Hypermobility 113 Fascia

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Who Am I?

- Professor Emeritus, Physical Therapy Department, Clarkson University
- Retired PT, St. Lawrence Health System, Potsdam NY
  - Clinical specialties: hypermobility, fibromyalgia, headaches, temporomandibular disorders
- Member: Ehlers-Danlos Society Medical and Scientific Board
- Chair: The Allied Health Working Group of the International Consortium of Ehlers-Danlos Syndromes and Hypermobility Spectrum Disorders
- Frequent presenter to professional and patient groups at national and international conferences
- Author of multiple review and research articles on hypermobility
- Author: “Pain Mechanisms in HSD” in Di Bon, *The Integral Movement Method for Hypermobility Management*
- Author: “Chronic Pain” chapter in *Physical Rehabilitation* textbook for PT students
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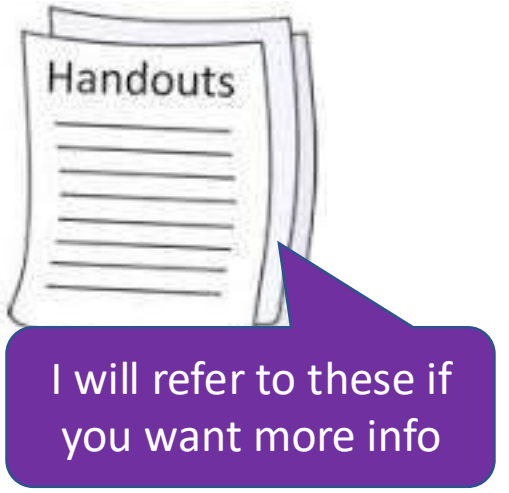
I do not have any conflicts of interest to report

Hypermobility Lecture Series Schedule

I will refer to these if you want more info

- HSD 101: Basics of HSD/hEDS and self-care
- HSD 102: POTS and POTS self-care, basics of MCAS
- HSD 103: Pain management in HSD/hEDS
- HSD 104: Safe exercise selection and progression with HSD/hEDS
- HSD 104b: Modifying exercises to address your challenges
- HSD 105: Posture and joint protection
- HSD 106: Gut issues in HSD/hEDS, POTS, MCAS
- HSD 107: Fatigue in HSD/hEDS and POTS
- HSD 108: Headaches, migraines, & TMJ pain associated with HSD, POTS and MCAS
- HSD 109: Breathing disorders in HSD
- HSD 110: Lumbar instability
- HSD 111: Conservative management of cervical instability
- HSD 112: The vagus nerve
- HSD 113: The role of fascia
- HSD 114: Optimizing your hospital experience with HSD, POTS, MCAS
- HSD 115: Functional Neurological Disorder
- **HSD 116: *NEW* Bleeding disorders in HSD**

Relevant Handouts Available



- https://webspace.clarkson.edu/~lrussek/research.html
- **Self-Care Strategies**
  - Self-Care Toolbox. A checklist to help you optimize your self-care toolbox
  - Breathing. Breathing incorrectly can increase pain sensitivity, headaches, jaw pain, and more.
  - Heart-rate variability biofeedback. Biofeedback to increase activation of your parasympathetic nervous system can help quiet sensitive nerves and decrease pain.
  - Sleep Hygiene and Positioning. Sleep posture and sleep hygiene strategies.
  - Sleep Checklist. Sleep is critical to good health. This checklist of sleep promoting strategies can make sure you don't overlook any options.
- **Pain Management**
  - Pain self-care plan. Create a pain self-care plan to improve your pain management.
  - Pain flare management plan - PDF version. Create your flare management plan.
- **Exercise**
  - Starting to Exercise Ideas. Some ideas to help you get started on exercise: how to deal with fatigue, pain, and fear of movement.
  - Starting to Exercise Worksheet.

Disclaimers

The information in this presentation is for general purposes, only, and may or may not apply to your situation.
Check with your health care provider
before starting any new treatment approach
to ensure that it is appropriate and safe for YOU.
I cannot diagnose or make specific treatment recommendations in this lecture.

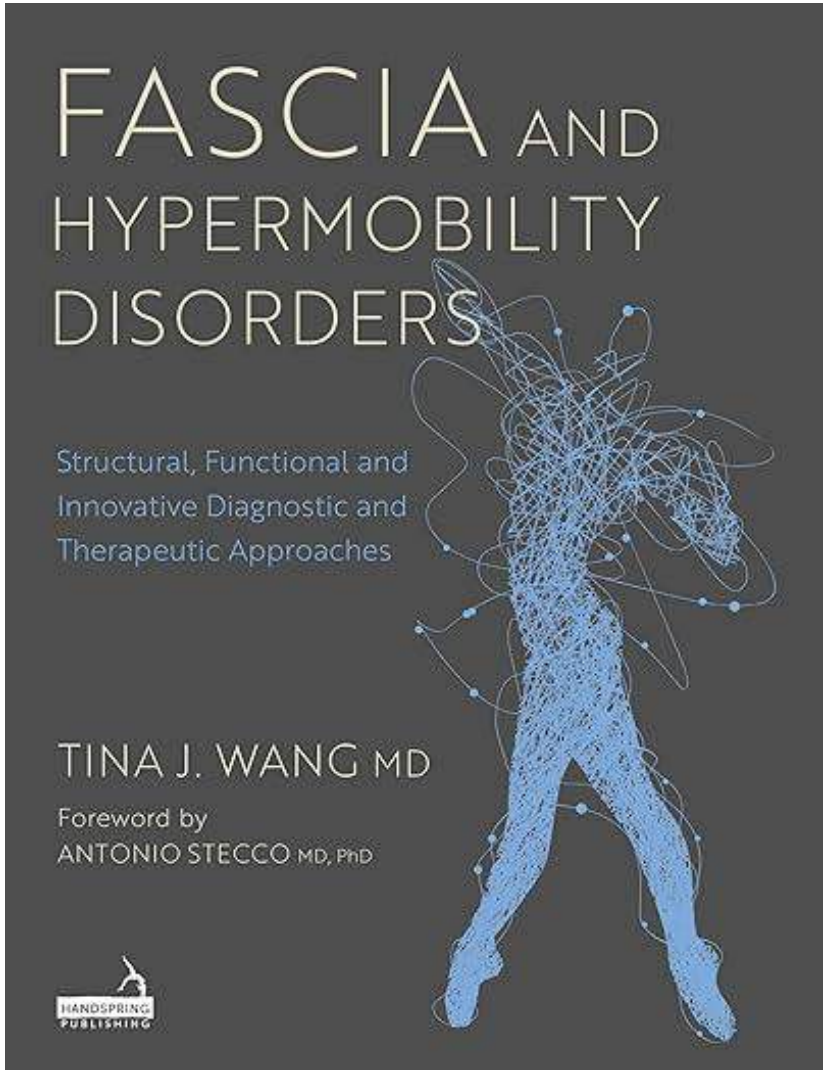
Our understanding of fascia is rapidly evolving.
Some information in this presentation includes hypotheses,
Not yet demonstrated by research

Objectives

By the end of this session, participants should be able to:

1. List locations and types of fascia in the body
2. Describe the functions of fascia
3. Relate the functions of fascia to structure, and abnormal structure of fascia in HSD to dysfunction
4. Describe how we might be able to improve the health and function of fascia

New Book on Fascia in HSD

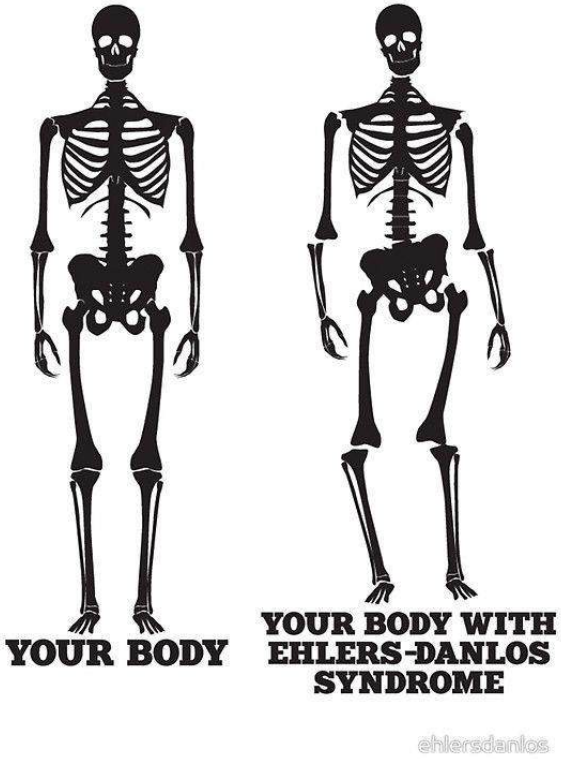


- *"Fascia is a body-wide network that permeates every organ, every tissue, every muscle; that envelops us and permeates us. It's a system on its own. It's critical to all metabolic, structural and signaling process, and we cannot be alive without it. And the organs and systems cannot function without it. In EDS this entire network is dysfunctional – it's too loose, too much, too little, too weak in different places."*

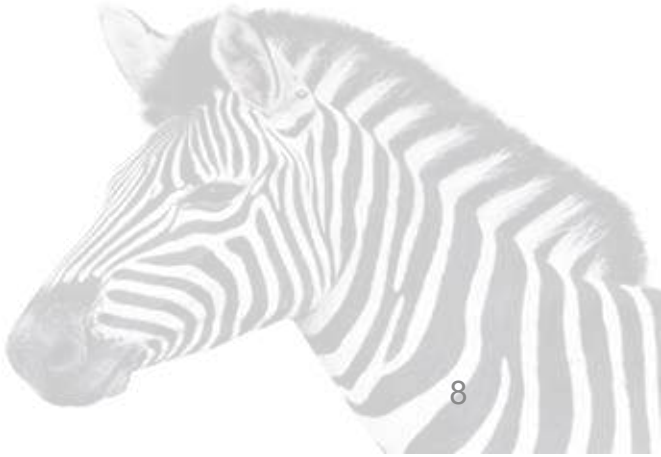
Tina J. Wang, MD

The Body is a Continuum

- The body is a continuous series of fascial structures that are mechanically, fluid dynamically, and chemically connected
- We are not a set of separate body parts, such as ‘hip’, ‘neck’, or ‘shoulder’
- We are not even a series of tissue layers
- Fascia doesn’t just connect different structures, but it allows those structures to interact and communicate with one another



Bordoni, 2024; Bordoni, 2025



Why is Fascia Important in HSD?

- Fascia is a type of connective tissue, and is abnormal in patients with HSD
- Fascia is found almost everywhere in the body
- If fascia is weaker in HSD, it could make many structures in the body more vulnerable to damage
- Fascial tension can make you feel ‘stiff’ or ‘tight’ even if you are hypermobile
- Fascia appears to be thicker in people with HSD, creating abnormal stress
- Fascial adhesions might place abnormal stress on loose joints
- Tight fascial bands might compress/damage structures

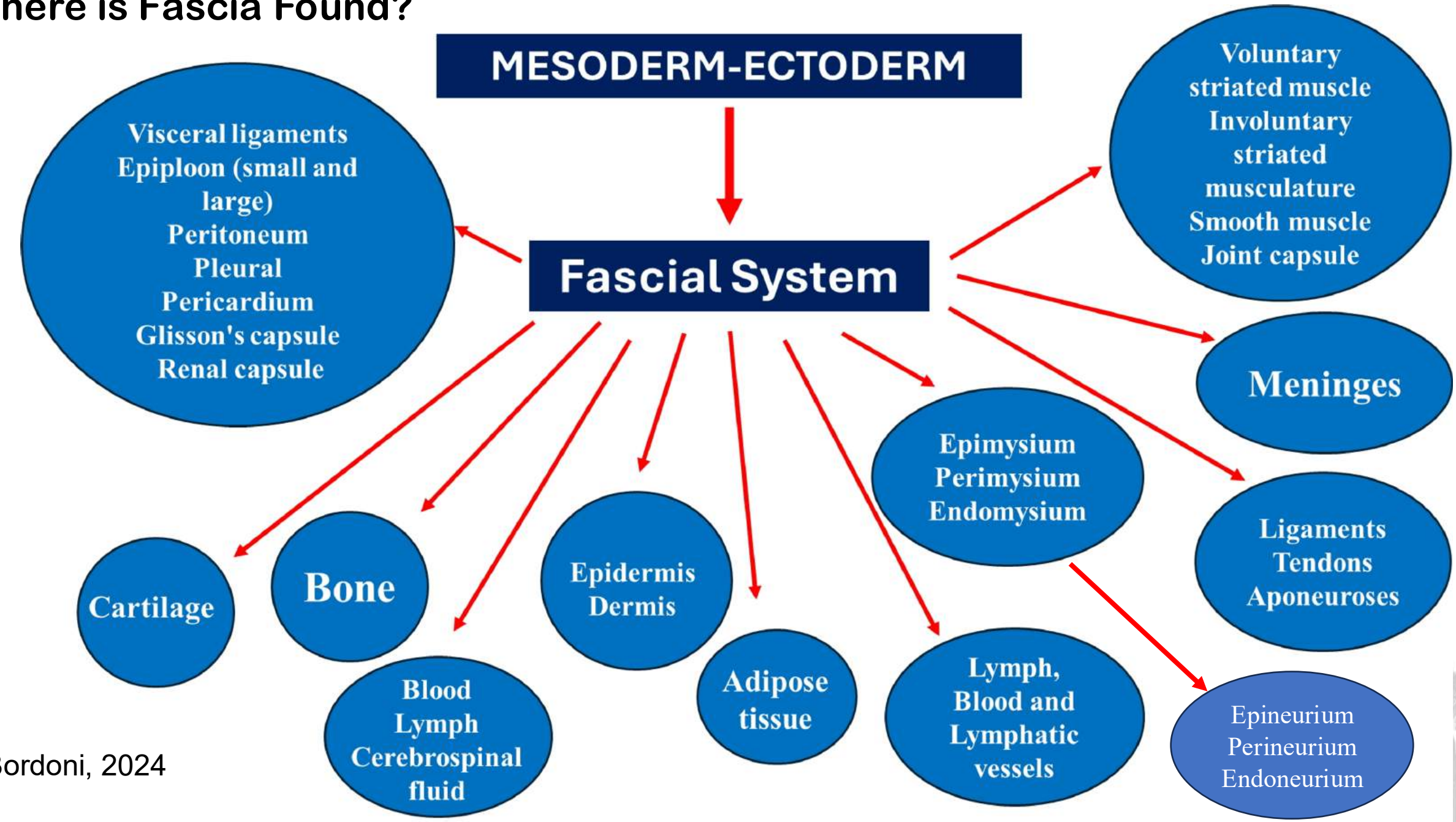
Might Fascia be Important in MCAS?

- Fascial is an organ that has normal physiological processes
  - Transports fluids, nutrients, chemical signals through the body
- Fascia normally provides a pathway to flush toxins and inflammatory chemicals out of the body
  - If this function is not operating properly, there may be a build-up of inflammatory chemicals causing diffuse chronic pain and adhesions
  - Neurogenic inflammation (reverse firing of pain-sensitive nerves) allows a sensitive nervous system to cause inflammation in the fascia; this inflammation would be diffuse as inflammatory chemicals flow through fascia
- Inflammation decreases the tissue mobility/sliding function of fascia (Wang, 2021)

Might Fascia be Important in POTS?

