



FACTA ANATOMICA

WONDERFUL WORLD OF FASCIA

Fascial Nomenclature: Update 2022

Bordoni B, Escher A R, Tobbi F, et al. (June 13, 2022) Fascial Nomenclature: Update 2022. Cureus 14(6): e25904.
doi:10.7759/cureus.25904

INTRODUCTION

The connective tissue or fascia plays key roles in maintaining bodily function and health. The fascia is made up of solid and fluid portions, which interpenetrate and interact with each other, forming a polymorphic three-dimensional network. In the vast panorama of literature there is no univocal thought on the nomenclature and terminology that best represents the concept of fascia. The **Foundation of Osteopathic Research and Clinical Endorsement (FORCE)** organization brings together various scientific figures in a multidisciplinary perspective. FORCE tries to find a common nomenclature that can be shared, starting from the scientific notions currently available. Knowledge of the **fascial continuum** should always be at the service of the clinician. FORCE has reviewed different concepts of fascia to gain an understanding of the broader fascial topic, and proposing new concepts, such as the holographic fascia.

The fascial tissue in the collective imagination is associated with a solid structure, which can lead to problems related to pain or a disturbance of motor functions. Despite the easy connection between solid fascia and functional or symptomatic behaviors that can arise from this tissue, when we try to investigate its real connections and/or functions, we do not have precise information. To give some examples, the **iliotibial band (ITB)** is connected to muscles such as the gluteus maximus and the tensor fascia latae; an alteration of the structure and function of the ITB causes pain and a disturbed distribution of the mechanical tensions suffered by the knee area [1].



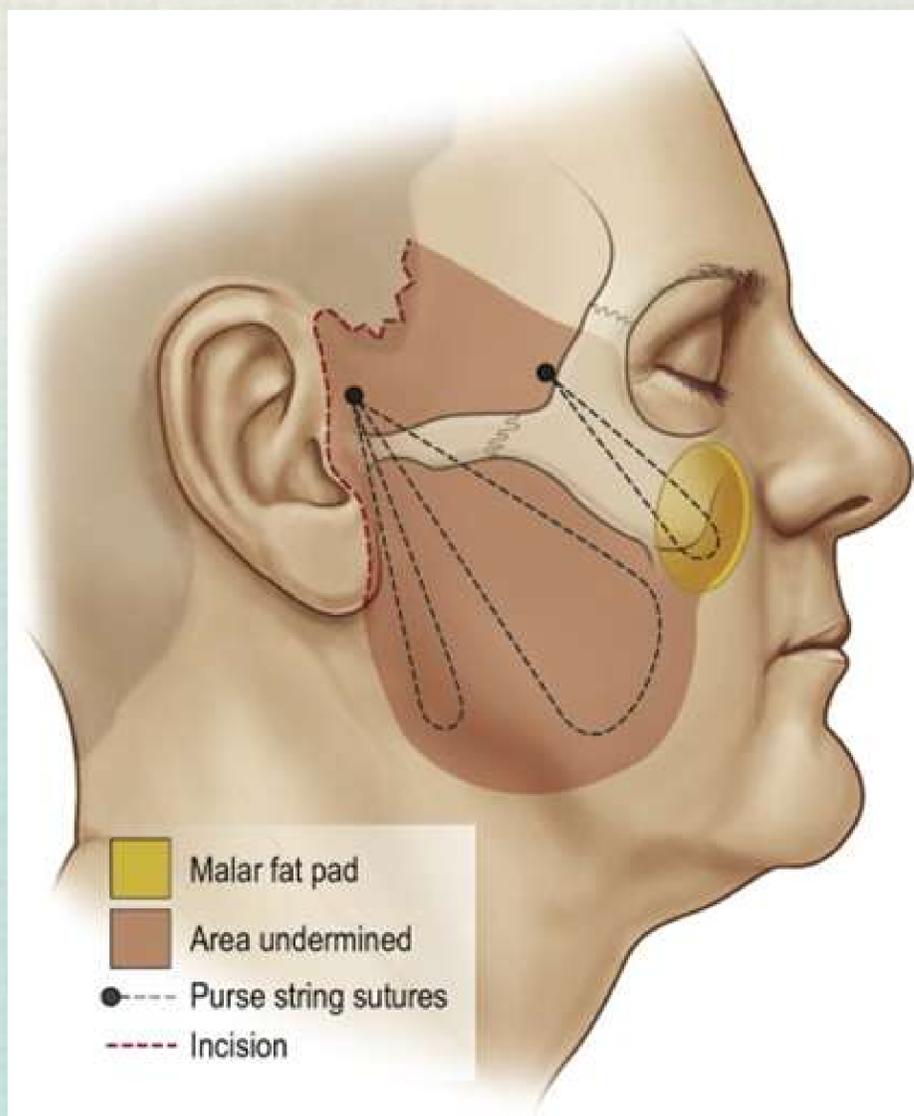
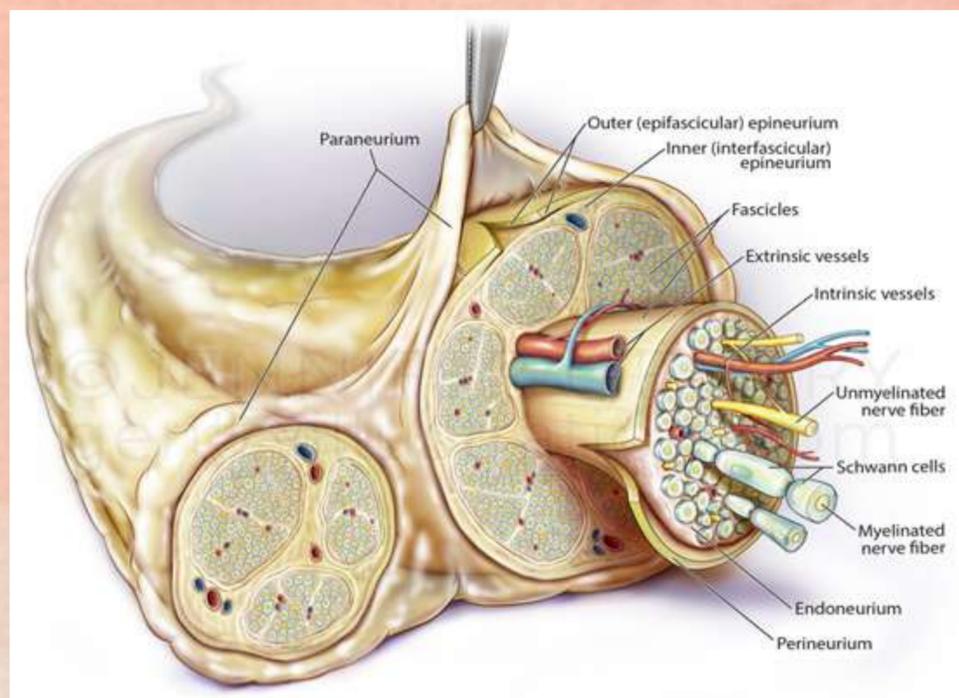
The value of the fascia changes according to the health professional. For the surgeon, the endopelvic fascia is a structure that plays an important role in the function and support of the viscera, while for the anatomist it is a weak layer consisting of areolar tissue with the function of covering the pelvic viscera [2].



