspective, fascia is unlikely to be separate from autonomic regulation because it constitutes much of the biological environment through which autonomic state is expressed. Porges' concept of neuroception, the unconscious evaluation of safety or threat before conscious awareness arises, introduces a further consideration. Neuroception is experienced through the continuously changing physiology of the organism. Breathing, posture, facial expression, visceral function, muscle tone, and connective tissue behaviour all contribute to the bodily context within which neuroception operates. The present hypothesis asks whether the fascial continuum, through its continuity, mechanosensory capacity, extracellular matrix organisation, hydration, and ionic environment, contributes to that embodied physiological context.

The relationship proposed here is complementary, not competitive. Neural regulation, extracellular matrix dynamics, mechanotransduction, fluid behaviour, and connective tissue adaptation together contribute to the organism's ongoing capacity for physiological coherence. Within this theoretical framework pulling is viewed as an embodied expression of ongoing autonomic regulation, integrating structural, somatic, and physiological adaptation (Fig. 5).

Adaptive pulling reflects the continual integration of structural loading, physiological regulation, sensory information, tissue adaptation, and environmental interaction. Gravity provides the constant challenge, adaptation is the organism's continual response. From this perspective, fascia is proposed as a continuously adapting biological continuum through which structural and physiological relationships are maintained throughout life. Changes in breathing, posture, muscle tone, movement, tissue hydration, and extracellular matrix organisation accompany changing autonomic states. These adaptive responses necessarily occur within the continuous fascial environment, linking heart, breath, posture, hydration, and ionic regulation within a dynamic biological continuum.

Figure 5 illustrates three interrelated physiological nervous system states, ventral vagal (relaxed and socially engaged), sympathetic (mobilized for action), and dorsal vagal (immobilized and conserving energy), as overlapping continua and not fixed categories. The hybrid zones (quiet intimacy, play and performance, or defensive freeze) demonstrate the fluidity of state transitions within the living body [19]. From the unique fascial perspective, these shifting autonomic states are proposed as mirrored in the body’s connective continuum, changes in fascial tone, tension, and hydration embody the felt sense of safety or threat. The fascial field acts as the pre-neural substrate of these neural platforms, mediating between physiology and experience, the tissue through which coherence, perception, and consciousness are expressed. In Dr. Porges’ latest elaboration of Polyvagal theory, he revisits how the autonomic nervous system (ANS) is structured not as a monolithic “arousal dial” but as a hierarchical, evolutionarily layered architecture comprising ventral vagal (social safety), sympathetic mobilization, and dorsal vagal (immobilization) branches.

This hierarchy is dynamically regulated through bidirectional coupling between neural circuits at multiple levels, from brainstem nuclei to higher cortical centres, in constant feedback with peripheral tissues, a nested coherence consistent with multi-scale coupling models of consciousness [23]. One of the more striking refinements is emphasizing neuroception, the unconscious, preconscious sensing of safety or threat that tunes autonomic state even before conscious thought arises. This hints at a pervasive “body intelligence” that operates at a level below mind, and is exquisitely sensitive to structural, somatic, and fascial cues. Porges underscores how respiratory sinus arrhythmia (RSA), when extracted via the improved Porges–Bohrer method, serves as a more precise marker of vagal