- Much of the extracellular fluid in our body is in fascia
  - If these fluids do not flow normally, fluid may build up in places it shouldn't, leading to swelling in hands, feet and belly. This could trigger POTS reactions
- Autonomic nerves travel through fascia and contain fascia
  - Adhesions in these nerves may alter function and POTS
  - Video showing how manual therapy to these autonomic nerve bundles can alter heart rate in a person with POTS: https://counterstrain.com/conditions/pots/
- The autonomic nervous system controls contraction of fascia
  - Dysautonomia can cause fascial tension or tightness

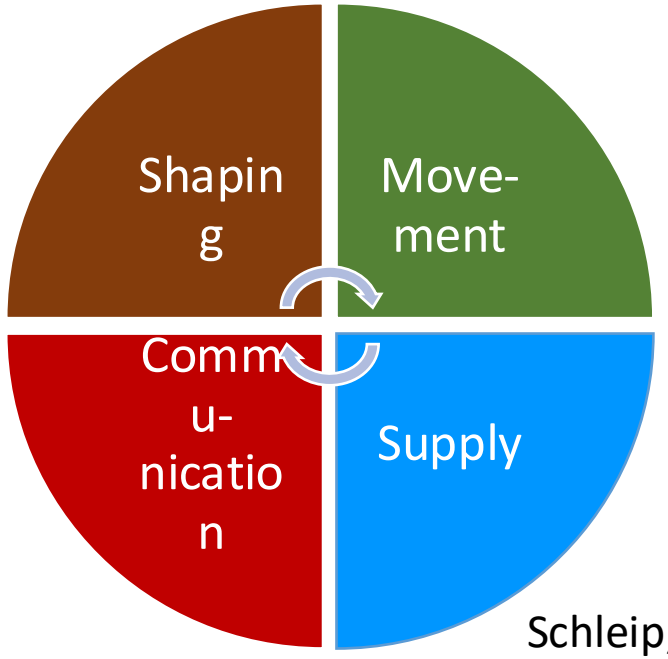
Where is Fascia Found?



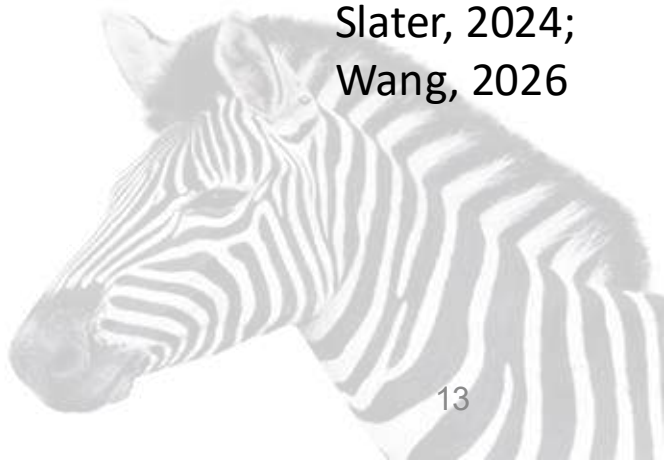
Bordoni, 2024

Functions of Fascia

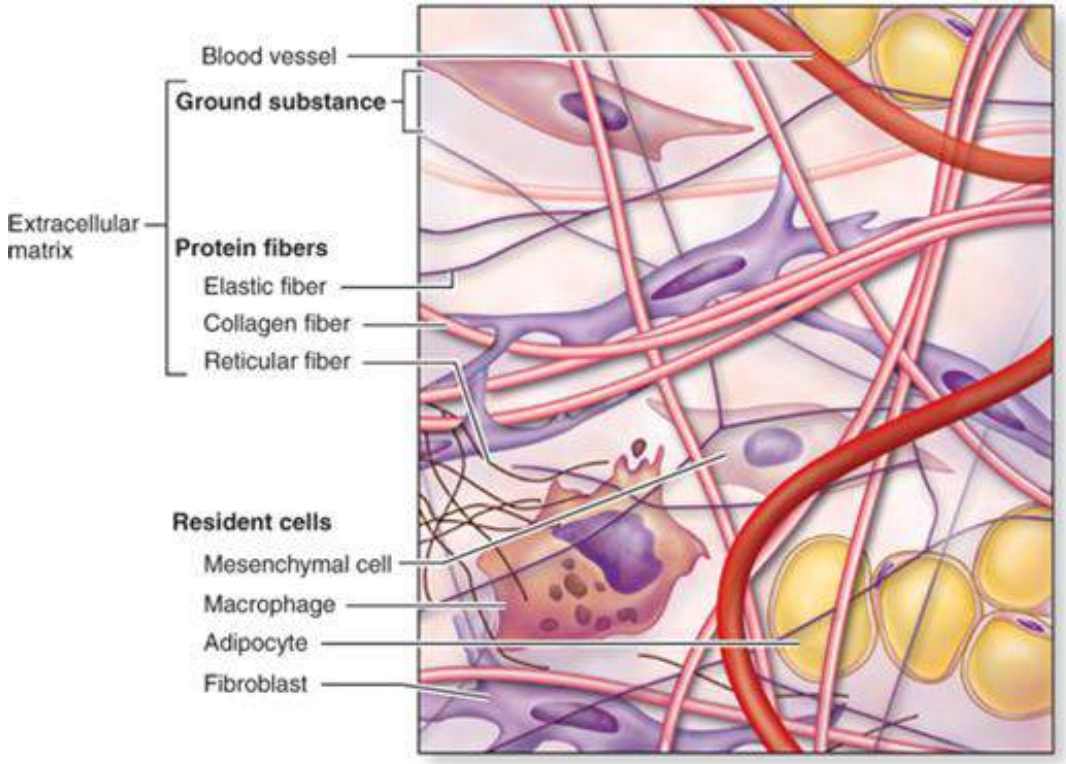
1. Protects and shapes structures enveloped (e.g, nerves, vessels, organs)
2. Increases stability of structures
3. Strengthens and contracts wounds during healing
4. Distributes tension among tissues of the body
   - Transfers forces among muscles & skeletal structures
   - Contraction of fascia alters tissue stiffness
   - The respiratory diaphragm is made of fascia
5. Allows movement between tissues: lubrication
   - Including skin, muscles, nerves, blood vessels, organs
6. Allows cellular communication to transmit information throughout the body
   - Biochemical and piezoelectric signaling, including neurotransmitters
   - Produces and releases hormones (adrenaline, estrogen, insulin, thyroid hormones, oxytocin)
7. Provides sensory input, including proprioception, interoception, and nociception
8. May contribute to mood & psychological state through interoception
9. Transports fluids and nutrients
   - Via lymphatic and blood vessels that travel through fascia
   - Also within extracellular fluids, as a third part of the circulatory system
   - May control blood pressure and flow through contracting/relaxing blood vessels



Schleip, 2017; Bordoni, 2022; Slater, 2024; Wang, 2026



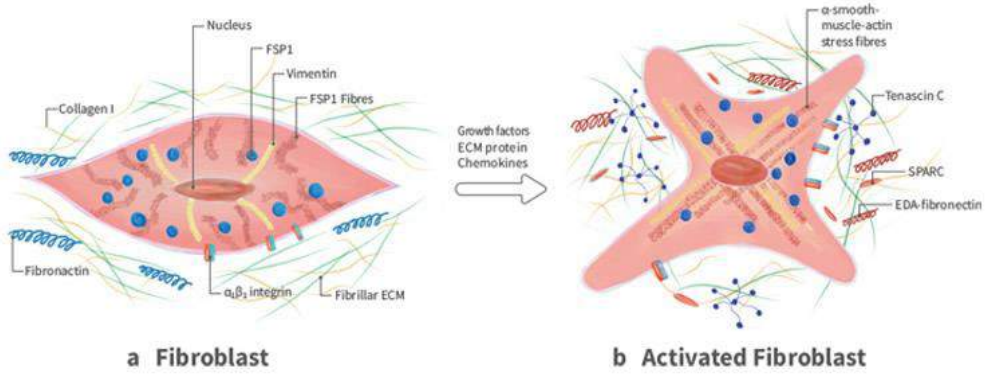
Fascia/Connective Tissue Structure



Junqueira's Figure 5-2

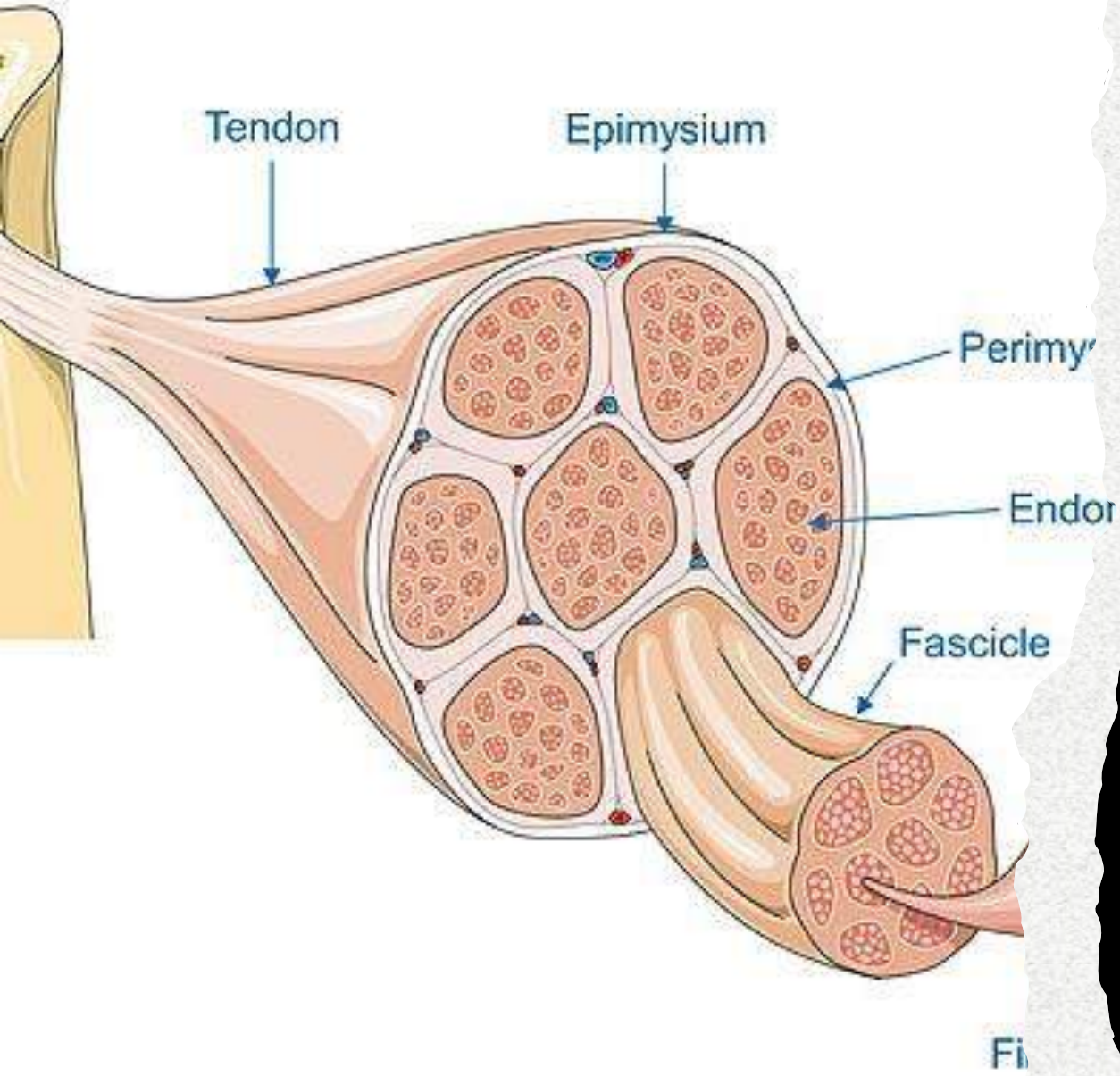
- Connective tissue is mostly extracellular material
  - It has fewer cells than many other tissues
  - Collagen, elastin and ground substance often make the majority of the extracellular material
- Fascia includes both solid and liquid components
  - Different types of fascia have different proportions of solid and liquid
- Movement keeps fascia fluid

Fibroblasts



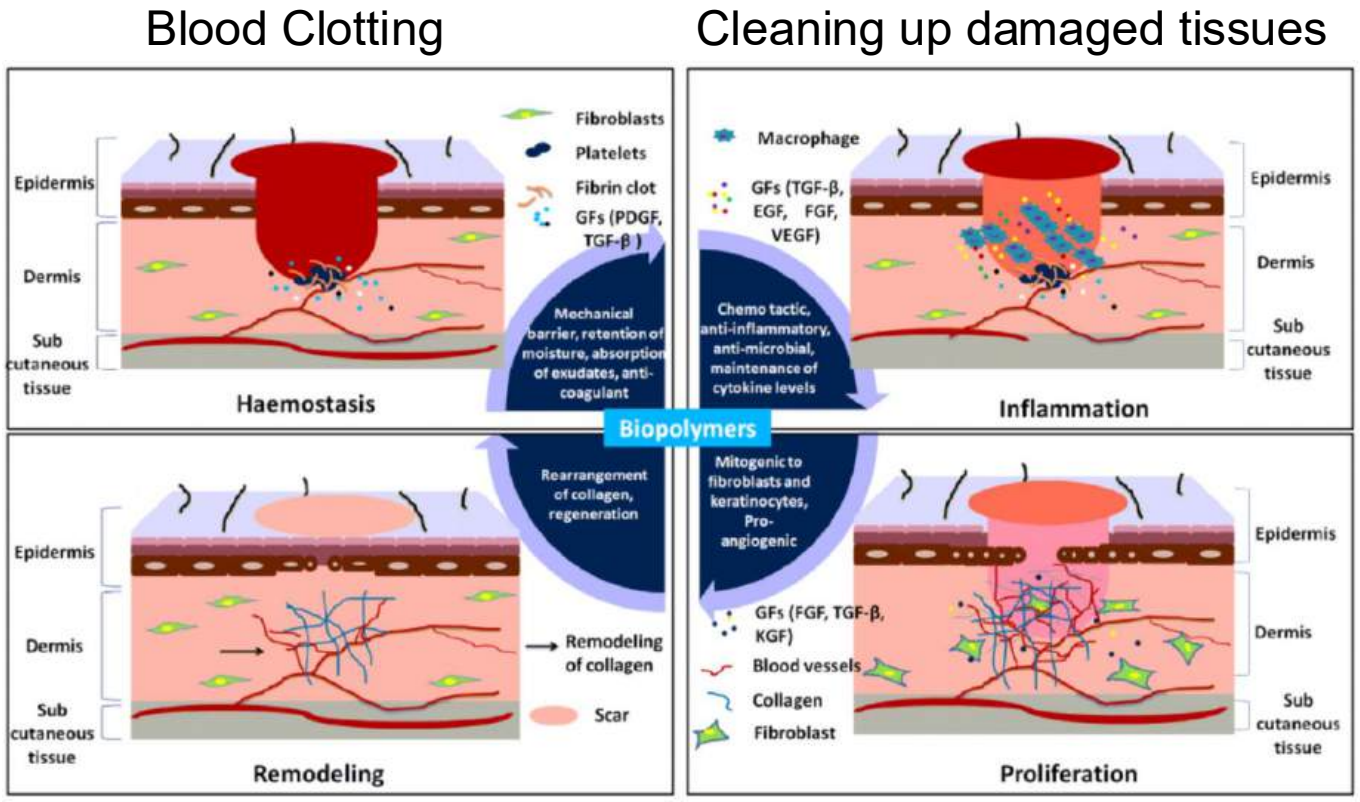
- The primary cell responsible for making extracellular matrix (ECM) proteins, including collagen, in the body.
- The primary cell in most types of fascia.
- Can transform into myofibroblasts, which are able to contract (like muscle, but typically not as much or as quickly).
  - Triggered by inflammation.
  - Essential for wound healing (pulling edges of wound together).
- They respond to mechanical stresses to change their environment, allowing tissues to become stronger in response to stresses.
- Communicate through chemical signaling by releasing growth factors, cytokines, etc.
- Contribute to immune response by responding to and releasing inflammatory chemicals.

