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Defining the fascial system

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ABSTRACT

Fascia is a widely used yet indistinctly defined anatomical term that is concurrently applied to the description of soft collagenous connective tissue, distinct sections of membranous tissue, and a body pervading soft connective tissue system. Inconsistent use of this term is causing concern due to its potential to confuse technical communication about fascia in global, multiple discipline- and multiple profession-spanning discourse environments. The Fascia Research Society acted to address this issue by establishing a Fascia Nomenclature Committee (FNC) whose purpose was to clarify the terminology relating to fascia. This committee has since developed and defined the terms *a fascia*, and, more recently, *the fascial system*. This article reports on the FNC's proposed definition of *the fascial system*.

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1. Introduction

Fascia is a widely used anatomical term yet its minimal, inexact and ambiguous definition confounds clear recognition of this fundamental body part (Mirkin, 2007). Over time, this term has, for example, diversely alluded to: a membranous tendon (Cruveilhier, 1844); a membranous part (Hall 1788); a strong aponeurotic band (Cruveilhier, 1844); a distinct section of dense fibrous tissue, and membranous tissue enveloping internal organs (Godman, 1824); a distinct, superficial or deep layer of connective tissue (Ellis, 1840); a distinct (i.e., aponeurotic or fibro-areolar) type of connective tissue (Gray, 1858); a global connective tissue system (Still, 1899); 'a sheath, sheet, or other dissectible mass of connective tissue' (FCAT, 1998); and 'the soft tissue component of the connective tissue system that permeates the human body forming a whole-body

continuous three-dimensional matrix of structural support' (Findley and Schleip, 2007). This single word accordingly identifies several different types of body part, which makes sense of Standing's (2016) assertion that *fascia* is effectively a 'generic,' rather than scientifically precise, anatomical expression.

Whether or not we personally agree with all of the (above-mentioned) meanings associated with *fascia*, it appears, in the words of Thomas Myers,¹ that 'the F-word has escaped its traditional confines. *Fascia*, like the genie in the bottle, has escaped its [conventional] medical meaning.' Also, as explained by Robert Schleip,² 'the media as well as many clinicians are frequently using the term *fascia* in unconventional ways. Nowadays, the media play a large part in shaping public thinking, so their unconventional use of this term is already having a widespread effect, especially considering the recent steep growth in publications relating to *fascia*.'

In a practical sense, the co-existence of several differing meanings for *fascia* appears to have triggered the development of a problematic tension between traditional 'scientific' (precise,

Definition of key terms used in this article: Anatomical term, Technical word or expression that refers to a specific part of the body; Anatomical terminology, Practical vocabulary of commonly used anatomical terms; Anatomical nomenclature, Officially approved terminological system intended to normalise use of anatomical language.

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¹ Myers made this claim during the FNC 'Anatomy Consensus Meeting,' held on 19 September 2015 prior to the Fourth Fascia Research Congress (FRC4), near Washington D.C.

² Schleip explained this at the same (10 September 2015) FNC meeting.

anatomically descriptive) and relatively recent 'holistic' (more expansive, functionally oriented) interpretations of this term. Concern has been expressed that imprecise, inconsistent, and or indiscriminate use of this term in reference to a variety of connective tissue parts (rather than one specific type of part) may be confusing international communication, research, and medical education relating to fascia (Wendell-Smith, 1998; Langevin and Huijing, 2009; Schleip et al., 2012a; Kumka and Bonar, 2012). In these professional contexts, it is vital that every anatomical term (such as *fascia*) unambiguously relates to one and the same body part. An editorial in this journal that highlighted this worry (Stecco, 2014) attracted feedback from several members of the interdisciplinary fascia research community, who mutually acknowledged that the language being used to describe fascia requires some remedial attention (Chaitow, 2014; Kumka, 2014; Langevin, 2014; Myers, 2014a; Natale et al., 2014; Schleip and Klingner, 2014; Tozzi, 2014; Adstrum, 2015).

