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with the collaboration of
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Atlas of Anatomy and Physiology of the Internal Fasciae

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FOREWORD

After 20 years of clinical practice experience, I got acquainted with the method “Fascial Manipulation” by Luigi Stecco and was amazed by the possibilities that the method opens up for the treatment, rehabilitation and prevention of injuries of the musculoskeletal system and dysfunctions of internal organs.

The method “Fascial Manipulation” is based on fundamental knowledge in the field of human anatomy and physiology and it is very encouraging that scientific research continues today, enriching clinical experience.

The presented knowledge and results force us to completely rethink the anatomy and functions of the autonomic nervous system. The role of internal fasciae in the correction of functional disorders of internal organs prove that the sympathetic and parasympathetic nervous systems are not antagonists.

During the rehabilitation period after musculoskeletal surgery, as a rule, the emphasis is made on physiotherapy and kinesiotherapy. However, this does not always allow to achieve a long-lasting result – patients often start to complain of various internal organs dysfunctions. This problem can be solved by understanding and consequent clinical application of the internal biomechanical model presented by Luigi Stecco, which is based on the motility and mobility of internal organs directly related to the autonomic nervous system and, of course, to the state of the fascial tissue of internal organs and muscles. This understanding makes the use of peristaltic therapy very effective. Proper coordination of the autonomic nervous system, three types of nerves – splanchnic nerve, vagus nerve, phrenic nerve – and fascial tissues improves peristalsis of internal organs by increasing their living space.

The brain must have an accurate and effective perception of the body which is very important for its survival, therefore, thanks to reflexology, manual therapy of the superficial fascia improves the vascularization of the dermatomere, adipotomere and lymphotomere and, as a result, there is an improvement of afferent and efferent interactions of surface structures with the central nervous system.

Despite the scientific depth, Luigi Stecco’s proposed concept is characterized by simplicity and logic. This knowledge will be useful for specialists from different medical fields and will allow achieving long-lasting results in the treatment and rehabilitation of patients.

I am sincerely grateful to Luigi Stecco, Antonio Stecco, Carla Stecco and other scientists in this field for their advanced knowledge, valuable practical experience and dedication to their mission - the preservation and restoration of human health.

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INTRODUCTION

The driving force behind writing this Atlas has been the opportunity to publish new images of the fasciae of human internal organs and to compare them with images of the internal fasciae of other animals. We are also excited to present new concepts regarding the physiology of organ-fascial units, apparatus-fascial sequences, systems and, in particular, of the autonomic nervous system.

This Atlas is divided into three parts and consists of a total of twelve chapters.

The first part starts from the first chapter, which presents the internal fasciae and a new interpretation of the microscopic autonomic nervous system. The second, third, fourth and fifth chapters address the organs within the neck, thorax, lumbar and pelvic segments. The organs within each one of these segments are united together by fasciae to form the glandular, visceral and vascular organ-fascial units (o-f unit).

The sixth chapter introduces the second part, which is dedicated to the apparatus-fascial sequences and to the autonomic nerves that originate from the central nervous system (CNS). The seventh, eighth, ninth and tenth chapters address the fasciae that connect the glandular, visceral, vascular and receptor o-f units together in a longitudinal direction.

The third part starts from the eleventh chapter, which is dedicated to the superficial fascia and the macroscopic autonomic nervous system formed by the paravertebral and prevertebral ganglia. The twelfth chapter addresses the development and the functions of the three external systems (cutaneous, adipose and lymphatic) and the three internal systems (thermoregulatory, metabolic and immune).

Our literature research regarding the autonomic nervous system (ANS) encountered some difficulties because different texts use different terms to describe the same structure. For example, in Chiarugi's anatomical text (1975), the first lines of the chapter regarding the ANS state: "Due to its anatomical connections, the autonomic or visceral or vegetative or sympathetic or greater sympathetic nervous system should be considered as an offshoot of the cerebrospinal system. The autonomic system includes I) the thoracolumbar or sympathetic system, II) the craniosacral or parasympathetic system and III) the intramural or metasympathetic system." On the contrary, as in many other anatomical texts, the physiology text by Saladin (2019) sustains that the ANS consists of two subsystems: the sympathetic system and the parasympathetic system. In English language texts, the term "sympathetic" is synonymous with the term "orthosympathetic", whereas Chiarugi uses the term "sympathetic" as synonymous to the "autonomic system". In this Atlas, the terms "sympathetic" and "autonomic nervous system" (ANS) will be used to indicate the entire autonomic system.