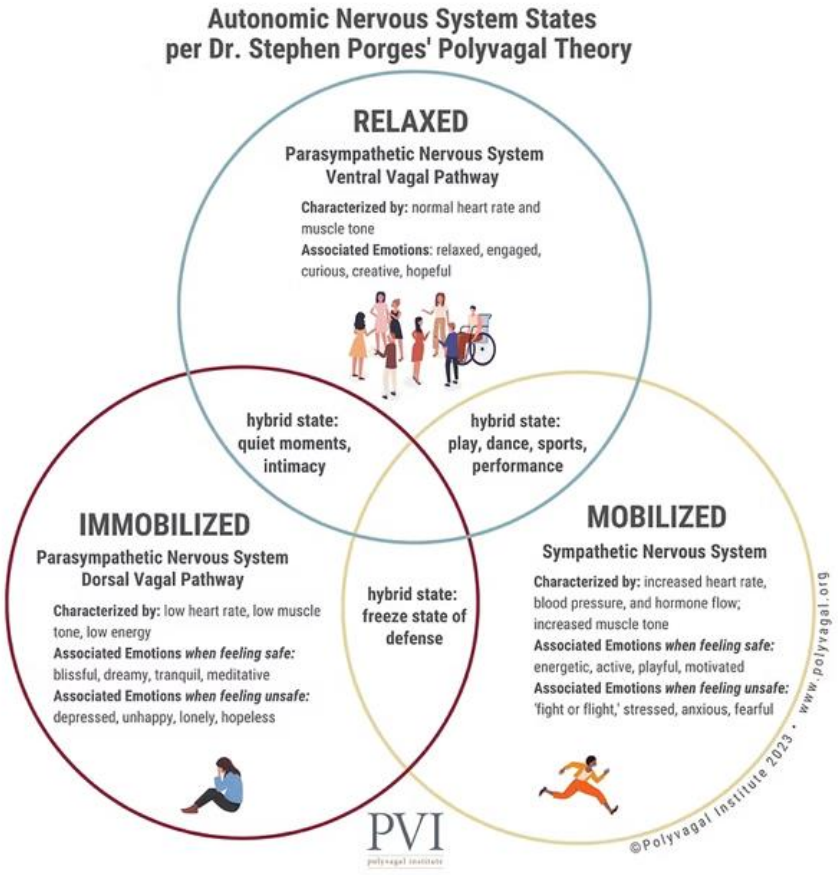

Figure 5. Autonomic nervous system states defined in Polyvagal Theory (after Porges, 2023). Image in conjunction with Dr Stephen Porges, Polyvagal Institute.

outflow from the nucleus ambiguus, thereby giving physiological readout of ventral vagal regulation as opposed to treating HRV as a crude aggregate (24). This specificity invites the hypothesis that fascia and local tissues, rich in piezoelectric and bioelectrical properties, might interact with or even modulate these vagal signals. Taken together, Porges model opens a conceptual doorway for fascia to function as an active modulator/feedback partner in the regulation of autonomic state. If neuroception can be unconsciously attuned to threat or safety cues from tissue tension, posture, or fascial strain, then fascia becomes part of the sensing apparatus that informs autonomic balance. The fascia–fibroblast matrix may well be a contributor to the bodily scene upon which neuroception operates. Therefore, the integration proposed in this paper is that neuronal microtubules might host the quantum-scale processing, while fascia and autonomic circuits co-regulate the amplitude, coherence, and expressivity of those processes. The ANS (especially the ventral vagal pathway) might serve as the translation channel between microtubular coherence and embodied experience, and fascia may amplify, gate, or filter those translations. Consciousness, rooted in neuronal micro-events, is always lived through the body. Porges refined Polyvagal architecture gives us the theoretical scaffolding for how that lived circulation might occur.

1.5 Fascia, Microtubules, and Quantum Coherence

Microtubules are dynamic cytoskeletal polymers composed of α- and β-tubulin dimers that continually assemble and disassemble according to cellular requirements. Their established functions include maintaining cell architecture, intracellular transport, mitosis, and mechanotransduction. Beyond these recognised roles, some investigators have proposed that microtubules may also exhibit coherent oscillatory behaviour capable of supporting forms of intracellular information processing [23]. Although these proposals

remain controversial and are the subject of ongoing investigation, they raise an important question relevant to the present perspective: how might coherence expressed at molecular scales become integrated across the organism as a whole?

At larger anatomical scales, fascia provides the only continuous connective tissue environment extending throughout the body. Rich in collagen, extracellular matrix molecules, water, and dissolved ions, the fascial continuum exhibits recognised piezoelectric, viscoelastic, mechanosensory, and electromechanical properties [25]. These established biological characteristics do not, in themselves, demonstrate quantum coherence. They do, however, suggest that fascia constitutes a dynamic physicochemical environment capable of integrating mechanical, electrical, fluidic, and biochemical information across multiple spatial and temporal scales.

Within the theoretical framework proposed here, the Orch OR hypothesis developed by Hameroff and Penrose provides a useful conceptual mode as opposed to an established biological mechanism [23]. If microtubular processes contribute to intracellular coherence, as proposed by Orch OR, a further question naturally arises: does organism-wide coherence also require an anatomically continuous substrate capable of integrating local biological events across the whole body? This paper proposes that the fascial continuum deserves consideration as one possible candidate for such integration.

The fascial continuum is not suggested to replace neural processing, nor is it proposed as the origin of consciousness. Its continuity, extracellular matrix organisation, hydration, ionic environment, and mechanosensory properties position it as a plausible biological medium through which local physiological events may become integrated within the living organism. Calcium ions, through their central roles in cytoskeletal organisation, mechanotransduction, cellular signalling, and extracellular matrix physiology, may contribute to this multiscale integration by linking intracellular dynamics with tissue-level adaptation [30,31].