The Fascia Research Society (FRS) responded to this issue by establishing a 'task force' (Langevin, 2014) – the Fascia Nomenclature Committee (FNC) - charged with improving the language relating to fascia. A preliminary discussion that aimed to establish a consensus understanding on this matter was conducted (during late 2014 - early 2015) using the 'Delphi Method,' an interactive structured communication technique³ (Stecco and Schleip, 2016). While those involved were unable to reach a precise consensus agreement about fascia's definition, their deliberations revealed that fascia is concurrently perceived in two main ways (i.e., morphological and functional) within the interdisciplinary fascia research community environment (exemplified in Tables 1 and 2). Furthermore, their advocates' divergent investigative interests mean their terminological requirements are not wholly congruent with each other. Consequently, as Stecco and Schleip (2016) explain, the morphological researchers are best suited by a

'narrower' style definition of fascia 'such as the one proposed by FCAT (Federative Committee on Anatomical Terminology (1998))', whereas if 'one intends to investigate functional aspects – such as force transmission or sensory capacities - then a wider definition of fascia tends to be more helpful.'

Importantly, the FNC recognised that conventional (anatomical) fascia-relating language lacks the linguistic capacity required to effectively discuss fascia's morphology, architectural distribution, material properties, and physiological roles (e.g., mechanical force transmission, sensory capacity) from a more holistic ideological position. For many proponents of this 'functional' perspective, several fibrous structures (e.g. aponeuroses, ligaments, tendons, retinacula, joint capsules) that have traditionally been depicted as existing separately from fascia are now portrayed as different aspects of a unitary global fibrous tissue network (or fascial system). In the absence of the language to differentiate between them, the word *fascia* is currently (paradoxically and often incompatibly) being applied to each of these two very different ways of comprehending fascia - i.e., reductionist/descriptive and holistic/heuristic (Adstrum, 2015). Little wonder people are getting confused!

This group's preliminary finding was reported (by Robert Schleip) and discussed at the FNC meeting held in Washington D.C. on 19th September 2015, immediately prior to the Fourth Fascia Research Congress (FRC4). Jointly chaired by Carla Stecco (Italy) and Robert Schleip (Germany), the meeting was attended by 15 voting fascia researchers (from Australia, Austria, Britain, France, Germany, Holland, Italy, New Zealand, Turkey, and United States of America), and 4 non-voting observers (from Austria and Germany). Following some lively discussion, this meeting's participants agreed to the necessity of developing two new definitions that, together, equitably represent how fascia is largely known within the interdisciplinary fascia research community. The first was required to tangibly relate to the distinct (dissectible) sections of fascial tissue that have been traditionally been known as *fasciae* (singular, *fascia*). It needed to be a precisely couched 'scientific term' that could conceivably be rationally used to identify individual fasciae within

scholarly discourse. According to Carla Stecco,⁴ having this type of definition is essential because, 'it permits anyone to know exactly what we're talking about when we use a particular term. It permits the in vivo study of fascial layers with imaging technology. It permits isolation of these layers in cadavers, and the performance of histological and mechanical studies. It permits sampling of these layers during surgery to evaluate pathological alterations. And, it permits comparison of results of studies performed by different groups' (i.e., review and meta-analytical studies).

The other looked-for definition had to have a more expansive focus, in order to address fascia research community's recently recognised need to be able to explain a hypothesised global fascial system (net, web) in functional terms. Use of this term has previously been mooted by Luigi Stecco (2004 pp. 19–20), who suggested it could precisely relate to 'the system of fibrous connective tissues that influence one another reciprocally throughout the whole body' (2004, pp. 19–20). This term has also, more recently, been incorporated in Carla Stecco's *Functional Atlas of the Human Fascial System* (2015).

By the end of this FNC meeting, most members agreed upon a precise definition for a new anatomical term, *a fascia* (see Stecco and Schleip, 2016 for more information about this). This concept (see below) and the way it is portrayed are deliberately aligned to the way fascia is defined on page 33 in the *Terminologia Anatomica* (FCAT, 1998; Federative International Programme on Anatomical Terminologies [FIPAT] 2011), yet (hopefully) helps to make its meaning more clear. The FNC-proposed definition for *a fascia* was submitted to, and is now being considered by, FIPAT.

