Atlas of Physiology of the Muscular Fascia

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Luigi Stecco

Atlas of Physiology of the Muscular Fascia

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To my wife Lena

FOREWORD

In order to understand the complexity fascial function and dysfunction, it is necessary to have an accurate appreciation of the constituents that make up these ubiquitous and versatile tissues, as well as of their coordinated physiological interactions and behaviors.

To achieve this it is suggested that a validated working model is necessary that simplifies reality.

Fortunately a number of excellent atlases and textbooks now exist that offer images of the architecture of fascia, from the microscopic to the macroscopic. What has been missing, however is a comprehensive English language description of the normal physiology of fascia: how it behaves in normal circumstances, as well as how to accurately and systematically identify both the nature and location of fascial dysfunction.

In this extensive and detailed text, Luigi Stecco, offers specific practical insights that merge appreciation of the anatomy and physiology of the multiple elements that make up myofascial biomechanical structures and how these operate in the body to produce integrated stability and movement, when operating normally.

Most importantly, from a clinical perspective, he then describes a wide range of reasoned functional assessment protocols that are able to identify and localize dysfunctional fascial features, whether these involve unidirectional, bidirectional or multidirectional myofascial actions and activities.

Symptoms associated with altered motor control, reduced ranges of motion and/or pain, may result from dysfunctional fascial features, including increased local densification (tissue stiffness) and/or altered sliding functions. Importantly, such changes need to be appreciated as being largely reversible – involving as they do altered function, but not necessarily pathology.

It is the well-thought-out descriptions of accurate, reproducible and practical evaluation methods, capable of leading to the identification of the locations of such changes, that makes Luigi Stecco's work so important. Critically, numerous studies have emerged that validate the reliability of the protocols associated with Fascial Manipulation®, the therapeutic method that has evolved from Stecco's years of dedicated research.

While a variety of methods of treatment and rehabilitation of painful and dysfunctional fascial structures have been proposed and studied, there are relatively few approaches that offer accurate identification as to which tissues and structures may be involved, or precisely where these are located.

The methods described by Stecco, in the objective examination process that leads to the identification of areas of fascial dysfunction, involve both palpatory assessments as well as functional movement tests that systematically evaluate and record the results of controlled movements in the sagittal, frontal and horizontal planes, involving all areas of the body.

These objective assessment methods are coupled with a subjective evaluation, incorporating factors such as age, trauma history, patterns of use in work and leisure activities, as well as previous medical history.

Using a combination of the results that emerge from both the objective and subjective examinations, a working hypothesis emerges on which subsequent treatment is based. The tests used are then repeated, following treatment, in order to evaluate functional and symptomatic changes. In this beautifully illustrated work Luigi Stecco has distilled his years of research into a carefully-crafted textbook that offers insights and practical guidelines, that are of immense potential value to practitioners and therapists of all schools - and for this he deserves our praise and profound thanks.

Leon Chaitow
Honorary Fellow, University of Westminster, London
Editor-in-Chief,
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INTRODUCTION

Since 1543 (Vesalius, *De humani corporis fabrica*) until now numerous studies have been conducted on the anatomy and physiology of the musculoskeletal apparatus but overall the muscular fascia has been overlooked.

An image of Vesalius is reported on the cover of this atlas. The drawing represents the four new proposals on the anatomy and physiology of the fascia reported below:

- *Unitas* or myofascial (MF) unit, the chosen example is formed by the biceps brachii and brachialis muscles (anatomy), the vectors highlighted are those formed by both muscles on the fascia (physiology);
- *Sequentia* or myofascial sequence, the sequence formed by the flexor muscles of the upper limb was emphasized (anatomy) on the drawing, the tractions produced by the muscle insertions on the aponeurotic fascia (physiology) are indicated by the arrows;
- *Diagonalis* or myofascial diagonal, it is formed by points of fusion between different fasciae (anatomy), they coordinate the intermediate movements between two spatial planes (physiology);
- *Spira* or myofascial spiral, it is formed by the spiral arrangement of several muscles and by intrafascial collagen fibres (anatomy) which together with the retinacula coordinate global motor activities or gestures (physiology).

Therefore, this atlas aims at combining, through their fascial interactions, the anatomy of muscles with the physiology of muscle spindles and Golgi tendon organs. In particular, it seeks to:

- incorporate all the motor units implementing a specific movement in the myofascial unit;
- describe the myofascial sequences moving and maintaining body posture in all three spatial planes;
- underline the interaction between the spindles and the fascia (stretch reflex) for the management of motor schemes;
- explain the role of fascia in the physiology of global motor gesture.

These premises are supported by the following findings:

1. the peripheral myofascial architecture corresponds to the motor organisation of the central nervous system;
2. in all body segments, the intrafusal muscles create vectors in the perimysial fascia that have a specular disposition to the vectors formed by the extrafusal muscles;
3. the architecture of the muscular fascia corresponds to the management of segmentary movements, posture, motor schemes and global gestures;
4. the images of anatomical dissections examined according to these new proposals demonstrate that the fascia is at the service of body movement.