Wang, 2026



Fascial Shaping

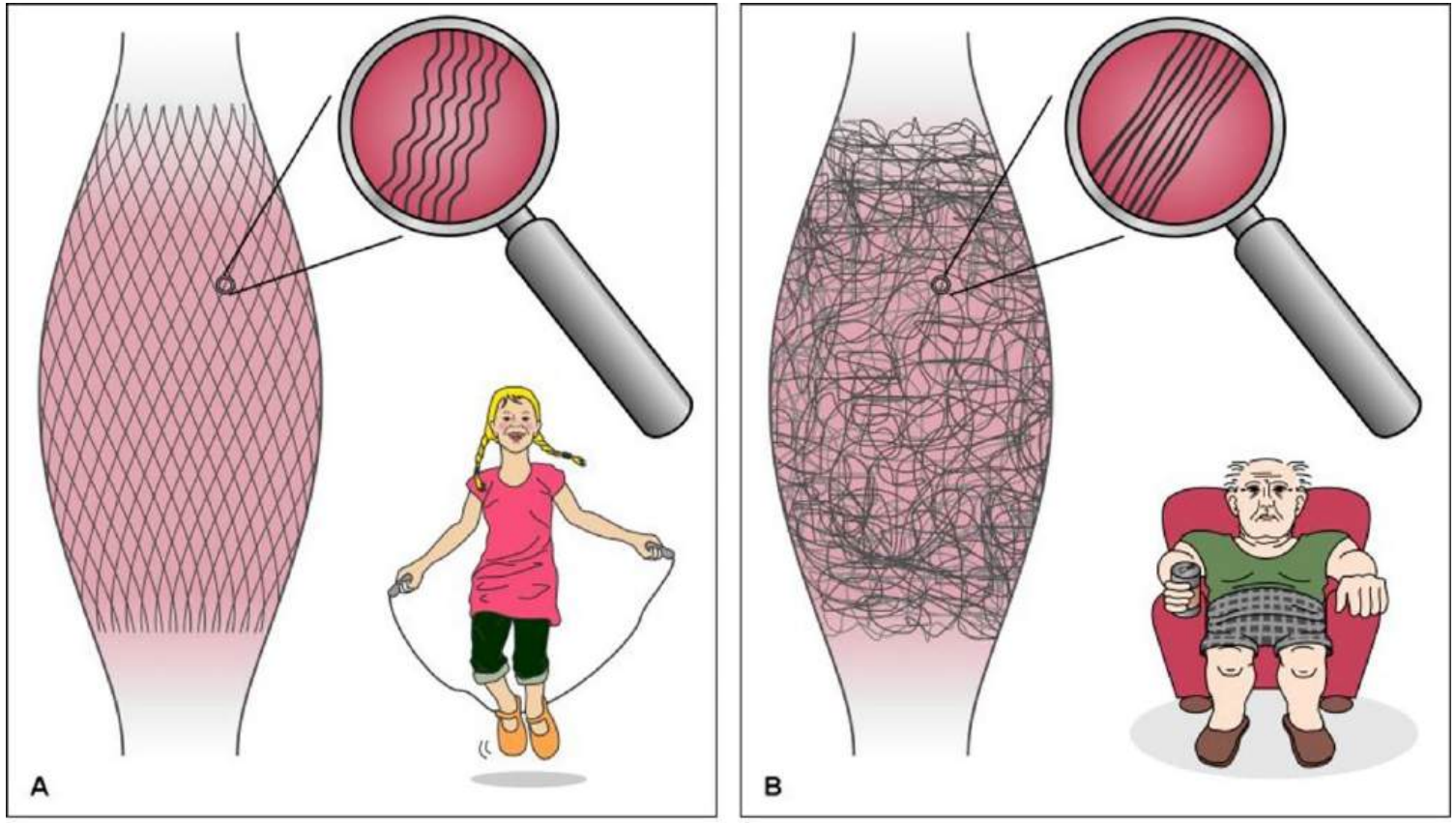
Fibroblasts and Wound Healing



- Wound → blood clotting → inflammation.
- Then activated fibroblasts move to the injured area and begin to produce materials for extracellular matrix (ECM).
- ECM is the framework that holds healing tissues together.
- Myofibroblasts pull the edges of the wound together.
  - (Like darning a sweater, where you pull the edges of a hole together.)
- Collagen is essential for strength of the healing tissue.
- Inactive myofibroblasts or fragile collagen will slow wound healing or result in a fragile scar.

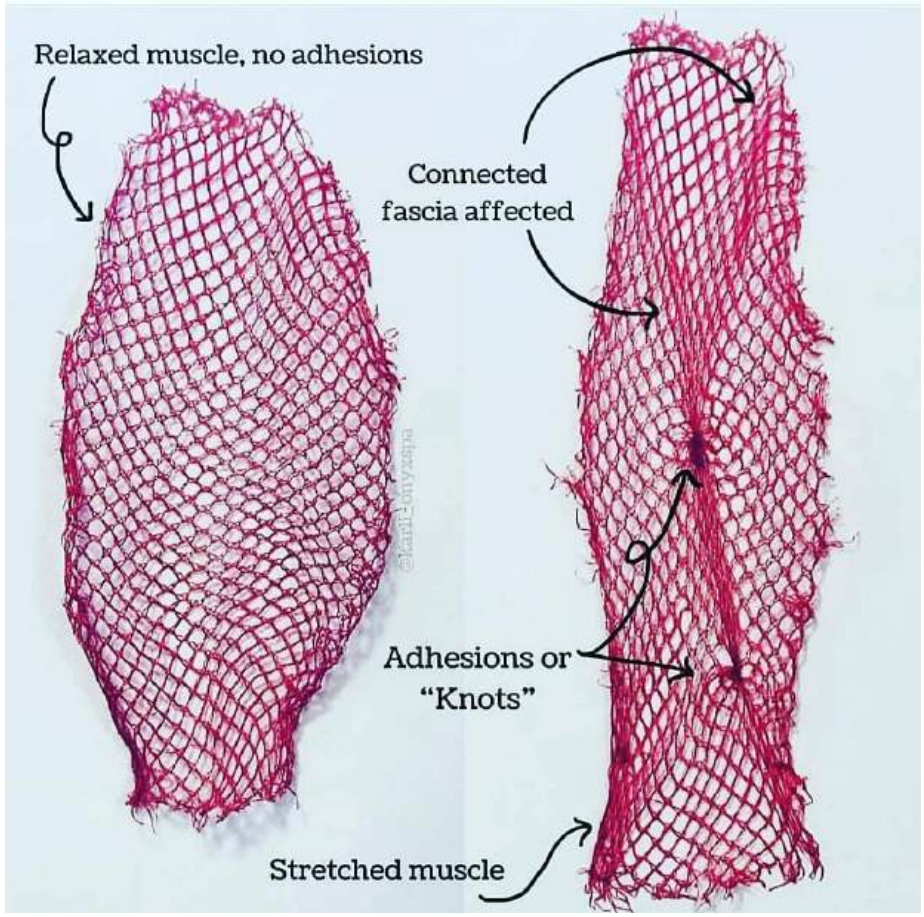
Sahana, 2018.
https://www.researchgate.net/publication/326915725_Biopolymers_Applications_in_wound_healing_and_skin_tissue_engineering

Normal and Abnormal Fascia



https://bendablebody.com/what-is-fascia-why-you-need-to-stretch-it/

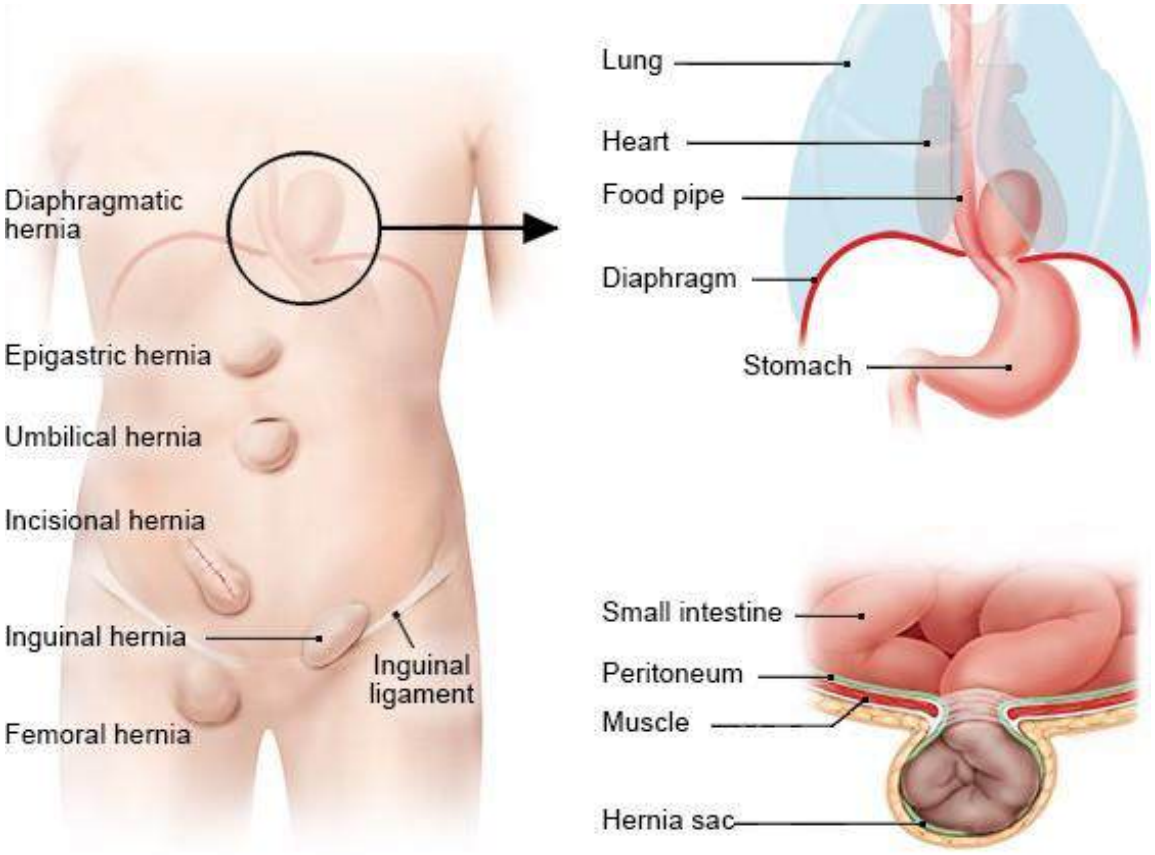
Fascial Adhesions



- Fascial adhesions can prevent normal tissue movement
  - For most tissues: muscles, nerves, blood vessels, organs, etc.

https://www.mountlawleyphysioandpod.com.au/what-is-fascia/

Hernias and Cysts: Gaps in Fascia



https://www.klinikadigjitale.net/en/hernia/

- Hernias occur when fascia fails and tissue pokes through
- Cysts also form when fluid collects in a pouch outside where it belongs
  - Ganglion cyst, Baker's cyst, Tarlov cyst, etc.
- Piezogenic papules may be similar

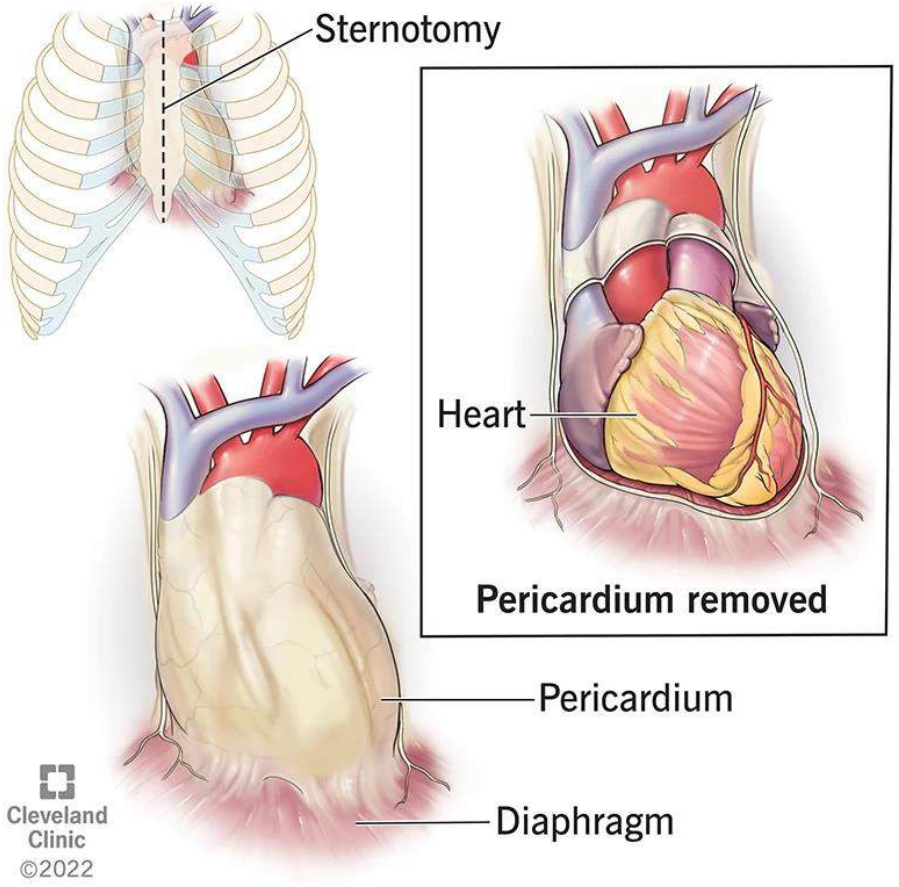
Piezogenic pedal papules. Courtesy of DermNet New Zealand (https://www.dermnetnz.org/assets/Uploads/dermal-infiltrative/piezogenic-papules5.jpg)

Lipedema and Fascia

- Bilateral, symmetric build-up of fat usually in the legs, sometimes arms
- Fatty nodules that are tender, may be rice to walnut sized
- Uneven, dimpled skin due to fibrotic tissue under the skin
- Fatigue
- Easy bruising
- Common in hypermobile people

- Inflammation in fascia causes fluid accumulation.
- Poor lymphatic drainage causes excessive fluid to stand in the extracellular space, and triggers fibrosis, where tissues become thicker and stiffer.
- https://www.lipedema.org