WONDERFUL WORLD OF FASCIA



With the advancement of technology, more detailed structures are observed, naming a certain tissue with **new terminologies** or replacing the previous ones. The **circumneurium** replaces the previous name of paraneurium or paraneural sheath, which is a non-neural tissue or fascia that covers most nerves and is more external than the underlying layer or epineurium, divided into an external and an internal border; the epineurium may contain in its thickness (internal and external) adipocyte-containing compartments, which may be absent or present depending on the overall thickness of the nerve [3].



The **superficial muscular aponeurotic system (SMAS)** is an important anatomical area for facial plastic surgery, which connects the superficial area of the upper lip, the nasolabial fold, the frontal, parotid, zygomatic and infraorbital portion, part of the platysma muscle, and the sternocleidomastoid muscle, creating a complicated fascial network [4]. The surgeon must consider these connections before organizing the surgery.



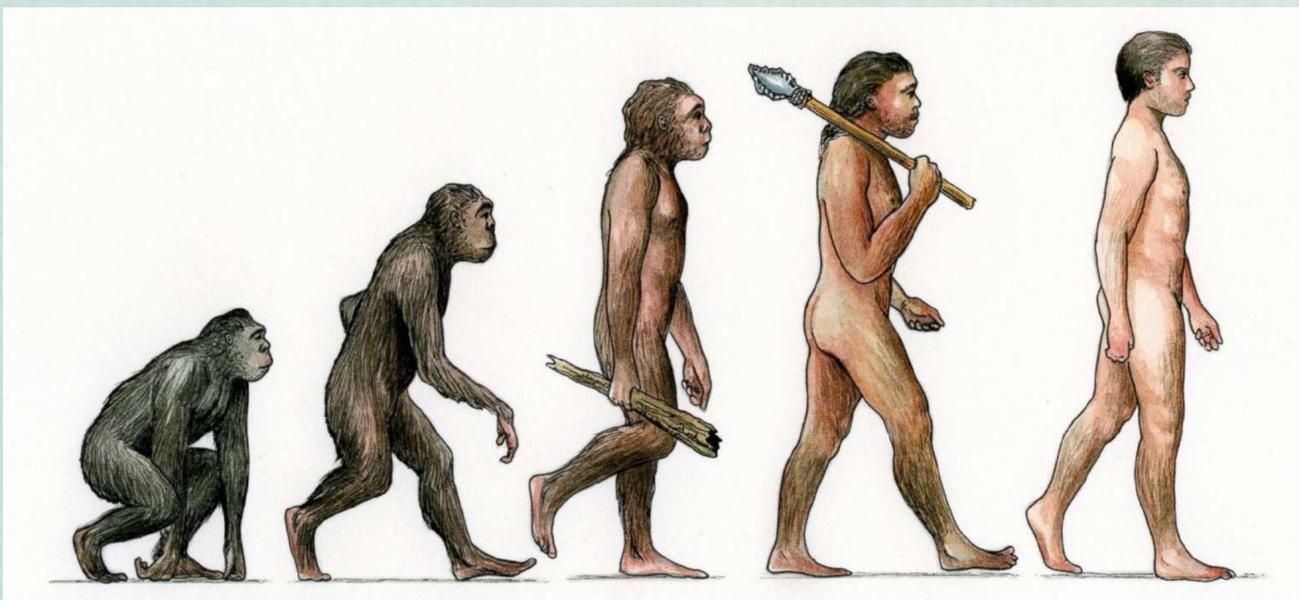
WONDERFUL WORLD OF FASCIA



Historical evolution of the fascia

The first to understand that the fascia is a complex system from an anatomical point of view were the ancient Egyptians (2,500 BC); the fascia is a Latinization of the Greek word "**taenia**" or "**ταινία**" (**ribbon/band**); the Romans gave the plural "**fascia**" and singular "**fascia**". In 1615, Crooke used the term fascia as an anatomical structure, later followed by other authors, in particular, to identify a membrane, a structure that connects and supports. In the 1700s, different terms began to be used to indicate something membranous, aponeurotic and tendon, especially related to the anatomy of skeletal muscles . In 1780, Dr. Simmons began to understand that fascia or connective tissue involved a large part of the body, with connected it and covered vessels, nerves, and organs . In 1851, Dr. Wilson began talking about layers, defining the fascia starting from the dermis (under the epidermis); the concept can be found in Gray's 1858 anatomy book [5,6].

In the **Twentieth century**, some anatomical clarifications of the terminology came out by groups of anatomists and researchers, such as **the International Committee for Anatomical Nomenclature (1983)** and **the Federative Committee of Anatomical Terminology (1998)**. These last two groups highlighted some words such as "**fascia superficialis**" and "**fascia profunda**", comparing the fascial tissue as "sheaths, sheets, or other aggregations of dissectable connective tissue" [5]. The name was given on the basis of the related tissue and the depth of the tissue layers (visceral fascia, fascial planes, fascial system, investing fascia); Towards the end of the 1900s, the concept that fascia is a connective tissue in continuity with all other connective tissues (without beginning and without end).



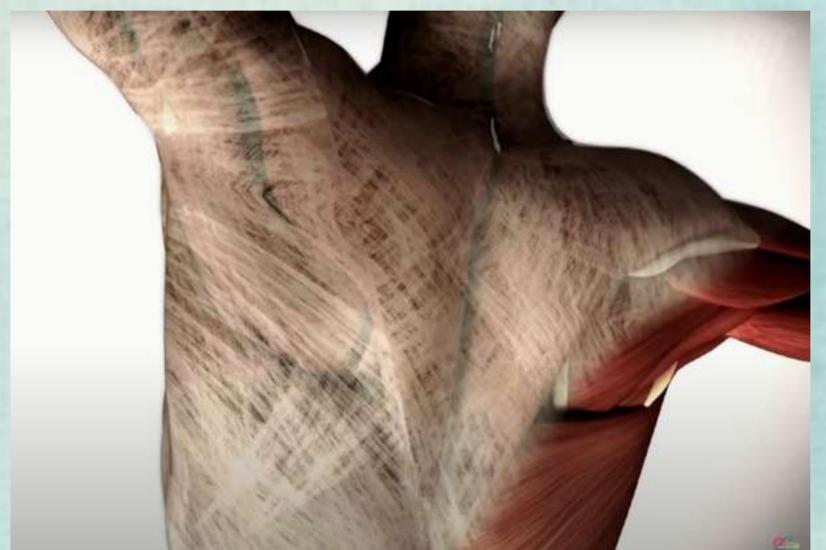


WONDERFUL WORLD OF FASCIA



In 2019, FRC(Fascia Research Congress) and FNC(Fascia Nomenclature Committee) gave concept of fascia: "a fascia is a sheath, a sheet, or any other dissectible aggregations of connective tissue that forms beneath the skin to attach, enclose, and separate muscles and other internal organs" [5]. For the FNC, the concept of the fascial system is contained in the following definition:

"consists of the three-dimensional continuum of soft, collagen-containing, loose and dense fibrous connective tissues that permeate the body. It incorporates elements such as adipose tissue, adventitiae and neurovascular sheaths, aponeuroses, deep and superficial fasciae, epineurium, joint capsules, ligaments, membranes, meninges, myofascial expansions, periosteal, retinacula, septa, tendons, visceral fasciae, and all the intramuscular and intermuscular connective tissues including endo-/peri-/epimysium. The fascial system surrounds, interweaves between, and interpenetrates all organs, muscles, bones and nerve fibers, endowing the body with a functional structure, and providing an environment that enables all body systems to operate in an integrated manner" [5].



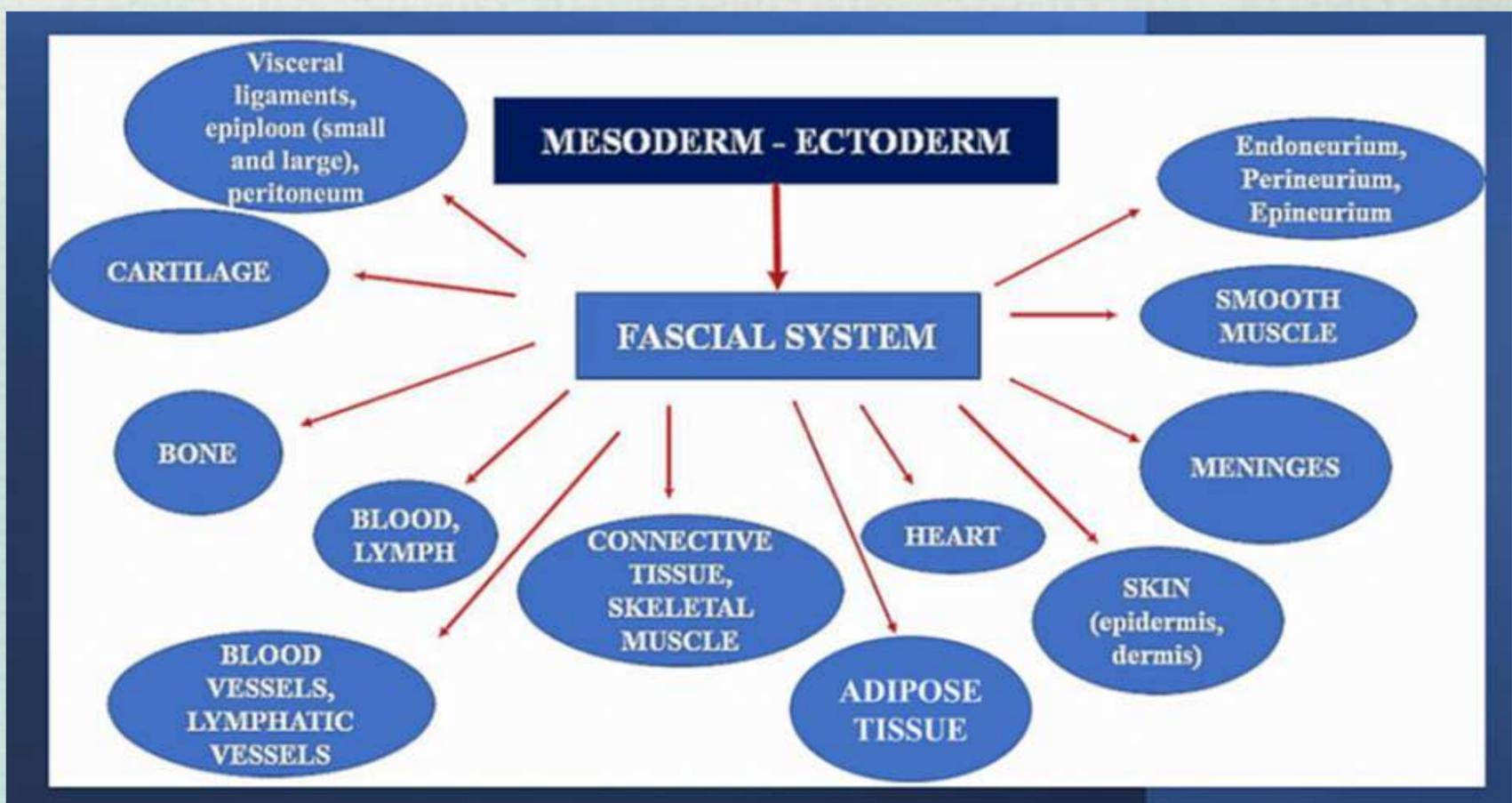


WONDERFUL WORLD OF FASCIA



Foundation of Osteopathic Research and Clinical Endorsement (FORCE) defines fascial continuum (fascial system) as follows:

"The fascia is any tissue that contains features capable of responding to mechanical stimuli. The fascial continuum is the result of the evolution of the perfect synergy among different tissues, liquids, and solids, capable of supporting, dividing, penetrating, feeding, and connecting all the districts of the body: epidermis, dermis, fat, blood, lymph, blood and lymphatic vessels, tissue covering the nervous filaments (endoneurium, perineurium, epineurium), voluntary striated muscle fibers and the tissue covering and permeating it (epimysium, perimysium, endomysium), ligaments, tendons, aponeurosis, cartilage, bones, meninges, involuntary striated musculature and involuntary smooth muscle (all viscera derived from the mesoderm), visceral ligaments, epiploon (small and large), peritoneum, and tongue. The continuum constantly transmits and receives mechano-metabolic information that can influence the shape and function of the entire body. These afferent/efferent impulses come from the fascia and the tissues that are not considered as part of the fascia in a bi-univocal mode" (Figure 1) [7]





WONDERFUL WORLD OF FASCIA



IMPORTANCE OF FLUID FASCIA

Body fluids (fluid fascia) give shape and function to the body (solid fascia). The lymphatic and blood vessels cross the entire body, from the epidermis to the bone, from the viscera to the nervous system (as well as the neural ramifications). The fluid network (FN) and the neural network (NN) pervade the whole body, and despite the clamor of complex innervation on solid fascial tissue (for some authors only what it envelops), if there were no FN/NN, there would not even be the function, the form, and the eventual symptoms. Before the movement, the pathways of nourishment, cleansing, and information must be created. The blood vessels are sensitive not only to external pressure but to the different modes of passage of fluids; as fluids behave, so will the tissues that transport them (vessels) and the tissues they pass through (from bones to skin) adapt, determining form and function [8].

