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Letter to the Editor

Regarding: Update on fascial nomenclature-an additional proposal by John Sharkey MSc, Clinical Anatomist

"It is very clearly apparent from the admonitions of Galen how great is the usefulness of a knowledge of the bones, since the bones are the foundation of the rest of the parts of the body and all the members rest upon them and are supported, as proceeding from a primary base. Thus if any one is ignorant of the structure of the bones it follows necessarily that he will be ignorant of very many other things along with them."– Niccolo Massa, 1559

I wish to express my sincere thanks to the authors of the recent papers discussing the appropriate definition of "fascia" (Stecco and Schleip, 2016) and "the fascial system" (Adstrum et al., 2017). Interest in this topic is evident from the number of discussions taking place globally and also with additional papers published recently in journals by other respected contributors (Bordoni et al., 2018). Bordoni suggests that any definition of fascia should take into account the functional characteristics of a tissue and that any new definition should embrace the epidermis. It is reassuring, from the scientific perspective, that discrepancy and open dialogue is alive and well. It is acknowledged that the various definitions of fascia offered by recognised authorities do not enjoy universal agreement and all have varying deficiencies. These definitions currently fall short of an agreed, descriptive, fully embracing definition that would suit all interested medical agencies/researchers and allied disciplines. In truth, such a definition may never be achievable due to the varied medical and complementary medical disciplines involved (Stecco et al., 2018).

In fact, we may have need of a number of definitions - each specific to a particular discipline. This would provide the required perspective necessary for accurate descriptions, diagnosis, medical, and movement interventions, or imaging, with the disparate needs/requirements thereof.

The discussion surrounding the definition of fascia and the fact that the current definition does not include bone is not merely one of semantics. The term fascia not including bone is, in my professional opinion, misleading; and misleading language has a habit of confusing our thinking while inhibiting alternative views of any given problem.

It is, for me, less important what a person thinks compared to how a person thinks. How we think about bone and continuity is vital to appreciating the inner wisdom of our human form.

Even if we restrict fascia to the reserve of ligaments, sheets, and aponeuroses, we would still require a universal term to reflect how we are capable of moving. Bone deserves special consideration, as it is vital to the musculoskeletal continuum but also, due to its embryologic development, is a condensation within the fasciae. The periosteum is not simply the next border or the next thing in sequence (that would be "contiguous"). Bone is "continuous" with the bone matrix. The Sharpie's fibers do not merely penetrate into bone, they become the bone matrix. If fascia is a continuum, as described by the IFRC committee, then the ligaments and tendons (by their definition of "fascia") must continue on into the interstices of the bone and the bone matrix and out the other end.

The kidney, liver, spleen, and pancreas are enmeshed in fascia but are not themselves fascia. However, the bone as fascia is part of the locomotor system while other organs are evidently not. Bone is undoubtedly the continuum of the muscles, tendons, and ligaments (in series as described by van der Wal), structurally and physiologically. It is where the compression occurs within our fascial net.

Anatomists use terminology to describe muscles, nerves, and others structures from the anatomical position. We reference these structures using specific terms dictated by the rules governing the use of those terms defined by agencies such as The Federative Committee on Anatomical Terminology (FCAT). FCAT was established by the General Assembly of the International Federation of Associations of Anatomists as recently as 1989.

The words making up medical terminology often cause confusion to the medical student or student physiologist starting out.

The language of anatomy is more often than not rooted in Arabic, Latin, French, or Greek. One assumes that professionals involved in the study of "muscles" do not truly believe they have mice running under their skin (muscularis) or that a sea monster (hippocampus) resides in the medial temporal lobe of the brain or that our hip joint is a vinegar bowel (acetabulum).

A cursory survey of a number of medical dictionaries complemented by a wide sweep of various medical based internet sites clearly demonstrates that bone is considered, and promoted widely, as "a rigid organ" and therefore not at all similar to the "soft tissues". Bone viewed as hard and separate from the "muscular system" has been the norm since at least the days of Galen of Pergamon (129AD-c 210 AD) and possibly earlier since the time of Erasistratos (*ca.* 290 BC). Yet a hint at the continuity of our form is reflected in the term "musculoskeletal system," a much used phrase in texts including modern and older anatomy tomes. The English noun "bone" has its origin in describing a "tusk" or hard animal tissue relating to the skeleton. The phrase "working your finger to the bone" can be traced back to the early 1800s while the expression "have a bone to pick" dates back earlier to 1560 supporting the use of the word in common phraseology. Research into the etymology of the word bone suggests it relates to the core or a deeply ingrained part of a structure and hence

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the idiom “I felt it in my bones” or “close to the bone” (Merriam-Webster). “Eous” is a Latin adjective suffix with the meanings “composed of” or “resembling, having the nature of”. Os refers to bone and hence combining these we get “osseous”.

This *“letter to the editor”* calls into question the current definition of “fascia” and its impact in creating a bridge that connects the numerous but allied disciplines in medicine. This author would also shed light on the importance that fascia garners among the movement and bodywork professionals (i.e. the complementary medical therapists) who see the body from a global, wholistic view. It is interesting to note key words and phrases chosen as an integral part of the definition, one assumes chosen with great care and considerable discussion, such as “three-dimensional continuum”, “permeate”, and “collagen containing”. The language used specifically paints a picture of the fascial system surrounding, interweaving between and interpenetrating in a manner that provides integrity to specific organs, muscles, nerve fibers, and even bone.