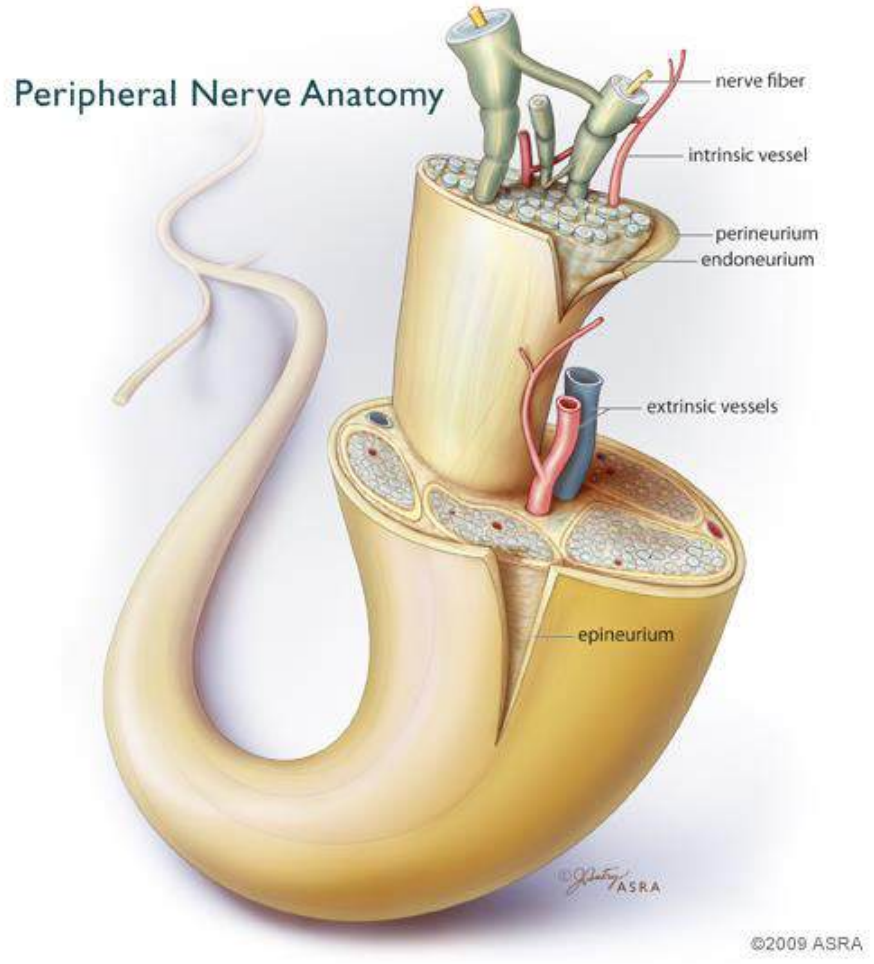
Fascia Shapes & Protects Organs

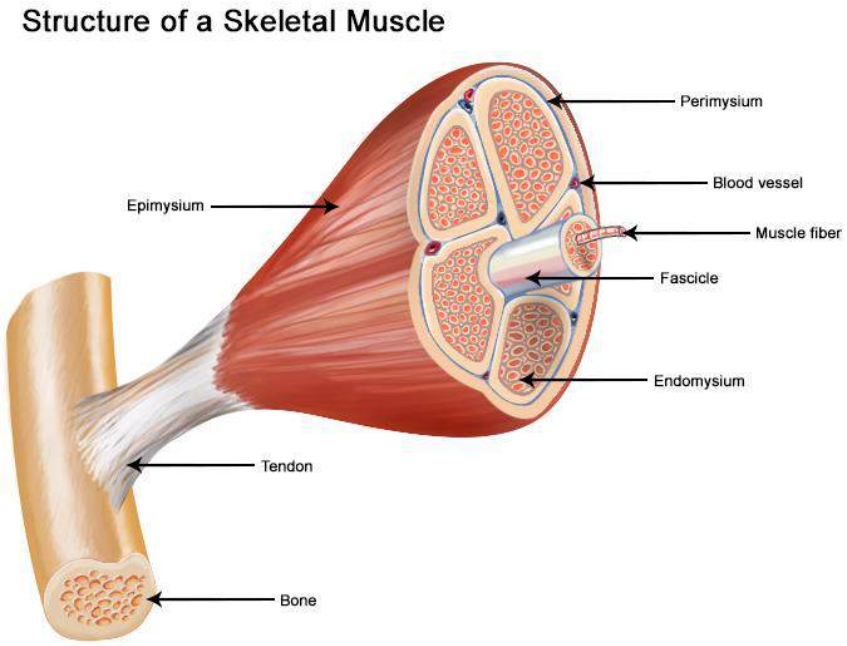


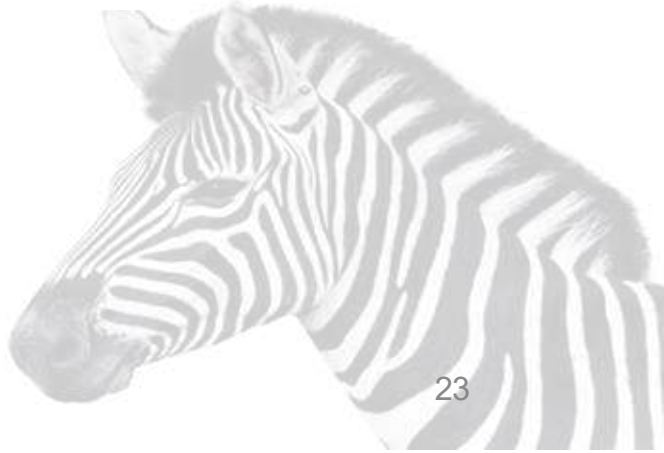
- Organs are wrapped in fascia
- This protects organs, and often improves function
- Allows organs to move relative to surrounding structures
- Example: pericardium around the heart protects it and allows it to move relative to the lungs and diaphragm

https://my.clevelandclinic.org/health/treatments/17352-pericardiectomy

Protects Tissues and Allows Movement





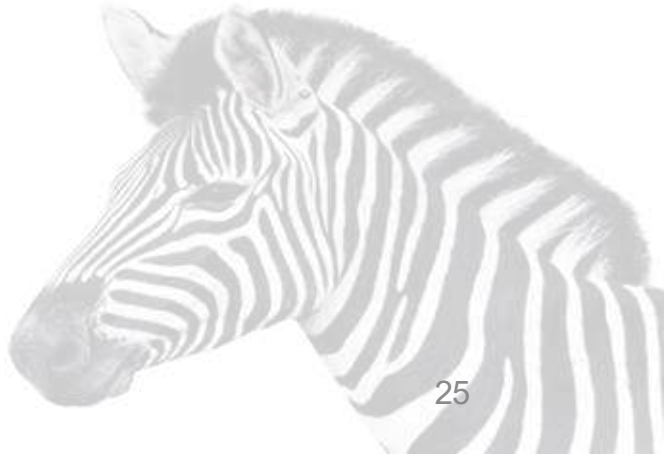


http://www.bats.ac.nz/detail-where_to_inject_the_la_a_closer_look_at_peripheral_nerve_anatomy-24

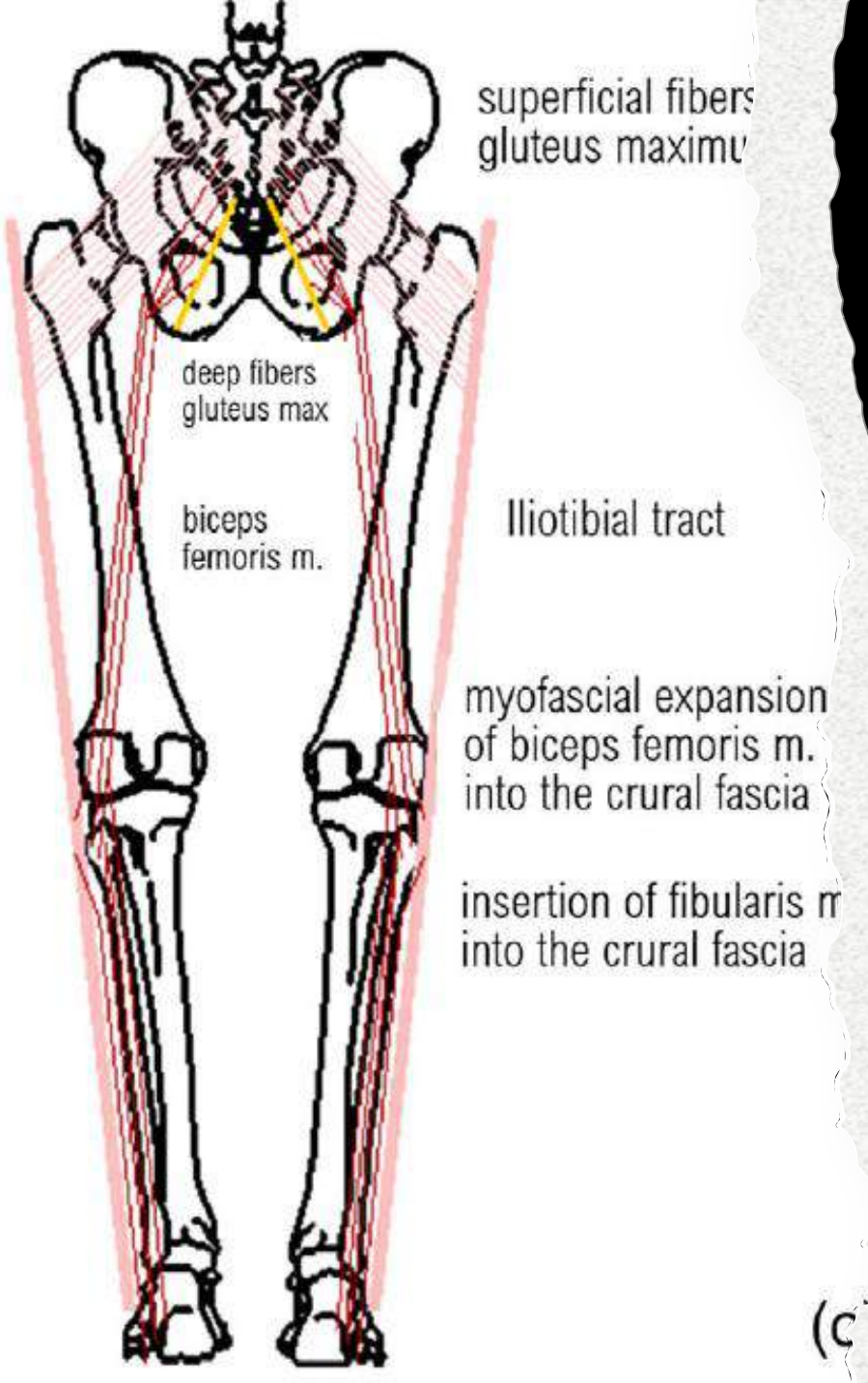
Fascial Wrapping: So, Who Cares?

- If fascia is weak in people with HSD, they may be more vulnerable to problems with the wrapping function
  - People with HSD might have more hernias, cysts, etc.
  - Chronic inflammation in fascia might cause adhesions or stiffness
- Tissues may be more vulnerable due to poor fascial packing
  - E.g., nerve compression may occur more easily because fascia doesn't protect
- Exercise helps keep fascia structure healthy
  - Lack of exercise might cause fascia to become weaker or develop adhesions

Questions?



Fascial Force Transmission

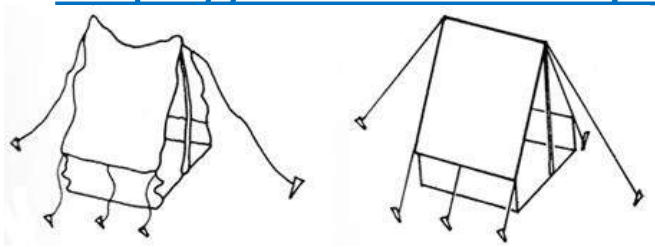


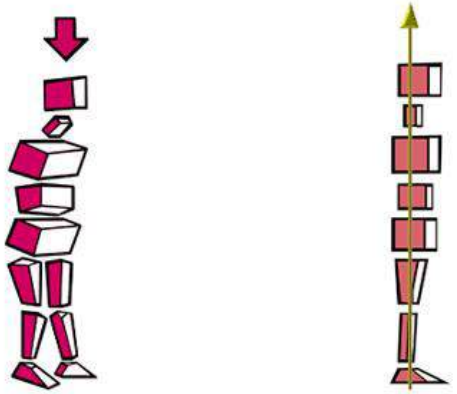
Fascia Wraps Tissues

- Fascia connects many muscles to bones or other muscles
  - Much of the force muscles produce is transferred through fascia rather than tendons
- Changes in the tension in this fascia can alter posture and function of muscles
- Fascia wraps and connects organs

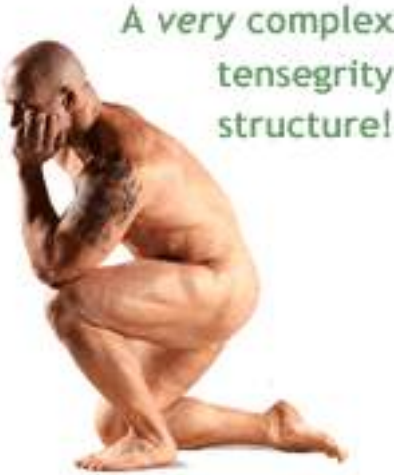
Fascia Transmits Forces

- Tensegrity
  - Using tension to provide support: it is like tent ropes holding up the tent
  - Floppy ropes result in a floppy tent
  - https://www.anatomytrains.com/fascia/tensegrity/





A more complex tensegrity structure



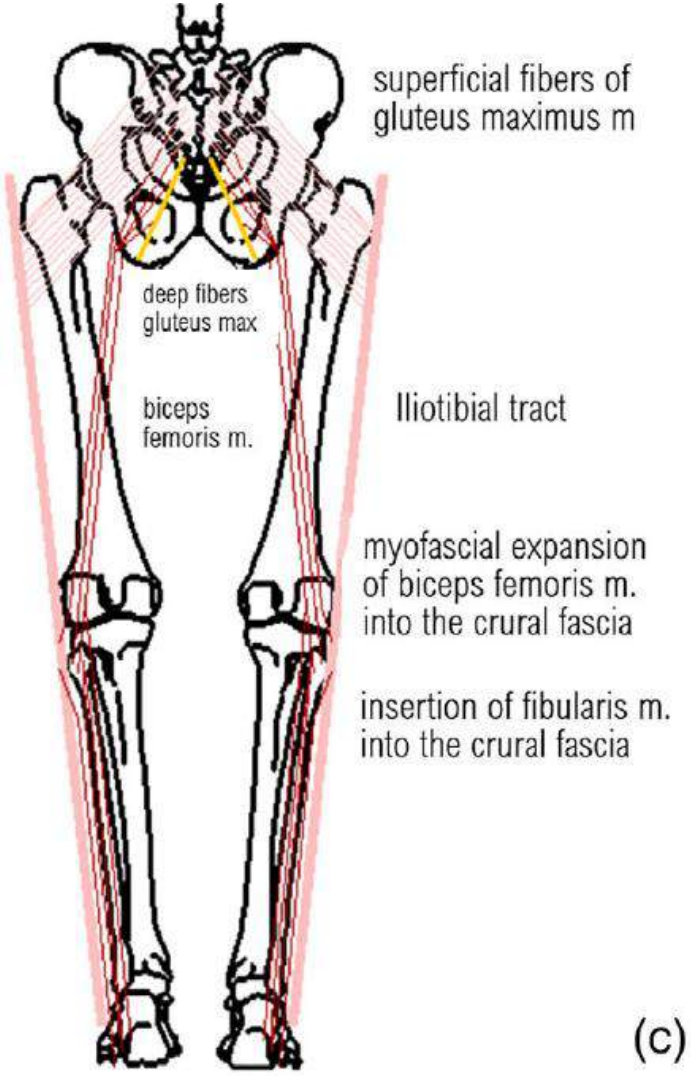
https://rolfyoga.com/English/Faszien_EN.html#.XdHr5S2ZOfU

https://www.painscience.com/articles/ten-trillion-cells.php

Fascia Transmits Forces

- Example: Iliotibial band (ITB)
- Forces produced by gluteal muscles and tensor fascial lata are transmitted to the ITB
- The ITB connects to the knee and kneecap
- Problems with the ITB can cause knee, hip, or low back pain

Force Transmission



- Fascia transmits forces widely through the body
- Everything is, quite literally, “connected”
- Therefore, you may need to treat the foot to help the hip, or treat the hip to help the neck.