Interstitial Fluids-Extracellular Matrix (IFEM)

A fluidic component of the human body is the IFEM; this represents about 40% of body mass and contains about 30% of body proteins. The IFEM is able to influence the shape and function of cells and tissues. The IFEM is found throughout the body, connecting the whole body, regardless of the layers or anatomical areas; it creates a continuity where all structures, local or systemic, are in contact, with a volume of fluids that is three times more than the sum of the blood and lymphatic volume. The IFEM is constantly changing and represents another fluid circulation system. The transport of fluids occurs due to the movement of muscles and the viscera and respiration [9]. In particular, the blood vessels (venous and arterial) transport interstitial fluids in a double way.



WONDERFUL WORLD OF FASCIA



A similar mechanism is seen in the **glymphatic system**. The cerebrospinal fluid (CSF), which exchanges information with the glymphatic and venous system, according to recent research, communicates with some medullary receptors within the bones of the skull to modulate a possible neuroinflammatory response. It travels between the perivascular space of the dural vessels (from the subarachnoid space), to reach the bone marrow of the bones of the skull, through bone channels; moreover, this journey is **bidirectional**, that is, from the dura to the bone marrow and vice versa. The cranial bone marrow discriminates the quality of the CSF composition and, based on the substances transported, it could send biochemical signals (inflammatory or non-inflammatory) toward the nervous system.

The IFEM transports not only chemical molecules but also cells. The fluid composition of the IFEM carries other types of messages, such as electromagnetic currents, which can involve areas distant from the physical passage of fluids [9]. The constant movement of fluids or fluid fascia ensures systemic electromagnetic integration and cellular cohesion. **The fluids carry the electromagnetic fields of cellular DNA, in order to maintain tissue memory and share this memory with all tissues.** The heartbeat itself generates electromagnetic fields, which are transported and distributed to various tissues by fluids [10].