Whether fascia participates in amplifying, filtering, or coupling biological information across multiple scales remains hypothetical and requires experimental investigation. Equally, whether coherent biological organisation extends from molecular dynamics to whole-organism physiology remains an open scientific question. These propositions should be regarded as hypotheses that invite investigation. This perspective does not propose that fascia produces consciousness, any more than the body of a violin produces music independently of the strings or the musician. Fascia is proposed as part of the resonant biological architecture through which coherence may become embodied. If consciousness reflects the continual integration of processes distributed across multiple biological scales, fascia may contribute to the anatomical continuity through which that integration becomes possible.

Conclusion

The central proposition of this paper is fascia is proposed as participating in the biological conditions through which embodied awareness becomes possible. While fascia may not originate consciousness, it may serve as an important biological, ionically active, continuum through which consciousness becomes embodied and continually refines itself. Every biological material possesses a unique physicochemical composition, expressed through its geometry, molecular architecture, hydration, ionic organisation, and capacity for dynamic exchange. Together these properties contribute to a field of biological potential that shapes what it is like to be a living organism.

The subjective dimension that Nagel (26) described in 1974 as *"what it is like to be"* finds a plausible physiological correlate within the continuous, self-sensing fascial continuum, a living field capable of sustaining both local sensation and global awareness. Such a perspective aligns with contemporary thinkers including McGilchrist (27), Theise (28), and Noble (11,29), each of whom proposes that consciousness and biological order arise through relational, context-dependent processes. This perspective has argued that fascia should be understood as more than a passive connective tissue or another anatomical system. Fascia is proposed as a continuous, developmentally grounded, and ionically active biological continuum participating in the organisation of structure, adaptation, sensation, and physiological integration. Embryology demonstrates that continuity precedes anatomical differentiation, while clinical anatomy reveals that this continuity persists throughout life despite the descriptive boundaries imposed by anatomical nomenclature.

The continuity of fascia, its physicochemical organisation, extracellular matrix dynamics, hydration, ionic regulation, mechanosensory properties, and intimate relationship with every organ system position fascia within the distributed biological processes through which the organism experiences itself as an integrated whole. Throughout this perspective, embryology, anatomy, physiology, bioelectricity, autonomic regulation, and emerging concepts of biological coherence have been considered as complementary and not competing perspectives. Together they suggest that the living organism is better understood as a continuously adapting process. Within such a framework, stochasticity reflects constrained biological variability through which coherence, adaptation, and individuality emerge throughout life. The purpose of this paper is to present an argument that any comprehensive account of embodied consciousness must also consider the continuous biological tissues through which organisms develop, adapt, sense, repair, and maintain relationship with themselves and their environment. Whether fascia

contributes directly to multiscale biological coherence remains an open scientific question and one that is amenable to experimental investigation. Future studies integrating developmental biology, connective tissue physiology, bioelectricity, mechanotransduction, autonomic regulation, and consciousness research may help determine the extent to which fascial continuity participates in the integration of local biological events into organism-wide awareness. If consciousness is the lived expression of biological coherence, then fascia deserves consideration as one of the principal biological continuities through which consciousness becomes embodied. The remaining scientific challenge is to determine whether, and to what extent, fascia participates in the biological processes through which the living organism becomes experienceable to itself.