The first chapter offers explanations that facilitate the understanding of the next chapters, furthermore it reports on several studies supporting this new view.

The second, third and fourth chapters respectively present the MF units and MF sequences of the upper limbs, trunk and lower limbs.

On the first page of each of the above chapters, the regional anatomical image (anterior, posterior, lateral, medial and deep) of each limb or trunk is reported. These pictures illustrate the entire limb or entire trunk with the aim of highlighting the synergy of the entire limb and not the action of a single muscle.

Besides each image is a list of the primary or monoarticular muscles, the secondary or biarticular muscles and the synergic muscles. The last two intervene in motor scheme movements and not in unidirectional movements.

On the opposite page the photographs feature the four segments of the limb or trunk. These pictures show the movements performed by the MF unit in a specific spatial plane rather than by a single muscle.

The initial anatomical drawing is repeated again on the third page. It highlights the fascial compartments encompassing the primary and secondary muscles, both are implicated in limb movement in one spatial direction. The page opposite presents a photograph of the movement executed by the sequence of muscles along the entire limb.

The next page will present the same anatomical drawing elaborated to show the vectors forming the myofascial unit.

In the opposite page the dysfunctions highlighted represent what occurs in this harmonious movement if the fascia loses its elasticity. Indeed densification of the fascia does not allow for the correct functioning of the neuromuscular spindles and consequent excitation of the muscular fibres belonging to that MF unit.

On the next page the muscle insertions on the fascia are highlighted. Through these muscle insertions on the fascia each MF unit is able to adapt its strength to that of the proximal and distal MF units when the entire limb or entire trunk is implicated in a directional effort.

The opposite page features the role played by biarticular muscles in the peripheral motor organization. These muscles move the proximal and distal joints whilst maintaining a constant angle of variation between both articulations. The Golgi tendon organs placed between the tendon fibres intervene in regulating these variables.

The last four pages of each chapter show several photographs of anatomical dissections of the fascia. These pictures provide added visual explanation.

The fifth chapter presents the peripheral motor organization through the centres of fusion (CFs) and the lines of fusion of the fasciae (myofascial diagonals). The centres of fusion manage the intervention of two or three myofascial units throughout the passage from one direction to another (segmentary motor scheme). The MF diagonals perform the same function as the MF sequences: they synchronise the action of the centres of fusion that participate in movement of the entire limb or trunk along an intermediate trajectory between two spatial planes (global motor schemes).

The sixth chapter takes into consideration the helicoidal fibres (spiral) included in the aponeurotic fasciae. The retinacula of the ankle and wrist are the starting point of these spirals. The small muscles of the hands and feet take origin on these retinacula. The movements of these extremities create tractions on the helicoidal collagen fibres that spread in a distal-proximal direction along the aponeurotic fascia.

The spiral collagen fibres coordinate the recruitment of muscles having an opposite direction between two contiguous segments, as is the case in complex motor gestures.

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GENERAL INDEX

ABBREVIATIONS

Ia II	primary, secondary spindle afferent
an	ante i.e. forward movements
an-ca	ante-carpus or flexion of the wrist
an-th	ante-thorax or forward flexion
an-la-cl	motor scheme of ante-latero collum
an-la-di	motor scheme of the hand
an-me-	motor scheme of ante-medio…
bi	bilateral, both right and left
ca	carpus, wrist
CC	centre of coordination of the myofascial unit
cl	collum, cervical region
CF	centre of fusion
CP	centre of perception and site of pain
cp	caput, head, face and cranium
cu	cubitus, elbow
cx	coxa, thigh-hip
di	digiti, fingers, I-II-III-IV-V
er	extra, extrarotation, eversion
er-ta	extra-talus, extrarotation of talus, pronation
ge	genu, knee
hu	humerus, distal shoulder
ir	intra, intrarotation, inversion
ir-ta	intra-talus, intrarotation of talus, ankle supination
la	latero, lateropulsion
la-ca	latero-carpus, lateral deviation of the wrist
la-cl	latero-collum, lateral flexion of the neck
LL	lower limb
lt	left, limb or trunk
lu	lumbi, lumbar
m.	muscle, muscles
me	medio, mediopulsion, medial
me-cl	medio-collum, bring back to the centre
MF	myofascial, unit, sequence, spiral
n.	neuron
pe	pes, foot, tarsus, metatarsals, toes
pv	pelvis, pelvic girdle
re	retro, retropulsion, backwards
re-ca	retro-carpus, extension wrist
re-la-	motor scheme of retro-latero-
rt	right, limb or one side of the body
sc	scapula, proximal shoulder
ta	talus
th	thorax
TP	trigger point
TR	trunk
UL	upper limb