WONDERFUL WORLD OF FASCIA



From the theoretical model of **tensegrity** to that of **fascintegrity**

The term "**tensegrity**" (tensional integrity) derives from an architectural concept, conceived by the designer R. Buckminster Fuller in 1960; a solid structure capable of managing tension variations, through structures capable of absorbing and transmitting mechanical tension (continuous tension with discontinuous compression). Dr. Robbie (1977) gave the concept of tensegrity to determine the mechanical behavior between the spinal column and muscle structure acting on the vertebrae. Dr. Ingber, in the 1970s, described the behavior of the cell, always from a mechanical point of view, with the concept of tensegrity, where the microtubules represent the continuous tension and the actomyosin protein complex represents the discontinuous compression [11].

Dr. Levin, in 1981, gave the term **biotensegrity**, combining the architectural concept with a purely biological field; this theory considers the bone tissue as the component in discontinuous mechanical tension, while the muscles and joints represent the component in constant tension or in pre-stress (Figure 2). Figure 2 illustrates the classic view of the human body formed solely by solid fascial tissue (in this case, muscles), forgetting the concept of the fluid fascia.

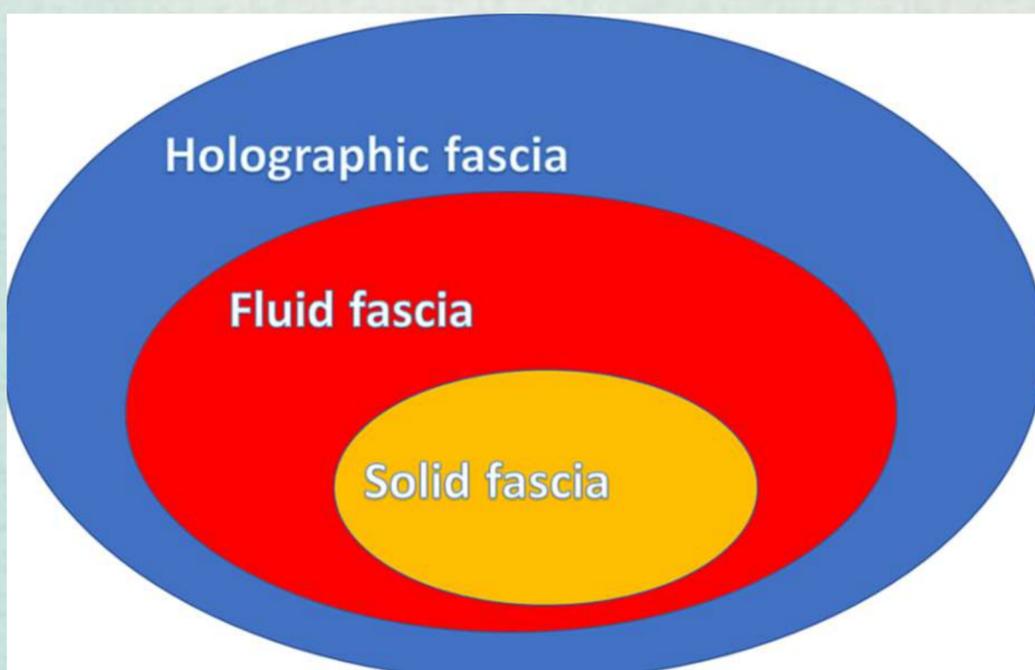


Figure 2 : Schematic diagram illustrating the greater influence of Holographic Fascia, compared to the fluid fascia and the solid fascia.
Figure Source: Bruno Bordonni



WONDERFUL WORLD OF FASCIA



In 2019, (FORCE) coined a new term, to try to conceptualize the behavior of the living, that is, "**fascintegrity**"; the word combines the term of tensegrity with the concept of fascial continuum (solid and fluid) [11]. What makes fascintegrity more relevant is the inclusion of fluids (blood, lymph, extracellular matrix, and interstitial fluids) in the fascial concept.

HOLOGRAPHIC FASCIA

The electromagnetic field interacts through particles such as **biophotons** (light) and **biophonons** (sound), which create an instrument of dialogue with matter through electrical charges. All cells throughout the body are in communication through the vision of quantum biology . The human body constantly receives and emits electromagnetic fields to maintain form and function. The biophonons are generated by the cell when the same is altered in its shape (nano-movements), by the oscillations of the biophotons; light creates responses of cellular structures, including biophonons. The human being is the response to a harmonic coherence of light and sound.[12]