It is, however, surprising that bone would not specifically be considered fascia based on the current criteria for inclusion. Considering the advantages gained when one takes into account *“muscular force transmission and proprioception”* (Schleip et al., 2012).

What exactly constitutes ‘fascia’ or ‘a fascia’ or a ‘connective tissue that is not fascia but is an integral “part” of the ‘fascial system’? Would readers consider epimysium, perimysium, and endomysium to be ‘fascia’ or are they merely ‘connective tissue’? (The most common retort when it is suggested that bone should be considered fascia is the old axiom *“all fascia is connective tissue but not all connective tissue is fascia”*). According to Standring's latest edition of Gray's Anatomy (41st Edition-2016) only epimysium meets the definition of fascia. A significant number of professionals in the bodywork and movement communities would, I suspect, be confused and most possibly disappointed with such a distinction.

One recognises that a need existed to establish an agreed vocabulary for identifying specific structures such as the ‘iliotibial band’. Thus, when conversing with a colleague, both individuals can be confident they are speaking about the same structure and location (in this case located at the thigh) and not confused by some other, possibly similar, connective tissue located in a different geographical or anatomical location.

Combing the name of so-called bony attachments, suggesting the attachment point of a structure to the skeleton (ilio from “ilium” and tibial from “tibia”), results in a type of GPS system and should not be confused with the need to “define” a tissue. If the iliotibial band were not a fascial structure, it would still be the iliotibial band. A significant aspect of the argument for bone as fascia is that muscles and their associated fascia do not “attach” to bone. Bones are “continuous with” (Sharkey and Avison, 2015) and “floating within” the softer connective tissues (Levin, 2006).

Regarding the model of tensegrity as a body-wide interconnected tensional network, Schleip et al. (2012) posed the question *“what constitutes the compressional-resistant struts in the human body, and what makes up the continuous network of elastic bands”?*

There is a problem with this well-intended question in that the narrative suggests that there is “one continuous network” and “one that is not continuous”. This reductionist and separatist description only works in a tensegrity model but not in a biotensegrity structure. In other words, if we use the tensegrity model as a reflection of the human form then bones would be discontinuously represented by the “struts” while fascia would be represented by the elastic element reflecting “the continuous member” of a two-member structure. This is not how humans are constructed.

Humans do not have “two” but rather “one” continuous member providing specialisation along its continuum. Why is this the case? Due to the undeniable fact that we grew ourselves. We emerged from within, self-developing, self-organizing, self-emerging, unified as one organized spectrum of connective tissue with specialisation and condensation. Such condensation is a specific response to genetic and epigenetic factors. These factors include, most importantly, tension and compression. Without the contribution of bone as a continuity of the various fasciae the necessary mechanical stimuli necessary for mechano-metabolic processes leading to growth factors, production of cytokines, and the overall dynamic required for a healthy cell environment would simply not occur. If bone was not an essential and core constituent of the fasciae, our entire connective tissue system would not receive the necessary forces that act as the stimulus for cellular activity, metabolic processes, proprioception, and overall physiology (Cukierman et al., 2002).

According to Wagner and Aspenberg (2011) *“Bone originated as mineralization around the basal membrane of the throat or skin, giving rise to tooth-like structures and protective shields …. Thus, even in man, there are still similarities in the molecular regulation of skin appendages and bone”*. Bone, as we know it today, did not simply appear overnight but gradually developed over millennia reflecting minute changes as were required in response to the pressures of the environment. This specialisation of the connective tissue matrix is a reflection of fascia's plasticity and ability to differentiate (Halstead, 1969).

An argument for considering “bone as fascia” is the reality of the tissue continuum and its specialty along that continuum (Sharkey and Avison, 2015. van der Wal, 2015) providing specific mechano-biological vibrational frequencies resulting from cell-specific stimuli translated via mechanotransduction into subtle energy communication (Oschman, 2015). These oscillations and energy exchanges are essential for the structure–function relationship of the fasciae in the context of its physical and biological make-up. In fact, it has widely been acknowledged that the development or genesis of an inner skeletal system was crucial in developing a myofascial system (i.e. muscular system- Ruben and Bennett, 1980).

Another argument supporting ‘bone as fascia’ is the chemical stability provided by the building blocks of calcium hydroxyapatite. Bone is essentially an amalgamation of triple helical collagen fibrils and mineral carbonated hydroxyapatite constituted for energy efficiency yet with low weight. The cellular structure of fascia adapts its architectural and material preferences. Laying down precise materials to meet the location-pecific mechanical demands results in the constructing of gothic cathedral and struss-like structures, such as seen in trabecular bone. Bone as fascia requires a greater densification and specific biotensegral architecture to facilitate its role in human movement, physiology, and metabolism.

I end with a short quote from Japp Van der Wal (2015) whose shoulders I stand upon: *“Connection, context, architecture is the item. But then you come to problems as an anatomist who learned (and teaches) that muscles and ligaments and bones are discrete elements. They are not”.*

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