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.

At the conclusion of the Washington FNC meeting, a subcommittee of five members were appointed and charged with progressing the development of a broader, functional definition of the *fascial system*.

It was recognised that this term needed to:

- Reflect developments in accrued scientific knowledge of fascia
- Correspond to the ways fascia is diversely perceived and discussed within an emergent interdisciplinary field of fascia-relating discourse
- Specifically relate to 'a network of interacting, interrelated, interdependent tissues forming a complex whole, all collaborating to perform movement' (Stecco and Schleip, 2016)
- Be accurate, taxonomically coherent, and free of ambiguity
- Logically relate to the preexisting system of anatomical nomenclature, which has been painstakingly (and very valuably) developed under the auspices of the International Federation of Associations of Anatomists throughout the past century

The process of developing this new definition is reported below.

2. Method

This job was initially assigned to a subcommittee of five FNC members, who attended the pre-FRC4 Anatomy Consensus Meeting – Carla Stecco (Italy); Robert Schleip (Germany); Can Yucesoy (Turkey); Sue Adstrum (New Zealand); and Paolo Tozzi

(Italy), who withdrew and was replaced by Gil Hedley (USA) in March 2016. They were charged with developing a 'functional' definition for the *fascial system*.

The definition development process, substantively facilitated by Robert Schleip, largely occurred during several long teleconference meetings (January to June 2016), and numerous, detail-clarifying emails. A preliminary definition of the *fascial system* was completed in September 2016, and was then circulated among FNC members with a request for their feedback on its suitability.

3. Result

The definition ultimately proposed by the subcommittee is:

The fascial system 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, adventitia and neurovascular sheaths, aponeuroses, deep and superficial fasciae, epineurium, joint capsules, ligaments, membranes, meninges, myofascial expansions, periosteum, retinacula, septa, tendons, visceral fasciae, and all the intramuscular and intermuscular connective tissues including endo-/peri-/epimysium.

The fascial system interpenetrates and surrounds 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.

4. Discussion

4.1. Why this definition was constructed this way

4.1.1. Holistic viewpoint

This original definition of the *fascial system* espouses the holistic perspective that is evident, for instance, in several 'functional' definitions of *fascia* (see Table 2), especially including the Fascia Research Congress definition seminally proposed by Findley and Schleip (2007). This big-picture view is prerequisite to examining the complex morphology and dynamic functioning of this whole-body anatomical entity from a variety of perspectives.

4.1.2. Continuum

The word *continuum* was selected because it highlights the fascial system's three-dimensional continuity of form, which is essential for understanding the fascial system's functional contribution to the generation and transmission of mechanical strain, and other forms of bodily information (e.g., neurological, biochemical). This term is congruent with the continuousness of fascial tissue and long-observed by several anatomists who have specifically studied this subject (e.g., Bichat, 1813; Still, 1899; Godman, 1824; Gallaudet, 1931), and reinforced by histologists' Ross and Pawlina's explanation that, 'Connective tissue forms a vast and continuous compartment throughout the body' (2011, p. 158). According to Jean-Claude Guimberteau,⁵ perceiving fascia (fibrous tissue) as 'a tensional continuous fibrillar network' makes it possible to comprehend fascia, and the body that contains it, 'in a new way.' In the past, he explains, dissection-based anatomy and surgery research has primarily focused on the identification and anatomical description of distinct fascial parts, whereas the use of new research technologies, such as endoscopic micro-videography, reveals fascia as a 'chaotic fibrillar

network,' with a dynamically changeable polyhedral architectural structure.