Stecco, 2019

Fascial Lines

Spiral Lines

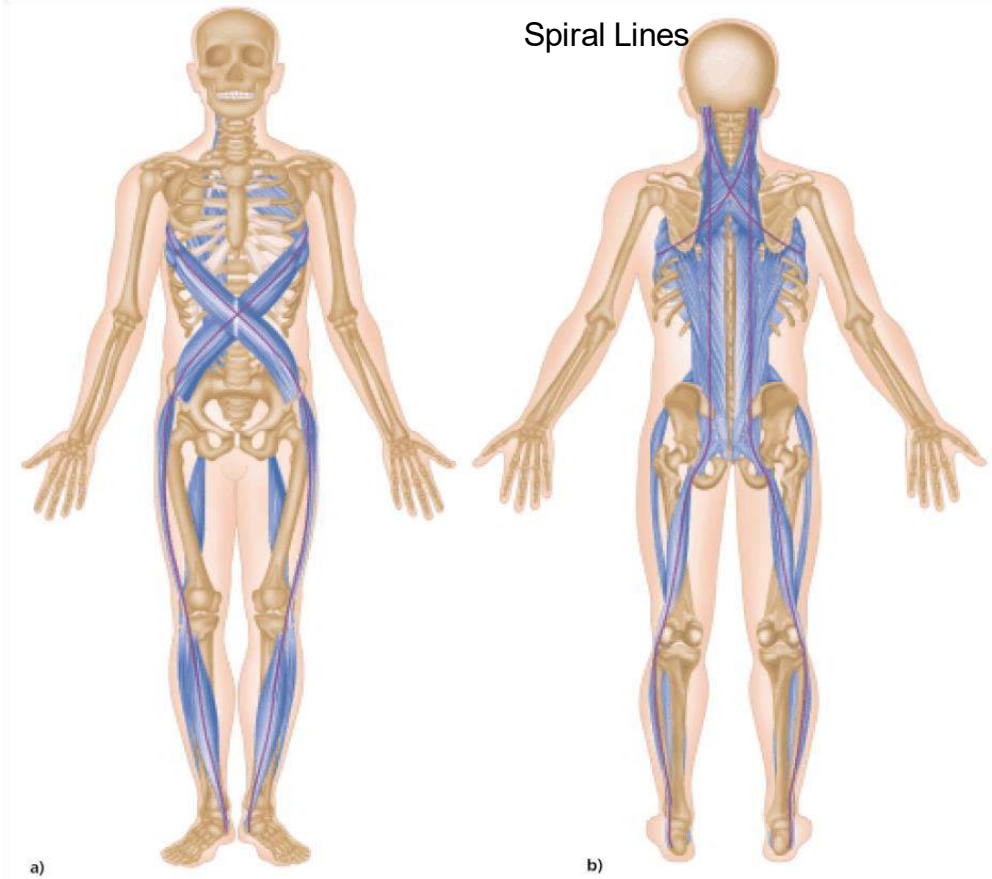
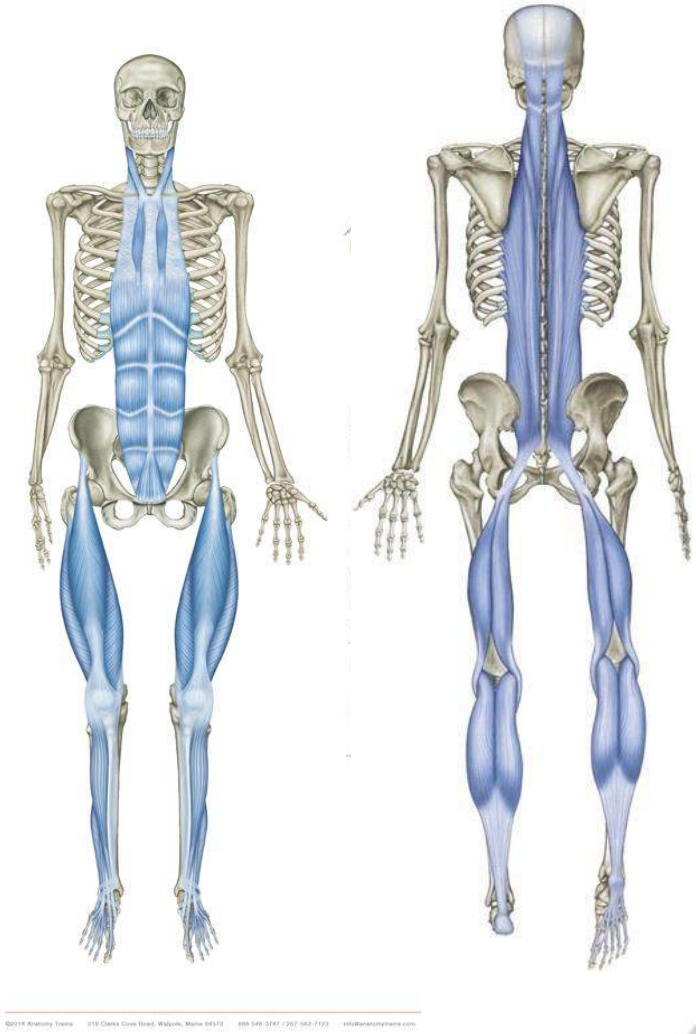


Figure 8.16: The Spiral Line (SL); a) anterior view, b) posterior view.

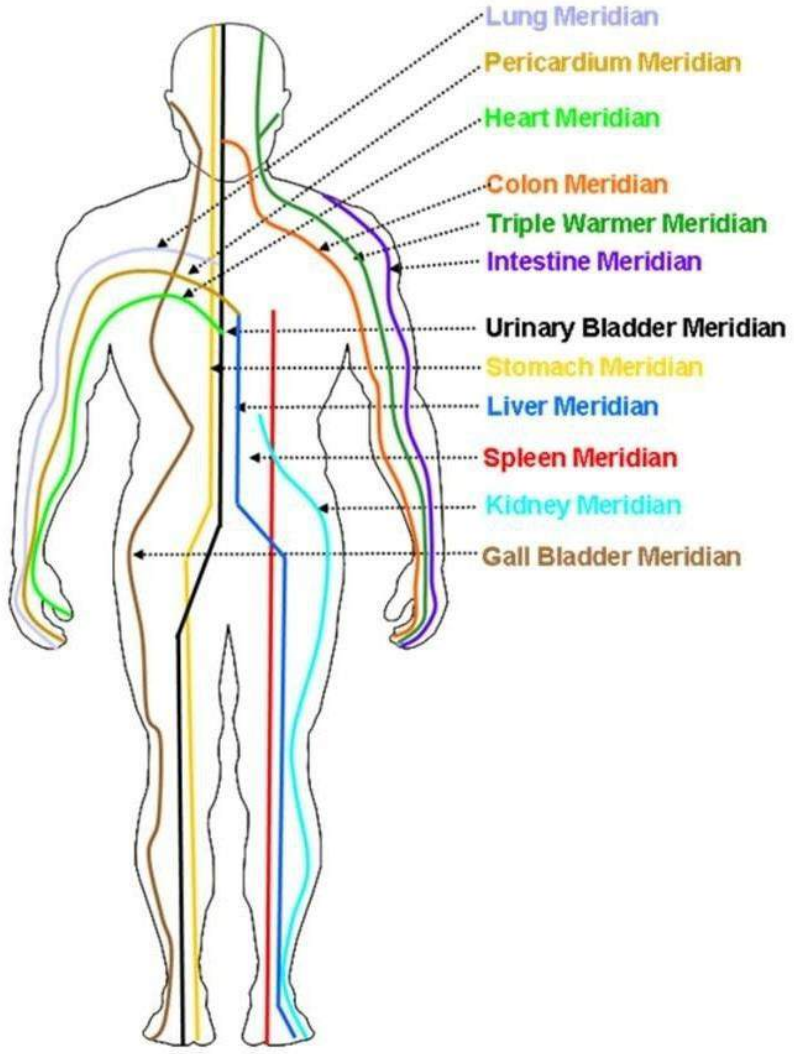
The Superficial Front Line

Superficial Back Line



T. Myers. Anatomy Trains

Fascia and Acupuncture Meridians

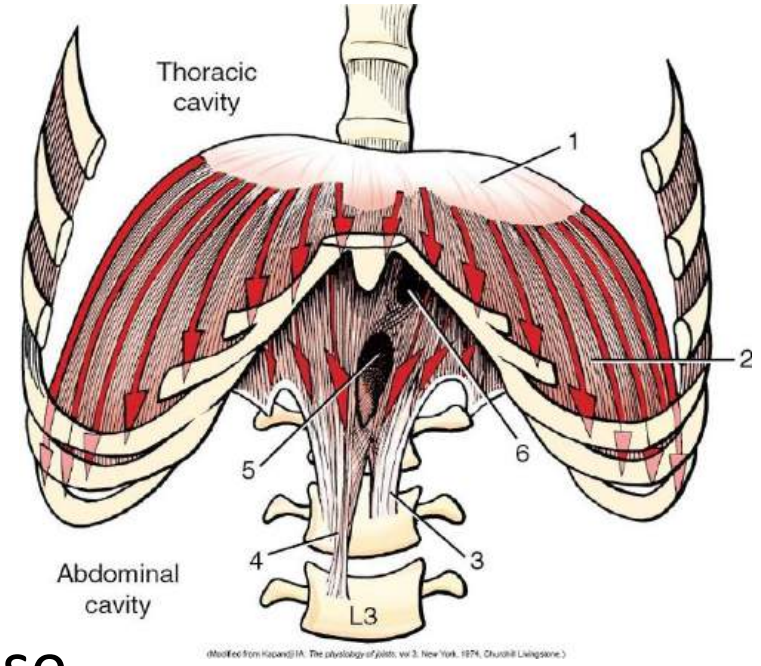


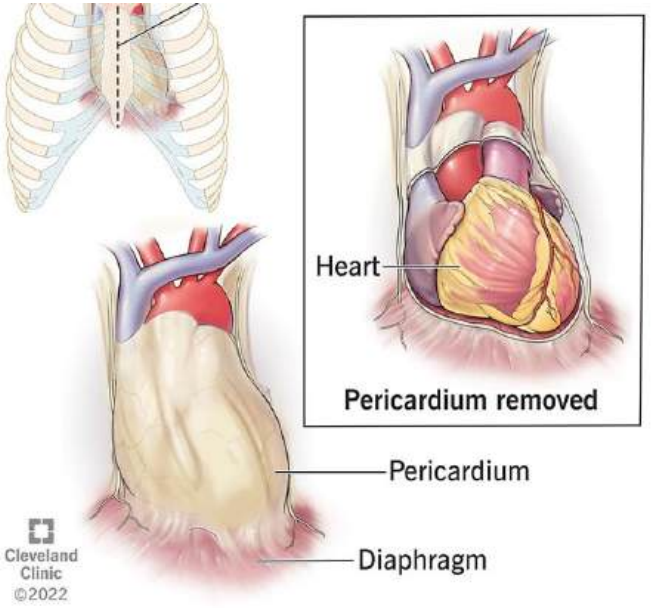
- Acupuncture meridians correspond to fascial densifications
- Acupuncture stimulates fascial receptors that send messages to muscles and the brain (via autonomic nerves)
- Fascial connections with organs may explain some visceral effects of acupuncture

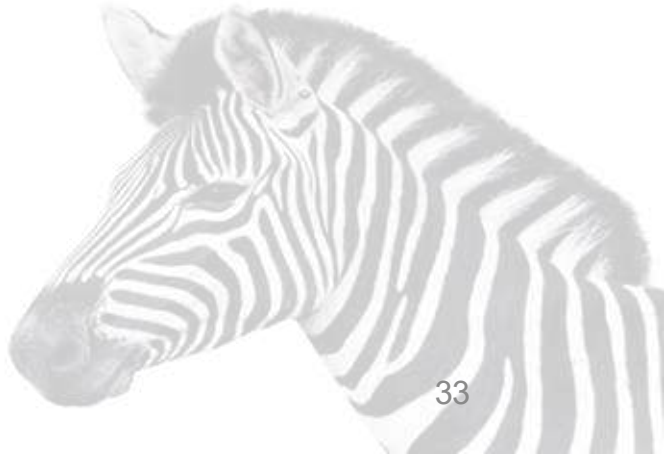
(Yang, 2015)

Fascia Links Diaphragm to…

- The respiratory diaphragm has extensive fascia connecting it to:
  - Esophagus
  - Heart
  - Abdominal aorta and veins
  - Kidneys, liver
  - Stomach, colon and intestines
  - Deep hip & back muscles
  - Superficial thoracolumbar fascia
  - Pelvic fascia
- Diaphragmatic breathing improves heart function because of this fascial connection







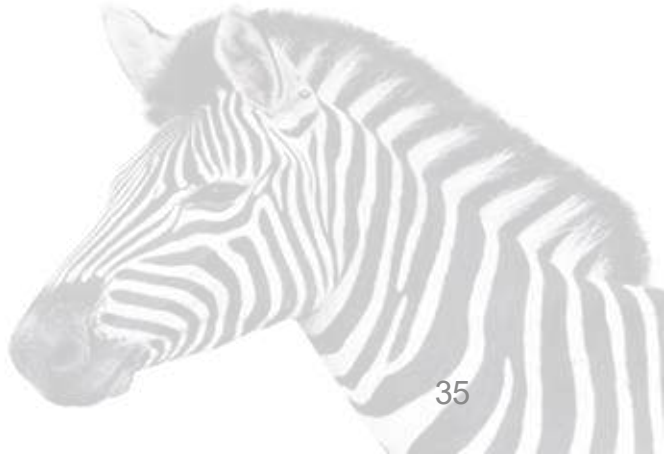
Fascia Can Actively Generate Force

- Contractile force production
  - In both intra- and extramuscular fascia
  - Very low loads, but potentially for long durations
  - Not controlled by motor nerves, but autonomic nerves and local chemical environment
  - Can contract in response to emotional stress
  - Slow process, occurs over minutes+
- Lumbar fascia has high number of myofibroblasts
- The respiratory diaphragm is made of fascia (embryologically formed from fascia) (Bordoni, 2019)
- May perpetuate musculoskeletal imbalances and contractures
  - E.g., frozen shoulder, Dupuytren's contracture, nerve compression syndromes

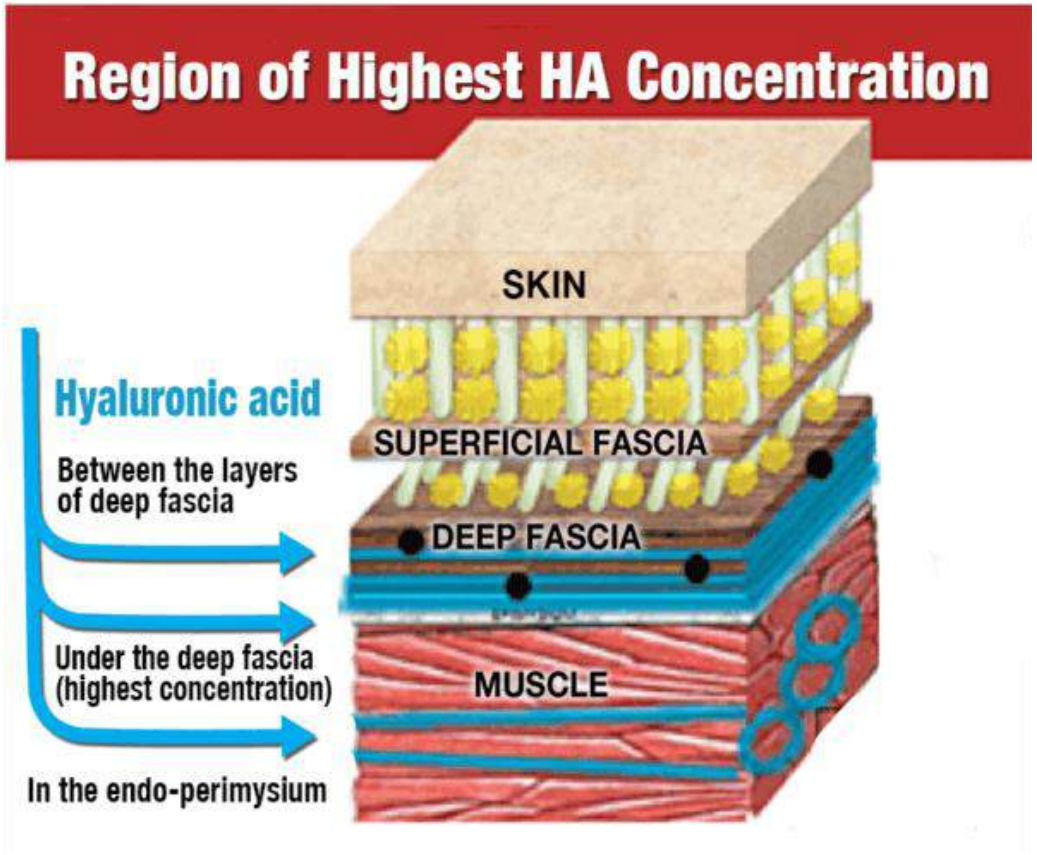
(Schleip, 2017 & 2019)