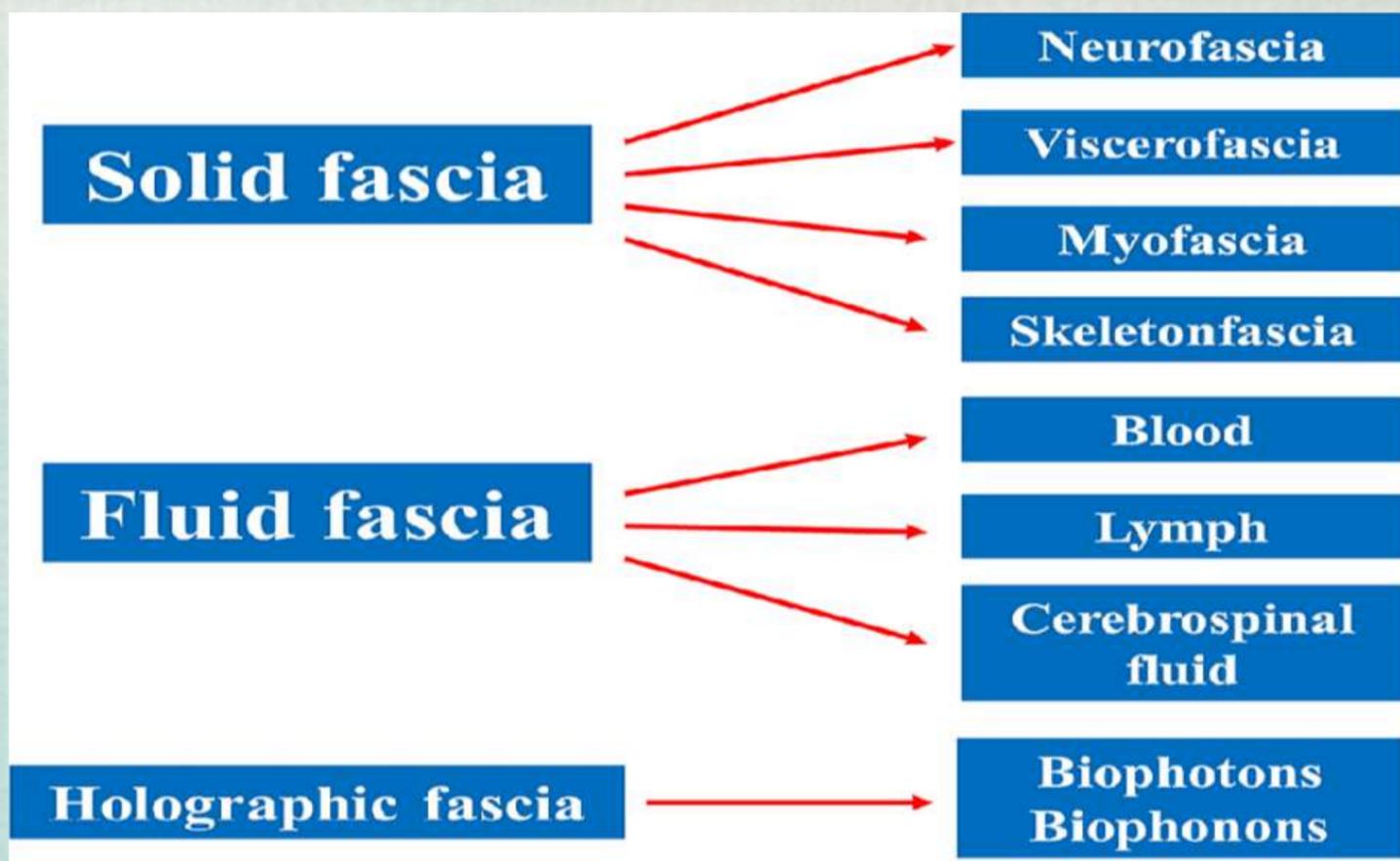


FIG 3: The subdivision highlights the existence of the holographic fascia, compared to the classic fascial subdivisions. Figure Source: Bruno Bordoni



WONDERFUL WORLD OF FASCIA



THE FASCIAL CONTINUUM TODAY

The fascial continuum today as defined by FORCE as follows ;

•“the fascia is any tissue that contains features capable of responding to mechanical stimuli. The fascial continuum is the result of the evolution of the perfect synergy among different tissues, fluids, and solids, capable of supporting, dividing, penetrating, feeding, and connecting all the districts of the body: epidermis, dermis, fat, blood, lymph, blood and lymphatic vessels, tissue covering the nervous filaments (endoneurium, perineurium, epineurium and circumneurium), voluntary striated muscle fibers and the tissue covering and permeating it (epimysium, perimysium, endomysium), ligaments, tendons, aponeurosis, cartilage, bones, meninges, involuntary striated musculature and involuntary smooth muscle (all viscera derived from the mesoderm), visceral ligaments, epiploon (small and large), peritoneum, and tongue. The continuum constantly transmits and receives mechano-metabolic-quantum information that can influence the shape and function of the entire body. These afferent/efferent information come from the fascia and the tissues that are not considered as part of the fascia in a bi-univocal mode.”