Recognition of fascia's intrinsic continuity is linked to this definition's open-ended incorporation of several anatomical parts (e.g., ligaments, meninges, tendons) that are fundamentally regarded as 'fascial' by many FRS/FRC community members - scholars and (manual, medical and movement) health practitioners, whose experienced knowledge of fascial continuity powerfully underpins their everyday work. The second sentence of this definition intentionally contains the terms 'such as' and 'including' in order to signal that this list of body parts, which identifies a broad range of fascial system elements, is not necessarily complete. For some scholars, this list may seem too liberal, yet others will argue that it is too short and should, for example, additionally include some more vascular parts, or the perineuria. At the end of the day, however, the purpose of a definition is to define a concept - in this instance, *the fascial system* - as succinctly as possible. This fundamentally entails determining the boundary, or spatial extent, of what constitutes *the fascial system* (which is in effect a socio-biological construct), but does not allow for the linguistic luxury of specifically mentioning each and every body part regarded by some (and perhaps debatably so) as fascial in nature.

Several alternative words (*net*, *web*, or *matrix*) that have recently appeared in the fascia-relating literature (e.g. Myers, 2014b; Schleip et al., 2012b; Schultz and Feitis, 1996) were considered as they implicitly convey a similar meaning to *continuum*, but were passed over as they do this in a less direct manner.

4.1.3. Histological aspects of the fascial system

Fascia is fundamentally composed of 'soft, collagen-containing, loose and dense fibrous connective tissues that permeate (i.e. are spread throughout) the body.' This part of the definition is based on established histological recognition of *connective tissue* as a basic tissue type, which is taxonomically sub-divided into three categories - *embryonic connective tissue* (mesenchyme, mucous connective tissue), *connective tissue proper* (loose and dense connective tissue), and *specialised connective tissue* (blood, bone, cartilage, adipose tissue, hemopoietic tissue, lymphatic tissue) (Ross and Pawlina, 2011). From this classificatory perspective, fascia is generally regarded as a form of *connective tissue proper*, although its specific sub-identification as *loose connective tissue*, and/or 'regularly' or 'irregularly' arranged *dense connective tissue* has yet to be made clear. This definition's use of the plural *connective tissues* recognises that, on a histological level, the fascial system is constituted from several, rather than just one, types of connective tissue - e.g., areolar, dense regular/irregular, adipose.

In recent years, the histology profession has increasingly favoured the term *connective and supporting tissue* over *connective tissue* (Young et al., 2014; Federative Anatomical Programme on Anatomical Terminologies [FAPAT] 2008). However, the proposed definition for the *fascial system* relates to the traditional term, *connective tissue*, in order to enable discussion about the fascial system's role in tensional force transmission (rather than only, as in the past, primarily compressional stabilisation, for which bones and other elements are more specialised) and also because this is how this tissue type is typically known within the FRS/FRC community.

The word *soft* distinguishes fascial connective tissue from cartilage and bone, both of which are tangibly harder and differently specialised forms of connective tissue. The term *soft tissue* was chosen instead of others (e.g., *fibrous tissue*, *connective tissue proper*, *soft supporting tissue*), as this is the term currently advocated in the *Terminologia Histologica* (FAPAT, 2008).

Again, the term *collagen-containing* deliberately distinguishes fascia from muscle, which is frequently categorised separately as another 'specialised' form of soft tissue. This general reference to

collagen implicitly includes Types I & III, and leaves the door open for whatever other collagens may (in the future) be found to significantly feature in this broad group of tissues.

4.1.4. Fascial function

The phrasing of the definition's recognition that the fascial system 'interpenetrates and surrounds all organs, muscles, bones and nerve fibers,' is copied from Findley and Schleip's widely used FRC definition of fascia (2007), with their knowledge and permission. It is widely accepted that the fascial system may additionally fulfil several other important functions in the body - including (but not limited to) architectural/structural, neurological functions, biomechanical force transmission, morphogenesis, and cellular signal transmission (Schleip et al., 2012b). Yet, in the interest of brevity, the proposed definition of *the fascial system* does not attempt to identify all of fascia's presently-known functions. It deliberately only alludes to these several and wide-ranging functions in a general manner, so that it can instead focus on its goal of describing what the fascial system is - i.e., identifying its basic elements (essential parts) - from a functional perspective. Once this initial description task is accomplished, others may decide to carry on from here and begin the very useful, though possibly open-ended, task of enumerating the currently known functions of this complex body system.