References

1. Riskin J. The Restless Clock: A History of the Centuries-Long Argument over What Makes Living Things Tick. Chicago, IL: University of Chicago Press; 2016.
2. Descartes R. Traité de l'homme. Paris; 1664.
3. La Mettrie JOD. Man a Machine and Man a Plant. Watson R, translator. Indianapolis, IN: Hackett Publishing; 1994.
4. Dupuy JP. The Mechanization of the Mind: On the Origins of Cognitive Science. Cambridge, MA: MIT Press; 2009.
5. Sharkey J. Understanding fascia, tensegrity and myofascial trigger points. *Int J Anat Var.* 2020;13(3):45-52.
6. Sherrington CS. Man on His Nature. Cambridge: Cambridge University Press; 1940.
7. Ingber DE. The architecture of life. *Sci Am.* 1998;278(1):48-57. doi:10.1038/scientificamerican0198-48
8. Carlino A. Books of the Body: Anatomical Ritual and Renaissance Learning. Chicago, IL: University of Chicago Press; 1999.
9. Standring S, editor. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 41st ed. London: Elsevier; 2016.
10. Caldarelli P, et al. Self-organized tissue mechanics underlie embryonic regulation. *Nature*. 2024;633:887-894. doi:10.1038/s41586-024-07934-8
11. Noble D. Dance to the Tune of Life: Biological Relativity. Cambridge: Cambridge University Press; 2017.
12. Vieira L. Embryology of the fascial system. *Cureus*. 2020;12(8):e10134. doi:10.7759/cureus.10134.
13. Van der Wal, J.C. De fabrica humani corporis - fascia as the fabric of the body., in Fascia, function, and medical applications. Lesondak, D.; Akey, A.M. Eds., CRC Press: Boca Raton, USA, 2021, ch. 1, pp. 3–18 Press; 2020.
14. Huang H, Gao S, Bao M. Exploring mechanical forces shaping self-organization and morphogenesis during early embryo development. *Annu Rev Cell Dev Biol.* 2024;40:75-96. doi:10.1146/annurev-cellbio-120123-105748.
15. Varela FJ, Thompson E, Rosch E. The Embodied Mind: Cognitive Science and Human Experience. Revised ed. Cambridge, MA: MIT Press; 2017.
16. Sharkey J, Kirkness KB. Stochastic nature of fascia: From layered pedagogical artifact to morphogenetic reality in clinical anatomy. *Life*. 2025;15:1924. doi:10.3390/life15121924.
17. Guimberteau JC., Armstrong, C. Architecture of Human Living Fascia: The Extracellular Matrix and Cells Revealed Through Endoscopy. Edinburgh: Handspring Publishing; 2015.
18. Morales JS, et al. From embryos to embryoids: How external signals and self-organization drive embryonic development. *Stem Cell Rep.* 2021;16(5):1039-1050. doi:10.1016/j.stemcr.2021.03.041
19. Porges SW. Polyvagal Theory: A Science of Safety. New York, NY: W.W. Norton; 2023.
20. Mineda K, Sato K, Nakahara T, Minami K, Ikushima K, Mizuguchi M, et al. Specific calcium signal responses in human keloid-derived fibroblasts during cyclical stretching: Basic research. *Health Sci Rep.* 2025;8:e70461. doi:10.1002/hsr2.70461.
21. Nevoit G, Poderiene K, Potyazhenko M, Mintser O, Jarusevicius G, Vainoras A. The concept of biophotonic signaling in the human body and brain: Rationale, problems and directions. *Front Syst Neurosci.* 2025;19:1597329. doi:10.3389/fnsys.2025.1597329.
22. Porges SW. Polyvagal theory: A journey from physiological observation to neural innervation and clinical insight. *Front Behav Neurosci.* 2025;19:1659083. doi:10.3389/fnbeh.2025.1659083.
23. Porges SW, Bohrer RE. The analysis of periodic processes in psychophysiological research. In: Cacioppo JT, Tassinary LG, editors. Principles of Psychophysiology: Physical, Social, and Inferential Elements. New York, NY: Cambridge University Press; 1990. p.708-753.
24. Hameroff S, Penrose R. Consciousness in the universe: A review of the Orch OR theory. *Phys Life Rev.*2014;11(1):39-78.
25. Athenstaedt H. Pyroelectric and piezoelectric properties of biological tissues. *Ann N Y Acad Sci.* 1974;238(1):68-89.
26. Nagel T. What is it like to be a bat? *Philos Rev.* 1974;83(4):435-450.
27. McGilchrist I. The Master and His Emissary: The Divided Brain and the Making of the Western World. New Haven, CT: Yale University Press; 2009.
28. Theise ND. Notes on Complexity: A Scientific Theory of Connection, Consciousness, and Being. New York, NY: Spiegel & Grau; 2023.
29. Noble D. A theory of biological relativity: No privileged level of causation. *Interface Focus*. 2012;2(1):55-64. doi:10.1098/rsfs.2011.0067.

30. Kollert MR, Krämer M, Brisson NM, Schemenz V, Tsitsilonis S, Qazi TH, Fratzl P, Vogel V, Reichenbach JR, Duda GN. Water and ions binding to extracellular matrix drives stress relaxation, aiding MRI detection of swelling-associated pathology. *Nat Biomed Eng.* 2025;9(5):772-786. doi:10.1038/s41551-025-01369-w.

31. Kirkness KB, Sharkey J, Scarlata S. Calcium Unified: Understanding How Calcium's Atomic Properties Impact Human Health. *Cells*. 2025;14(14):1066. doi:10.3390/cells14141066.

32. Levin M. Bioelectric signaling: Reprogrammable circuits underlying embryogenesis, regeneration, and cancer. *Cell*. 2021;184(8):1971–1989. doi:10.1016/j.cell.2021.02.034.

33. Levin M. *Endogenous bioelectrical networks store non-genetic patterning information during development and regeneration.* The Journal of Physiology. 2014;592(11):2295–2305. doi:10.1113/jphysiol.2014.271940.