According to which prefix (ortho, meta, adeno or para) is associated with the suffix "sympathetic", the meaning is modified as follows:

- metasympathetic system: indicates the intramural neuronal network that has the role of activating smooth muscles within the walls of the internal organs (myenteric autonomic nervous system)
- orthosympathetic system: excitomotor stimuli that are conducted by splanchnic nerves and are directed to the kidneys and the smooth muscles of the blood and lymphatic vessels
- adenosympathetic system: excitomotor stimuli that are conducted, in part, by the phrenic nerve and are directed to the glandular capsules and glands (from Greek, *aden* = gland)
- parasympathetic system: excitomotor stimuli conducted by the vagus nerve and, in particular, directed to the intramural ganglia of the respiratory and digestive apparatus.

The autonomic system can also be divided into two parts according to size and function:

- the microscopic autonomic system, which, in turn, includes the intramural or metasympathetic neuronal network and the extramural ganglia situated in the insertional fasciae
- the macroscopic autonomic system, which, in turn, includes the paravertebral and prevertebral autonomic ganglia. These ganglia connect with the CNS via the vagus, phrenic and splanchnic nerves.

The macroscopic ganglia are influenced by stimuli coming from the medulla oblongata and the hypothalamus. Hence, they do not have a completely autonomous activity because they act in response to stimuli that come from the CNS.

NEW TERMINOLOGY

Adenosympathetic	Autonomic component connected to the functions of the glandular sequence. The stimuli originate from the medulla oblongata and the hypothalamus and are conducted by the phrenic nerve
Adipotomere	Quadrant of adipose tissue between the dermis and the deep fascia; the boundaries of a quadrant are formed by thickenings of the superficial fascia
Advanced autonomic centres	Advanced nuclei that have formed in the hypothalamus for the control of internal autonomic systems, namely: thermoregulatory, immune and metabolic systems
Archaic autonomic centres	Primitive nuclei of the medulla oblongata responsible for the central control of the intramural ganglia of the visceral, vascular and glandular sequences
Catenary	Union of four tensile structures of the trunk to form a chain of longitudinal tension that continues with the tensors of the limbs
Catenaries of the head	Fasciae connected with the receptor apparatus (photoreceptor, mechanoreceptor and chemoreceptor) and, thereby, have a function of control over the entire body
Catenaries of the trunk	Lines of fusion of the muscles that cover the anterior and posterior trunk; they are like chains that hang from the shoulder and pelvic girdles
Dermatomere	Quadrant of the dermis and epidermis innervated by a specific cutaneous nerve for exteroception or, in other words, for the perception of touch, cold and heat
Diagonals	Coincide with intermuscular septa and intermediate lines between two myofascial sequences; diagonals manage the passage of movement from one plane to another
Fascia, aponeurotic or fibrous lamina	Fascia that surrounds the limbs; formed by collagen fibres arranged longitudinally (mf sequences), transversally (mf diagonals) and obliquely (mf spirals)
Fascia, deep or muscular	General term that includes both the aponeurotic and epimysial fasciae. The muscular fascia of the trunk is divided into three laminae: superficial, middle and deep
Fascia, epimysial or connective tissue sheath	Connective tissue membrane that adheres to the muscular tissue and is continuous with the perimysium (CC of mf unit) and the endomysium
Fascia, superficial or hypodermis	Formed by the retinaculum cutis superficialis (rich in adipose cells), a membranous layer or true superficial fascia and the retinaculum cutis profundus
Fasciae, parietal or insertional	Fasciae forming the mesenteries that attach (or insert) the internal organs onto the trunk walls; therefore, it is more appropriate to call them insertional fasciae
Fasciae, visceral or investing	Fasciae that adhere to the viscera; given that they also cover vessels and glands, it is more appropriate to call them investing fasciae
Fasciatomere	Sector of the deep fascia containing nerve endings that are responsible for proprioception or the perception of movement in a particular direction
Lymphatomere	Lymphatic component (capillaries, ducts and lymph nodes included in a quadrant of the hypodermis)