5. Conclusion

The FRS/FNC's explicit intention in developing and defining this new term (*the fascial system*) has been to facilitate clear and unambiguous international, interdisciplinary, and inter-professional communication about fascia. The authors of this article strongly recommend that the terms *a fascia* and *the fascial system* are widely adopted and used in oral and written communications about fascia as they occur in bioscientific, clinical, and community health environments. Constructive feedback about this is warmly invited from this Journal's readers.

Table 1

Four traditional 'morphological' definitions of *fascia*.

Terminologia Anatomica *Fascia* consists of sheaths, sheets or other dissectible connective tissue aggregations ... [This term] includes not only the sheaths of muscles but also the investments of viscera and dissectible structures related to them. (FIPAT, 2011, p. 33)

Gray's Anatomy *Fascia* is a term applied to masses of connective tissue large enough to be visible to the unaided eye. Its structure is highly variable but, in general, collagen fibres in *fascia* tend to be interwoven and seldom show the compact, parallel orientation seen in tendons and aponeuroses. (Standring, 2008, p. 39)

Dorland's Illustrated Medical Dictionary *Fascia* [is] a sheet or band of fibrous tissue such as lies deep to the skin or forms an investment for muscles and various other organs of the body. (Anderson, 2012, p. 679)

Stedman's Medical Dictionary *Fascia* [is] A sheet of fibrous tissue that envelops the body beneath the skin; it also encloses muscles and groups of muscles and separates their several layers or groups. (Stegman, 2006, p. 700)

Table 2

Four holistic 'functional' definitions of *fascia*.

Fascia Research Congress *Fascia* is the soft tissue component of the connective tissue system that permeates the human body forming a whole-body continuous three-dimensional matrix of structural support. It interpenetrates and surrounds all organs, muscles, bones and nerve fibers, creating a unique environment for body systems functioning. The scope of our definition and interest in *fascia* extends to all fibrous connective tissues, including aponeuroses, ligaments, tendons, retinacula, joint capsules, organ and vessel tunics, the epineurium, the meninges, the periosteal, and all the endomysial and intermuscular fibers of the myofasciae. (Findley and Schleip, 2007, p. 2)

The *fascia* is a tough connective tissue that spreads throughout the body in a three-dimensional web from head to foot functionally without interruption ... The fascial system surrounds, infuses with, and has the potential to influence profoundly every muscle, bone, nerve, blood vessel, organ, and cell of the body. *Fascia* also separates, supports, connects, and protects everything. This three-dimensional web of connective tissue is alive and ever changing as the body demands. Thus it is a network for information exchange, influencing and influenced by every structure, system, and cell in the organism. Like air and gravity, its influence is so all-pervasive that we have tended to take it for granted. (Barnes, 1990; pp. xi & 3)

The fasciae constitute an uninterrupted sheet of tissue that extends from the head to the feet and from the exterior to the interior. This is a perfectly continuous system that is suspended from bony structures to form a fully integrated supporting framework. The ubiquitous fasciae not only invest the external surface of all the body's diverse structures – muscles, organs, nerves, vessels – but also form the internal matrices which support these structures and maintain their integrity. (Paoletti, 2006, p. xiii)

Fascia is an uninterrupted viscoelastic tissue which forms a functional 3-dimensional collagen matrix. It surrounds and penetrates all structures of the body extending from head to toe, thus making it difficult to isolate and develop its nomenclature ... [it] is virtually inseparable from all structures in the body and acts to create continuity amongst tissues to enhance function and support. (Kumka and Bonar, 2012)

³ See https://en.wikipedia.org/wiki/Delphi_method

⁴ Stecco explained this at the Washington FNC meeting (10 September 2015)

⁴ Stated at the Washington FNC meeting (10 September 2015)

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