Fascia Can Cause Muscle Contraction

- Pain can cause tension or adhesions in fascia that can trigger or perpetuate muscle spasm
  - Shown to occur in the low back (Brandl, 2022)
- Might contribute to myofascial pain
  - (Wang, 2021)

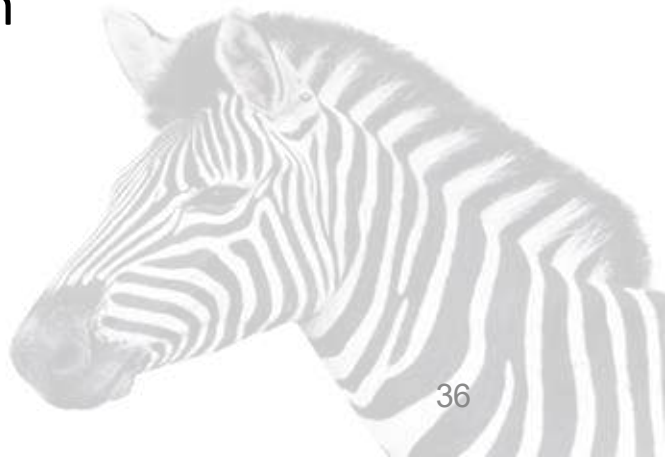


Facilitating Movement

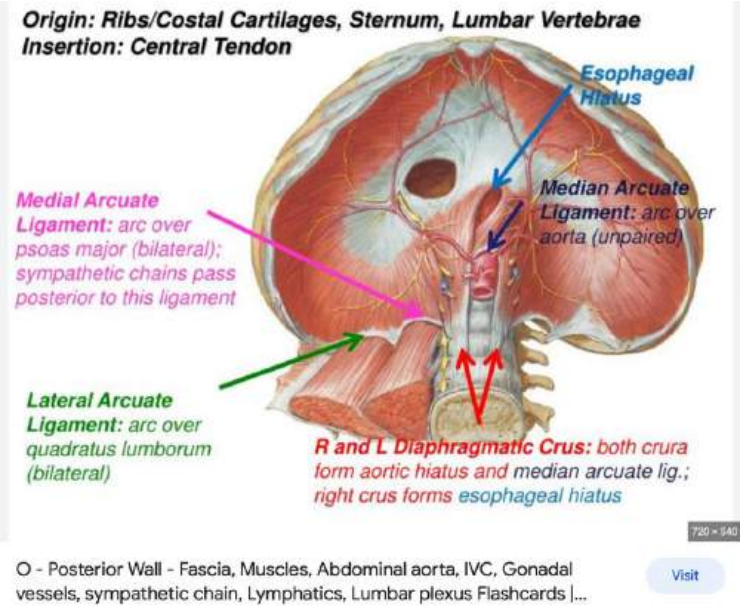


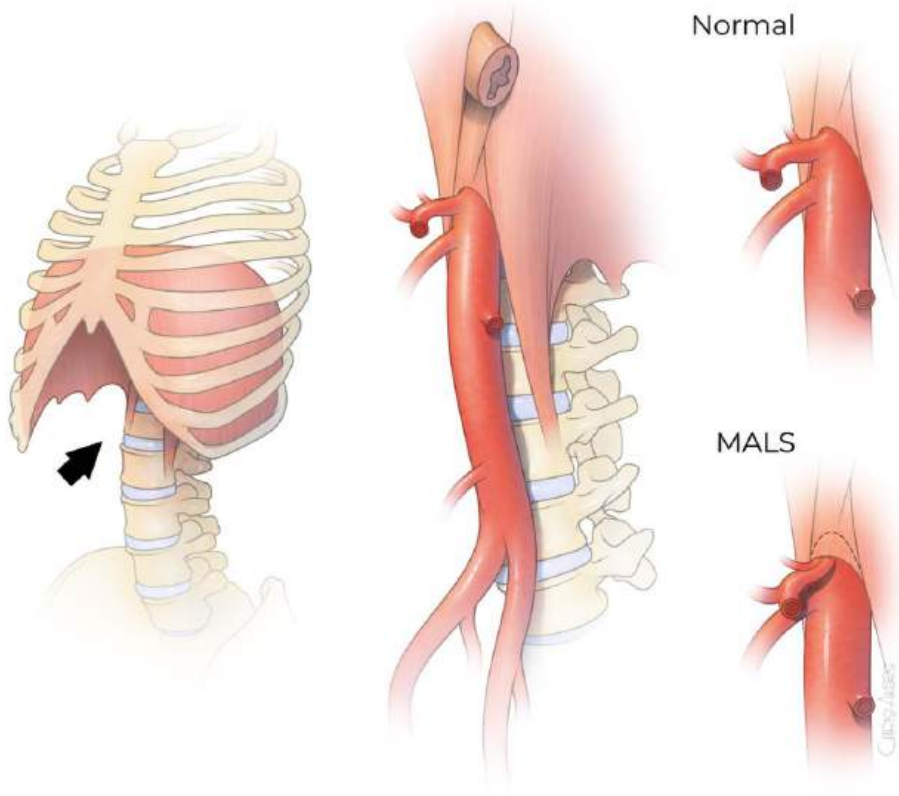
https://www.n2physicaltherapy.com/blog/fascia-mysterious-tissue/

- Movement occurs between planes of fascia
- Hyaluronic acid in ECM is *thixotropic*: viscosity decreases with movement
  - Decreased movement increases stiffness
  - "Motion is Lotion"



Fascial Problems in HSD: MALS

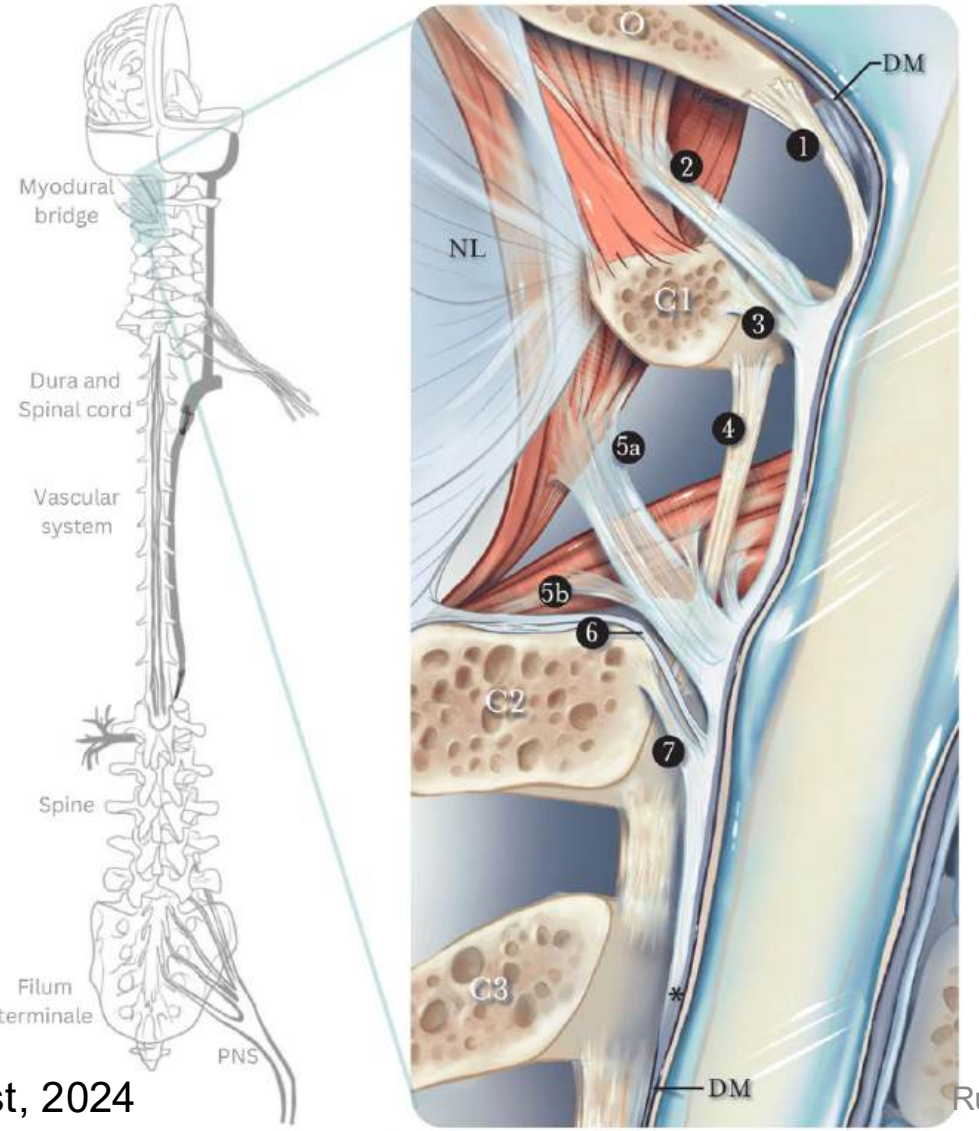




- Example: median arcuate ligament syndrome (MALS)
  - Involves a fascial ligament that attaches the diaphragm to the spine
  - The ligament can compress the celiac artery, compromising blood flow to the intestines
  - Symptoms: Pain between ribs, below sternum; pain after eating; pain or fatigue after exercise; nausea/vomiting; constipation/diarrhea
  - Test: doppler ultrasound

https://med.uth.edu/cvs/patient-care/conditionsandprocedures/median-arcuate-ligament-syndrome-mals/
https://www.chegg.com/flashcards/o-posterior-wall-fascia-muscles-abdominal-aorta-ivc-gonadal-vessels-sympathetic-0d30f525-3803-40b3-a4e3-9b1a40b76cd7/deck

Spinal Cord Fascia: Potential Problems



Frost, 2024

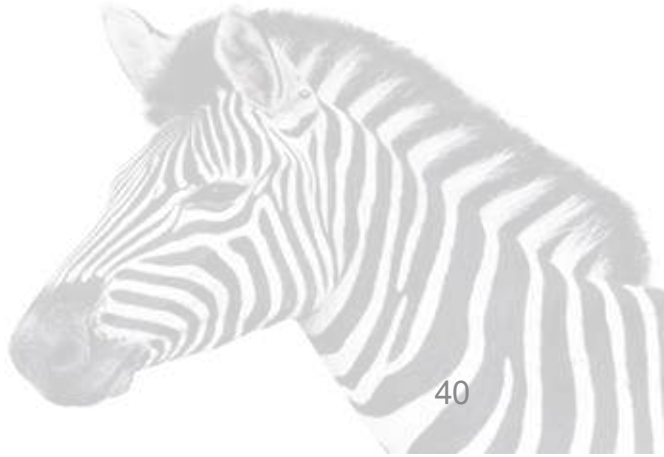
- 'Myodural bridges' (MDB) are fascial structures linking neck muscles to spinal cord
  - #2: Superior myodural bridge
  - #5a: Inferior myodural bridge
- Excessive neck motion and excessive muscle activation strain MDB, which may become stiff and tight and pull on spinal cord.
- Too much movement of the spinal cord seems to cause thickening of the filum terminale, contributing to tethered cord syndrome (TCS)

(Frost, 2024)

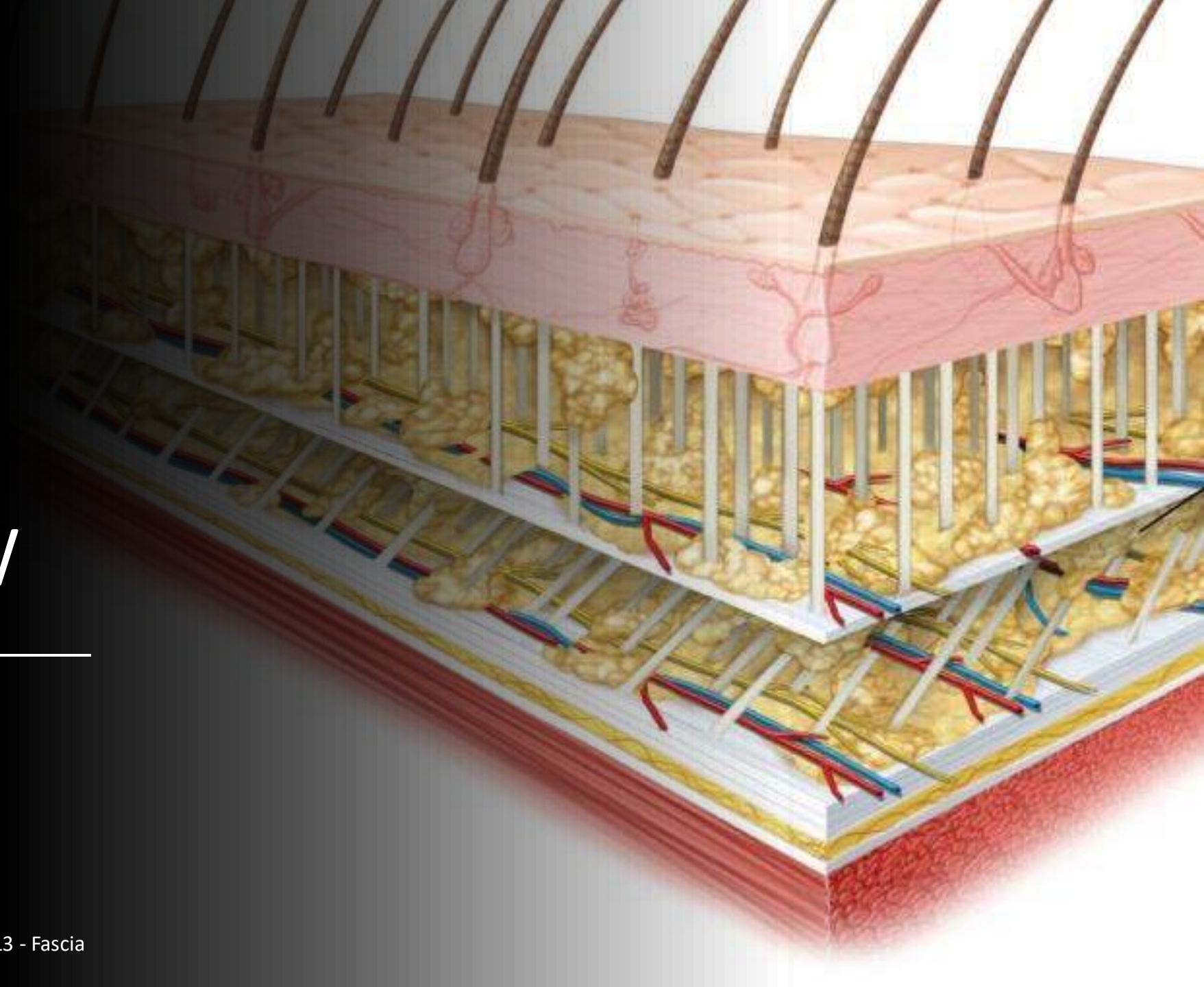
Force Transfer: So, Who Cares?

- Fascial connections often explain why a problem at one location causes mechanical stresses and pain at another
  - E.g., foot problems affecting the hip or knee
- Fascia can contract, and this change in shape and tension affects muscles
  - Dysautonomia and pain both trigger fascial contraction
  - Contracted fascia does not naturally relax, and treatment might be needed
- Fascial contraction helps wound healing, weak fascia → poor healing
- Abnormal forces between tissues might be problematic
  - E.g., MALS is an example of fascial connections causing problems
- Excessive joint motion may stress fascia and cause restrictions
  - E.g., cervical instability and tethered cord

Questions?