CONCLUSION

The fascia has solid, fluid, and electromagnetic components, which create a perfect functional mosaic observable at the macroscopic and nanoscopic level. Fascial tissue is concerned with the patient's health, and should be viewed as an important tool for finding more suitable solutions for maintaining the same health.

"The difficulty lies not so much in developing new ideas as in escaping from old ones"

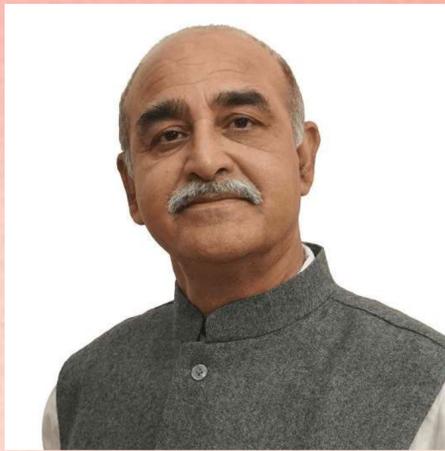


WONDERFUL WORLD OF FASCIA



REFERENCES

1. Hutchinson LA, Lichtwark GA, Willy RW, Kelly LA: The iliotibial band: a complex structure with versatile functions. *Sports Med.* 2022, 52:995–1008.
2. DeLancey JO: Lies, damned lies, and pelvic floor illustration: confused about pelvic floor anatomy? You are not alone. *Int Urogynecol J.* 2022, 33:453–7.
3. Reina MA, Boezaart AP, Tubbs RS, Zsimevich Y, Fernández-Domínguez M, Fernández P, Sala-Blanch X: Another (internal) epineurium: beyond the anatomical barriers of nerves . *Clin Anat.* 2020, 33:199–206.
4. Hînganu D, Stan CI, Ciupilan C, Hînganu MV: Anatomical considerations on the masseteric fascia and superficial muscular aponeurotic system. *Rom J Morphol Embryol.* 2018, 59:513–6.
5. Adstrum S, Nicholson H: A history of fascia. *Clin Anat.* 2019, 32:862–70.
6. Gray H, Carter HV (illustrations): The muscles and fasciae. *Anatomy Descriptive and Surgical.* John W. Parker and Son, West Strand, London; 1858. 186–7.
7. Bordoni B, Escher AR, Tobbi F, Ducoux B, Paoletti S: Fascial nomenclature: update 2021, part 2 . *Cureus.* 2021, 13:e13279.
8. Owen-Woods C, Kusumbe A: Fundamentals of bone vasculature: specialization, interactions and functions . *Semin Cell Dev Biol.* 2022, 123:36–47.
9. Murshid SA: Bone permeability and mechanotransduction: some current insights into the function of the lacunar-canalicular network. *Tissue Cell.* 2022, 75:101730.
10. Thorp KE: Morphogenic fields: a coming of age . *Explore (NY).* 2022, 18:187–94.
11. Bordoni B: The shape and function of solid fascias depend on the presence of liquid fascias . *Cureus.* 2020, 12:e6939.
12. Tassinari R, Cavallini C, Olivi E, Taglioli V, Zannini C, Ventura C: Unveiling the morphogenetic code: a new path at the intersection of physical energies and chemical signaling. *World J Stem Cells.* 2021, 13:1382–93.



MESSAGE FROM EXECUTIVE DIRECTOR

PROF.DR. (COL.) CDS KATOCH, AIIMS RAJKOT

I heartily congratulate the Department of Anatomy for bringing this informative newsletter on Fascial Nomenclature: Update 2022 in Anatomy. My best wishes to the entire team.

DEPARTMENT OF ANATOMY

DR. SIMMI MEHRA

*Professor & Head
Department of Anatomy
AIIMS, Rajkot*

DR. ROHIN GARG

*Associate Professor
Department of Anatomy
AIIMS, Rajkot*

DR. SUNDIP CHARMODE

*Associate Professor
Department of Anatomy
AIIMS, Rajkot*

DR. PRADIP CHAUHAN

*Assistant Professor
Department of Anatomy
AIIMS, Rajkot*

DR. SHALOM PHILIP

*Senior Resident
Department of Anatomy
AIIMS, Rajkot*

DR. RISHITA VALA

*Junior Resident
Department of Anatomy
AIIMS, Rajkot*