Metasympathetic	Functional component of the autonomic system responsible for the activation of the smooth muscles (peristalsis) in a single segment of viscera, vessel or glandular duct
Orthosympathetic	Autonomic component connected with the functions of the vascular sequence; the stimuli originate from the medulla oblongata and hypothalamus and are conducted by the splanchnic nerves
Parasympathetic	Autonomic component connected with the functions of the visceral sequence; the stimuli originate from the medulla oblongata and hypothalamus and are conducted by the vagus nerves
Pivots	Areas of transition between the trunk and the extremities: located in the neck for the head, the shoulder girdle for the upper limb and the pelvic girdle for the lower limb
Quadrant	Subdivision of the superficial fascia into four parts for every segment of the body; each quadrant includes a dermatomere, a lymphatomere and an adipotomere
Sequence, apparatus-fascial	Sectors of internal fasciae that have preferential relationships with the vessels (mesoderm), viscera (endoderm), glands (transderm) and nerves (ectoderm)
Sequence, glandular	Fasciae that synchronise the activity of the endocrine and haematopoietic glands by surrounding (or restraining) them and, thereby, form the glandular apparatus-fascial sequence
Sequence, vascular	Fasciae that extend from the head to the urethra and synchronise the activity of the vessels and kidneys by surrounding or containing them, and, thereby, form the vascular apparatus-fascial sequence
Sequence, visceral	Fasciae that synchronise the activity of the respiratory and digestive apparatus by surrounding them, and, thereby, form the visceral apparatus-fascial sequence
System, autonomic	Autonomic nervous system, which, from an anatomical viewpoint, can be divided into microscopic and macroscopic and, from a functional viewpoint, into metasympathetic, parasympathetic, orthosympathetic and adenosympathetic
Systems, external	Adipose, lymphatic and cutaneous systems connected with the superficial fascia (hypodermis) and coordinated by paravertebral ganglia via peripheral nerves
Systems, internal	Metabolic, immune and thermoregulator systems, coordinated by the hypothalamus via branches of the vagus, phrenic and splanchnic nerves that insert into the prevertebral ganglia
Tensors	Muscles of the limbs that, having originated from the trunk, absorb excess tone (hypertonus) of the trunk muscles and vice versa
Tensile structure	Covering formed by muscles that extend over the four body cavities and attach to bones, which, in turn, constitute the pivots and anchorage points
Transderm	Fasciae derived from the transverse septum during the embryonic phase that is connected with the glands of the endocrine and haematopoietic apparatus
Tunica adventitia	External fascia of vessels, capillaries excluded, that is formed by elastic fibrillar connective tissue and collagen with cells of a mesenchymal origin
Tunica serosa or serous membrane	Fascia or membrane formed by peritoneum that consists of mesothelium and a layer of dense connective tissue and unites with the tunica muscularis of the intestine
Unit, myo-fascial	Motor units, fasciae and joint capsule involved in carrying out the movement of a joint in a specific direction: ante, retro, latero, medio, intra, extra
Unit, organ-fascial	Organs, fasciae and extramural ganglia included in a segment of the trunk that, all together, carry out the visceral, vascular and glandular functions

NOMENCLATURE OF THE FASCIAE

SUPERFICIAL FASCIA

The term “superficial fascia” is often used as synonymous of the “hypodermis”. However, the hypodermis is actually formed by three layers: a superficial adipose tissue layer (SAT), a membranous layer or the true superficial fascia layer, which contains muscle fibres in some places (panniculus carnosus), and a deep adipose tissue layer (DAT).

DEEP FASCIA

The deep fascia includes the muscular fascia of the trunk (axial fascia) and the fascia of the limbs (appendicular fascia). In turn, the fasciae of the limbs are divided into aponeurotic fascia and epimysial fascia. In the trunk, the muscular fascia is subdivided into three laminae: superficial, middle and deep.

MENINGEAL FASCIA

The meninges are the investing membranes that surround the brain and the spinal cord. They are divided into leptomeninges (pia mater and arachnoid) and pachymeninges (dura mater). The latter is continuous with the epineurium, or the connective tissue sheath of the peripheral nerves.

INTERNAL FASCIAE

In many texts, the internal fasciae are called visceral or splanchnic fasciae. These terms are not appropriate because they exclude the fasciae of the vessels and the glands. In fact, according to the Basel Nomina Anatomica classification, splanchnology only includes the digestive, respiratory and urogenital apparatus. Therefore, we propose the following divisions and classifications of the internal fasciae:

- visceral fasciae or serous fasciae that are connected to the viscera, and are represented primarily by the pleura (respiratory apparatus) and the peritoneum (digestive apparatus)
- vascular fasciae or adventitia or the external tunica of the walls of blood vessels, which is formed by fibrillar connective tissue with cells of a mesenchymal origin
- glandular fasciae or connective tissue capsules derived from the septum transversum, which adheres to the liver (Glisson’s capsule), prostate (containing smooth muscle fibres) and thyroid (separated from the pretracheal fascia)
- investing fasciae that surround or contain the viscera, vessels and glands. In older texts, these fasciae are called by the limited term of “visceral”
- insertional or parietal fasciae that, after enveloping the walls of the viscera, vessels and glands, insert onto the wall of the container
- membranes, which can be mucosal, serous, synovial or meningeal membranes; the latter are formed by three layers that are arranged concentrically (dura mater, arachnoid and pia mater)
- sheaths: for example, in the neck, the vascular sheath envelops the carotid and jugular, the visceral sheath envelops the pharynx and larynx and the pretracheal sheath envelops the thyroid and parathyroids
- laminae, which are fasciae that extend in front of the thyroid (pretracheal lamina), behind the pancreas (retro-duodenal-pancreatic lamina) and between the two vascular sheaths (alar lamina).

The internal fasciae (visceral, vascular and glandular) are often indicated with different names:

- fasciae that take the name of the organs they envelop: pharyngeal fascia, oesophageal fascia, anal fascia, pharyngobasilar fascia, rectovesical fascia, renal fascia, umbilicovesical fascia, and so forth
- fasciae that are named according to their shape or position: cribriform or perforated fascia, transversalis fascia or arranged in a transverse direction; fascia dentata, as pertaining to the dentate gyrus, and so forth
- fasciae that take the name of the various anatomists that initially described them: Dartos fascia, which envelops the testicles; Buck’s fascia, which is the deep fascia of the penis; Denonvilliers’ fascia, which is the membrane located between the prostate and the bladder; Treitz fascia, which is behind the pancreas; Zuckerdandl’s or posterior renal fascia; Told’s or anterior renal fascia, and so forth
- tunica, or fascia formed by several connective tissue layers: tunica vaginalis, tunica serous and tunica adventitia. The spermatic cord is covered by three tunicae: the common tunica vaginalis or internal spermatic tunica, which is the continuation of the transversalis fascia; the erythroid tunica, which is the continuation of the internal oblique and the cremasteric or external spermatic fascia, which is the prolongation of the superficial fascia of the abdomen (De Caro, 2016).

ABBREVIATIONS

<i>Abbrev.</i>	<i>Extended form</i>	<i>Definition</i>
ACI	Apparatus, circulatory	Lesser circulation or pulmonary and systemic circulation
ACR	Apparatus, chemoreceptor	Nasal wall for olfaction and lingual surface for taste
ADI	Apparatus, digestive	Mouth, oesophagus, stomach, small & large intestine and rectum
AEN	Apparatus, endocrine	Endocrine glands and organs for reproduction
a-f	Apparatus-fascial	Sequence of two apparatus united by a specific internal fascia
AHE	Apparatus, haematopoietic	Bone marrow and other organs for production of blood
AMR	Apparatus, mechanoreceptor	Organs that transduce vibrations into perception of sound
ANS	Autonomic nervous system	Central, peripheral and myenteric autonomic systems
APR	Apparatus, photoreceptor	Apparatus for sight and three-dimensional perception
ARE	Apparatus, respiratory	Organs responsible for the exchange of gases
AUN	Apparatus, urinary	Organs responsible for the elimination of urine
CNS	Central nervous system	Includes all parts of the brain and the spinal cord
cx	Coxa or hip	Refers to the coxofemoral mf units, coxarthrosis
di	Digits, segment of the hand	Refers to the metacarpals and the five digits (I, II, III, IV, V)
ge	Genu, knee	Refers to the mf units around the knee and the knee joint
gl-cl	Glandular o-f unit in the neck	Includes the thyroid, the parathyroids and their sheath
gl-lu	Glandular o-f unit in the lumbi	Includes fascia that unites the liver, pancreas and adrenal glands
gl-pv	Glandular o-f unit in the pelvis	Includes the fascia that unites the gonads and appendages
gl-th	Glandular o-f unit in the thorax	Includes pericardium and epithelial tissue united to pericardium
hu	Humerus	Glenohumeral joint included in the mf units
la-ta	Latero-talus, astragalus	Mf unit that moves the ankle laterally
lt	Left	Left side of the trunk and of the limbs
me-pe	Medio-pes, forefoot	Mf unit that moves the forefoot (tarsus, metatarsal, toes)
mf	Myo-fascial	Combination of unidirectional motor units and their fascia
o-f	Organ-fascial	Internal units formed by organs involved in a function
o-fu	Organ-fascial unit	Organs activated simultaneously by extramural ganglia
PNS	Peripheral nervous system	Includes cranial nerves and voluntary spinal nerves
PS	Psychogenic system	Emotional and mental component
q-an-la-cl	Quadrant, ante-latero-collum	Subdivision of the superficial fascia into four parts
re-me	Diagonal, retro-medio	Resultant of tensions produced by retro and medio sequences
rt	Right	Right side of the body or of the limbs
SAM	System, adipose-metabolic	SA = superficial adipose system; SM = internal metabolic
SCT	System, cutaneous-thermoregulatory	SC = cutaneous system; ST = internal thermoregulatory system
SE-GL	Sequence, glandular	Includes the endocrine and haematopoietic glands
SE-RC	Sequence, receptor	Includes three head apparatus: photoreceptor, chemoreceptor and mechanoreceptor
SE-VA	Sequence, vascular	Includes the pulmonary and the systemic circulation
SE-VI	Sequence, visceral	Includes the respiratory and the digestive apparatus
SLI	System, lymphatic immune	SL = lymphatic system; SI = internal immune system
UL	Upper limb	All the segments of the upper arm, forearm and hand
va-cl	Vascular o-f unit in the neck	Vascular sheath that surrounds the carotid and jugular
vi-lu	Visceral o-f unit of the lumbi	Fascia that synchronises the cardia, stomach and pylorus
VNS	Vegetative nervous system	Includes central, vertebral & myenteric ganglia & plexuses

Adjacent to the photographs of the anatomical dissections there are circles that define the orientation of the various body segments.

The following abbreviations and terms are used in these circles:

proximal = proximal for the limbs or cephalic direction for the trunk

distal = distal for the limbs or caudal direction for the trunk

an = ante or anterior

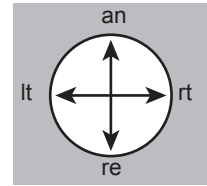
re = retro or posterior for the trunk

rt = right side of the trunk

lt = left side of the trunk

la = lateral or external part

me = medial or internal part



In Italian medical texts, the terms “dermatome” and “dermatomere” are often used as synonyms. In fact, the following definitions can be found in various dictionaries (Dorland’s, Stedman’s, Treccani, etc.):

Dermatome (Italian = *dermatomo*):

- 1) Instrument used for the removal of very thin slices of skin.
- 2) Cutaneous area innervated by a single posterior afferent nerve root.
- 3) Lateral portion of the embryonic somite from where the mesenchyme that produces the dermis derives.

Dermatomere (Italian = *dermatomero*):

metameric area of the integument or portion of skin innervated by a single sensory root of a spinal nerve.

As can be noted, the definition of dermatomere corresponds to the univocal meaning that is preferred in Fascial Manipulation (FM), and it indicates the skin included within a quadrant and innervated by a cutaneous nerve. Therefore, for this English edition, the Authors have also chosen to use the term “dermatomere” to distinguish the FM definition from the traditional idea of a dermatome.

For uniformity, the portion of adipose tissue is called “adipotomere”, and the group of lymphatic vessels of a quadrant is called “lymphatomere”.