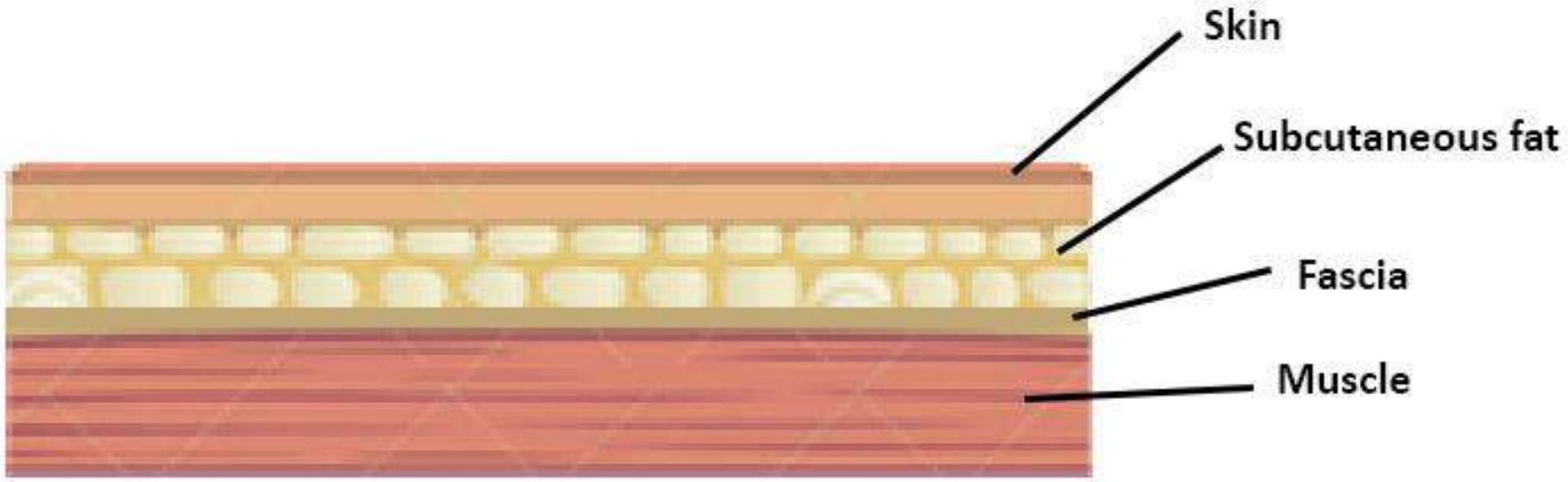


Fascial Fluid Flow

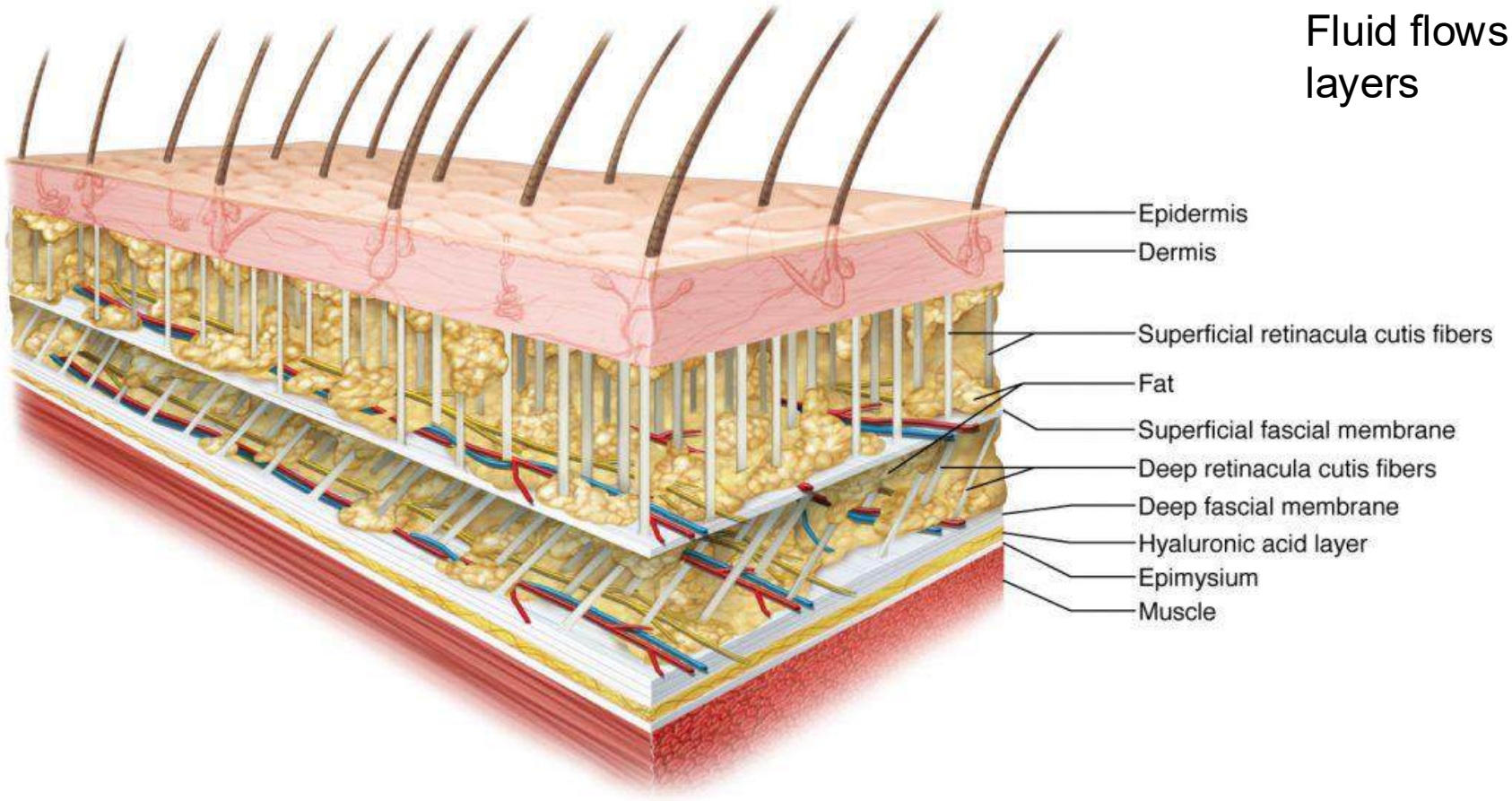


Russek: HSD113 - Fascia

Old Image of Fascia



Recent Model of Fascia

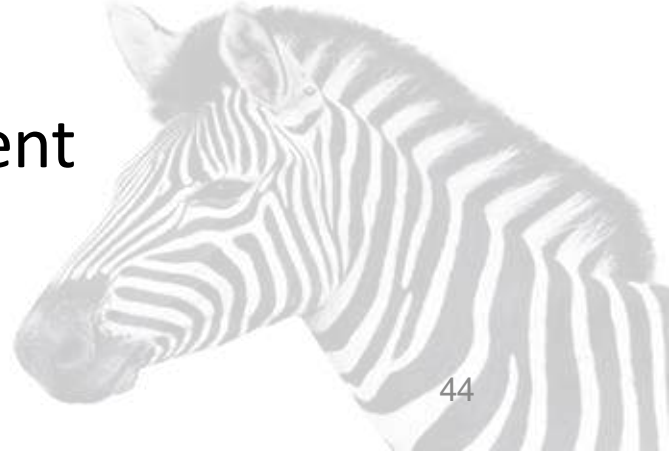


Fluid flows between fascial layers

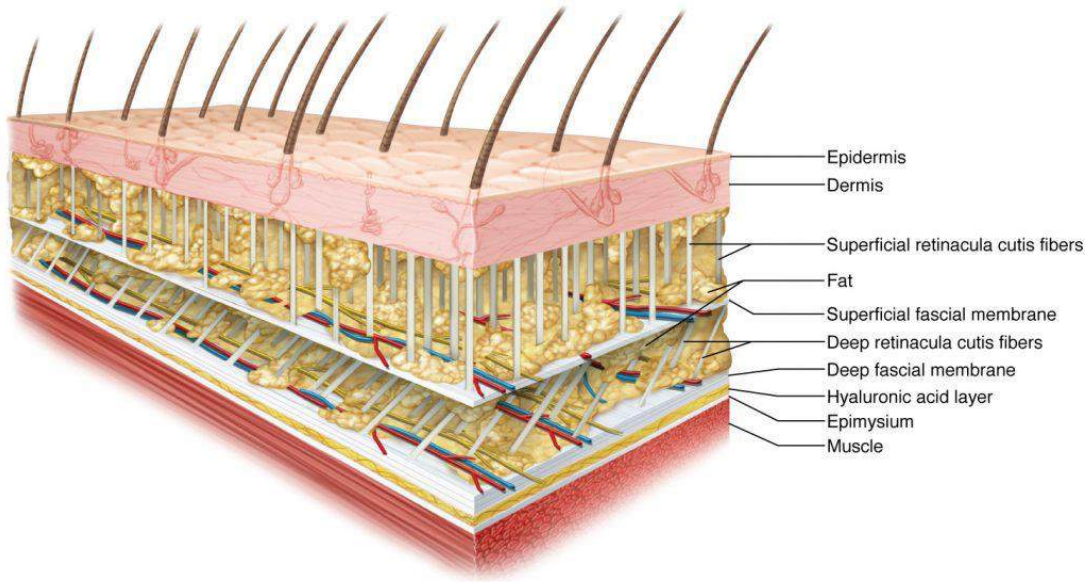
Muscolino JE. Fascial structure. In. *Massage Therapy Journal.* Vol 512012:73+.

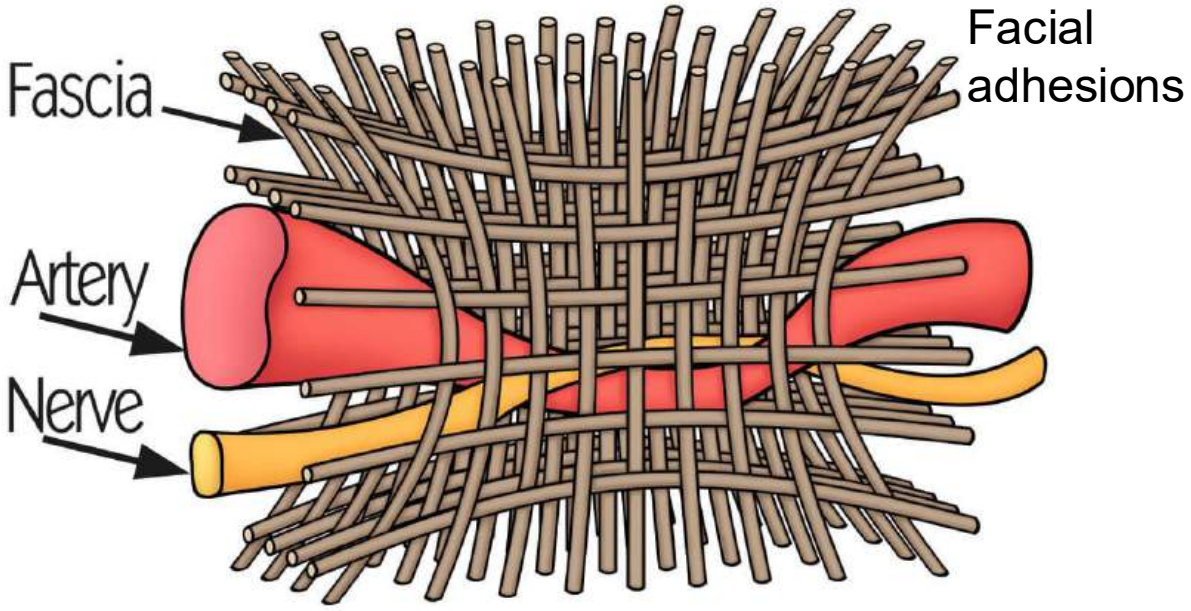
Fluid Flow Through the Body

- Fascia is 2/3 water
- Much of the interstitial fluid in the body is in fascia
- This fluid flows through the fascia
- Fibroblasts (cells that produce and maintain fascia) align perpendicular to fluid flow
- This fluid flow is important for providing nutrients and cellular communication
- Fluid and nutrient movement is influenced by movement



Fascia Allows Fluid Flow in the Body





https://clearpassage.com/blog/fascia-and-fascial-adhesions/

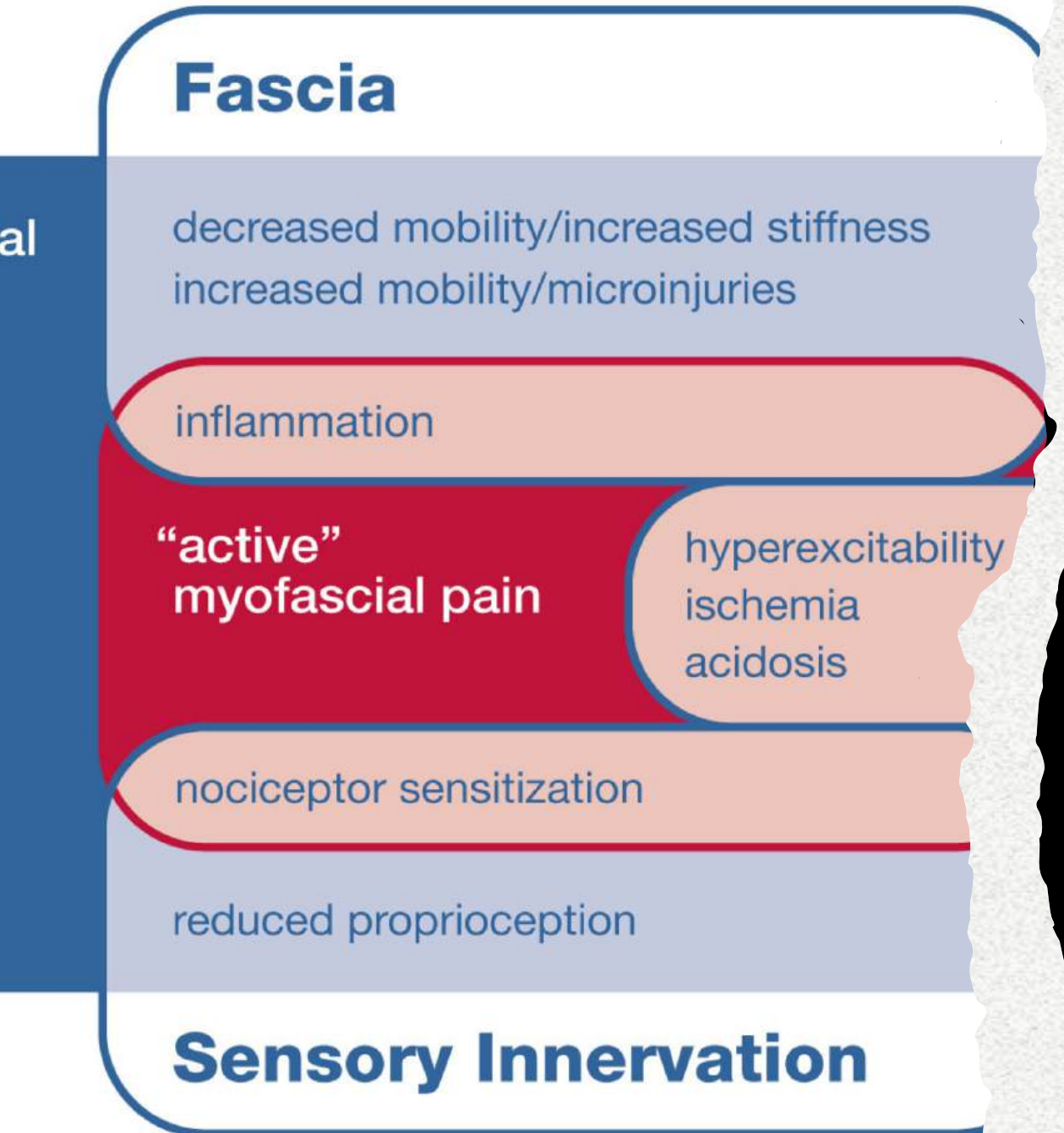
Fascial adhesions may:

- Interfere with fluid flow within the fascia, causing swelling
- Interfere with flushing of toxins and inflammatory chemicals
- Compress arteries, veins, and lymphatic vessels, interfering with their ability to transmit fluids

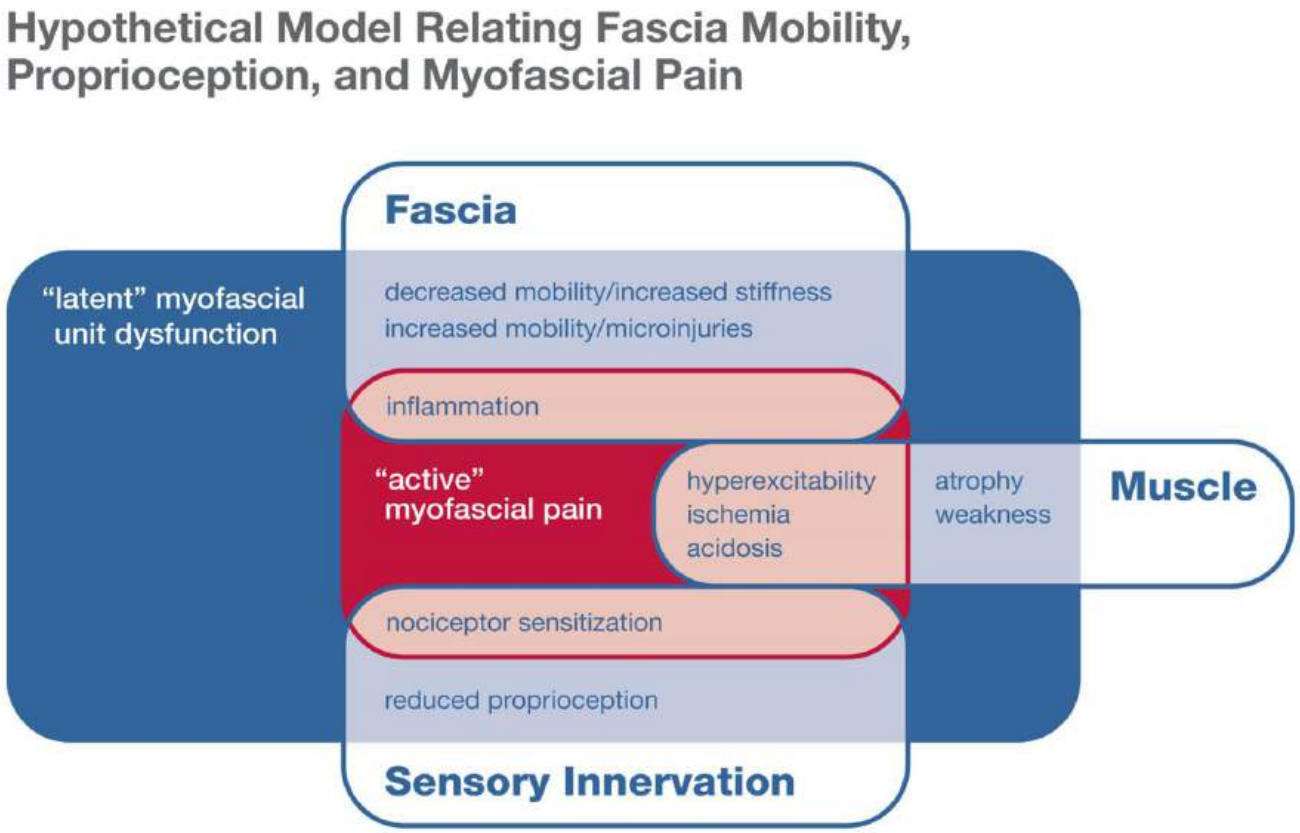
Fluid Flow: So, Who Cares?

- Proper fluid flow through the body is essential for nutrition and tissue health
  - Decreased fluid movement compromises tissue health and may increase inflammation and pain
- Problems with fluid flow can aggravate POTS
  - POTS symptoms might be affected by fascial health
- Fascia might be particularly sensitive to inflammation from MCAS
- Motion helps to pump fluids through the body
  - Certain motions might be more helpful for moving fluids through the body

Fascial Sensory Function & Communication



Fascia Has Lots of Sensory Nerves



- Many nerve fibers can transmit pain in inflammation
- Sensory innervation also provides:
  - Proprioception: body position sense
  - Interoception: the body senses, interprets, integrates, and regulates signals from within itself

Langevin, 2021

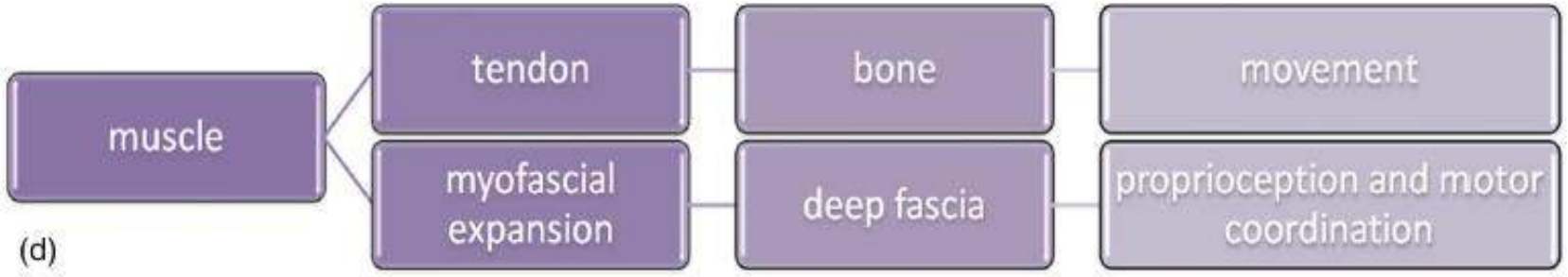
https://www.mdpi.com/2075-1729/11/7/668

Proprioception

- "…proprioception is defined more narrowly and evaluated as the ability to sense whether a joint is moving in one direction versus another"

  (Langevin, 2021, p2)

- Fascia contains high numbers of proprioceptive sensory nerves:
  - Pacinian corpuscles, Ruffini corpuscles, Golgi receptors, interstitial receptors
  - Fascia contains far more sensory nerves than muscle
- Muscle spindles are concentrated where fascia connects to muscle.



(d)

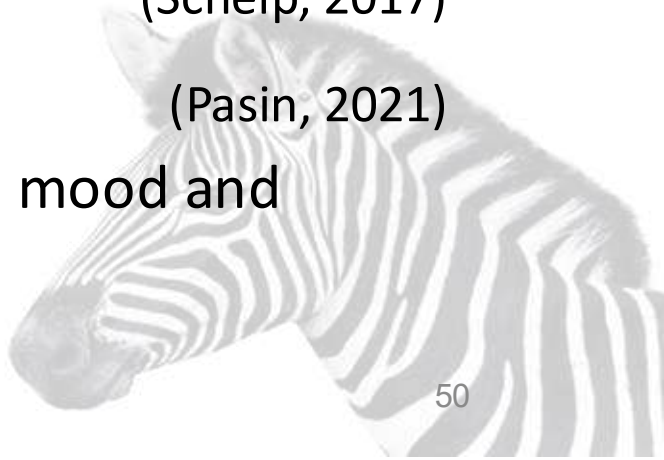
(Stecco, 2019)

Interoception

- “Interoception is the processes by which the body senses, interprets, integrates, and regulates signals from within itself”

  (Langevin, 2021, p2)

  - Proprioception is a type of interoception
- Interstitial receptors connect to the autonomic nervous system and help communicate unconscious sensation
- Fascia is our largest sensory organ (Scheip, 2017)
- Interoception from the gut influences emotions. (Pasin, 2021)
  - Gut fascia contributes to the Gut-Brain Axis, which regulates mood and overall health



Nociception: Pain Perception

- Fascia is heavily innervated with nociceptive nerves
- These nociceptors can become sensitized
- Irritated fascia generates a deep, dull, annoying pain
- Pain is more intense than similar irritation to muscle
- Referral pattern is different from dermatomes: “fasciatomes”

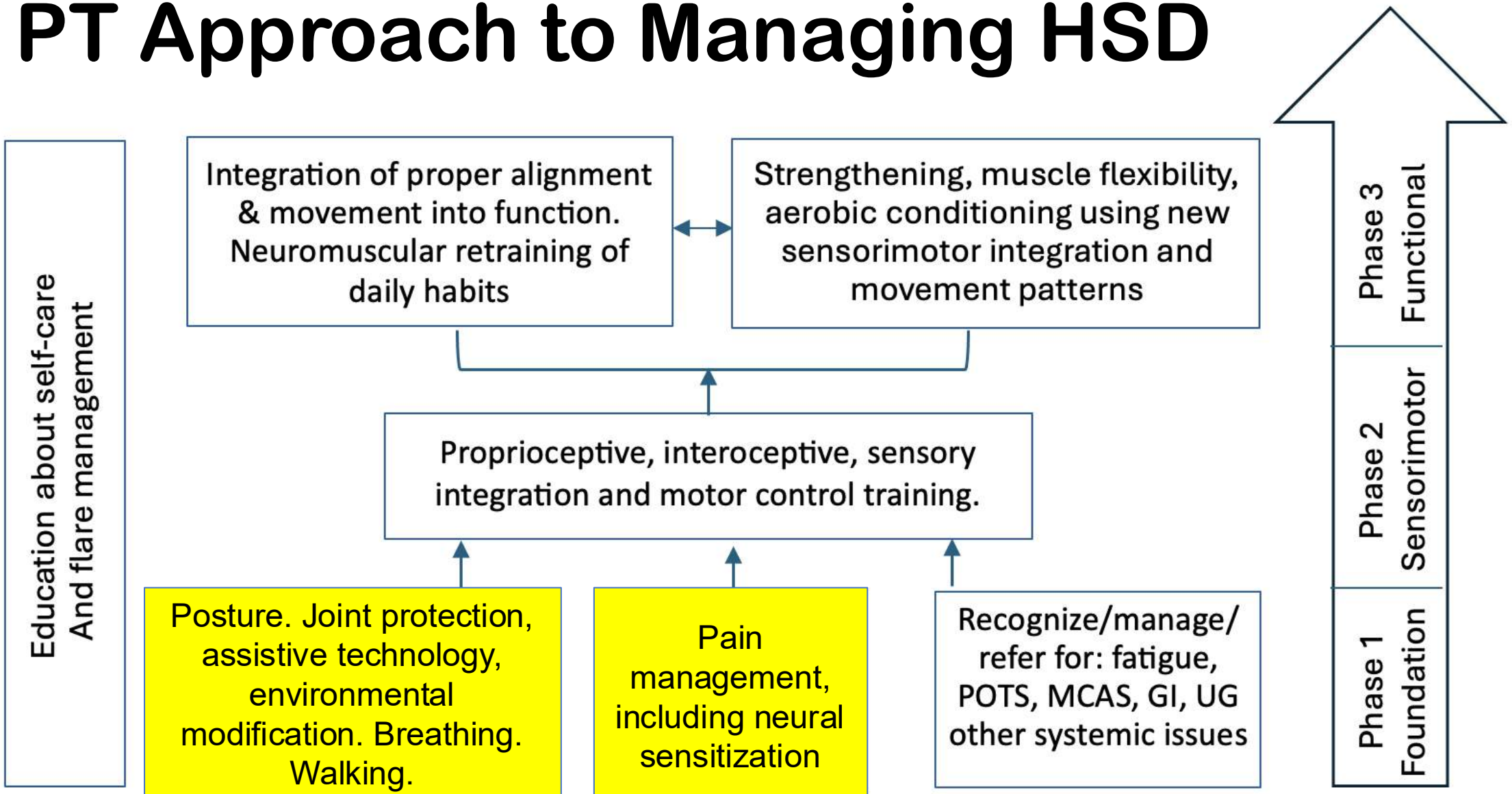
(Stecco, 2019)

Fascial Sensory Function: So, Who Cares?

- Fascia has a lot of nociceptor neurons
  - It can be the source of significant pain, often diffuse, vague discomfort
- Normal sensory input is important for movement
  - Decreased proprioception and interoception can lead to poor motor control
- Abnormal sensory input contributes to chronic pain neuroplasticity
  - The brain needs normal sensory input to process correctly. Lack of input or abnormal input can lead to nociplastic pain (sensitive nervous system) through neuroplasticity

How Do We Treat Fascia?

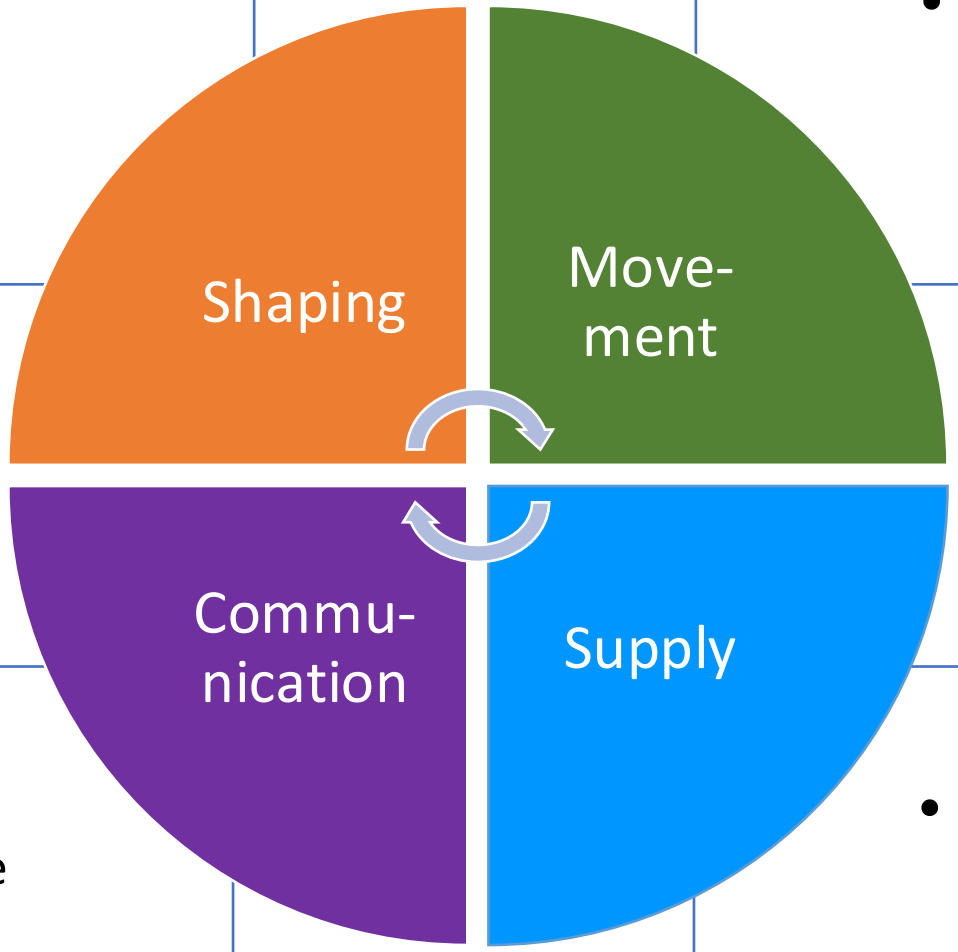
PT Approach to Managing HSD



Function Guides Management

- Stretch: full body elongation

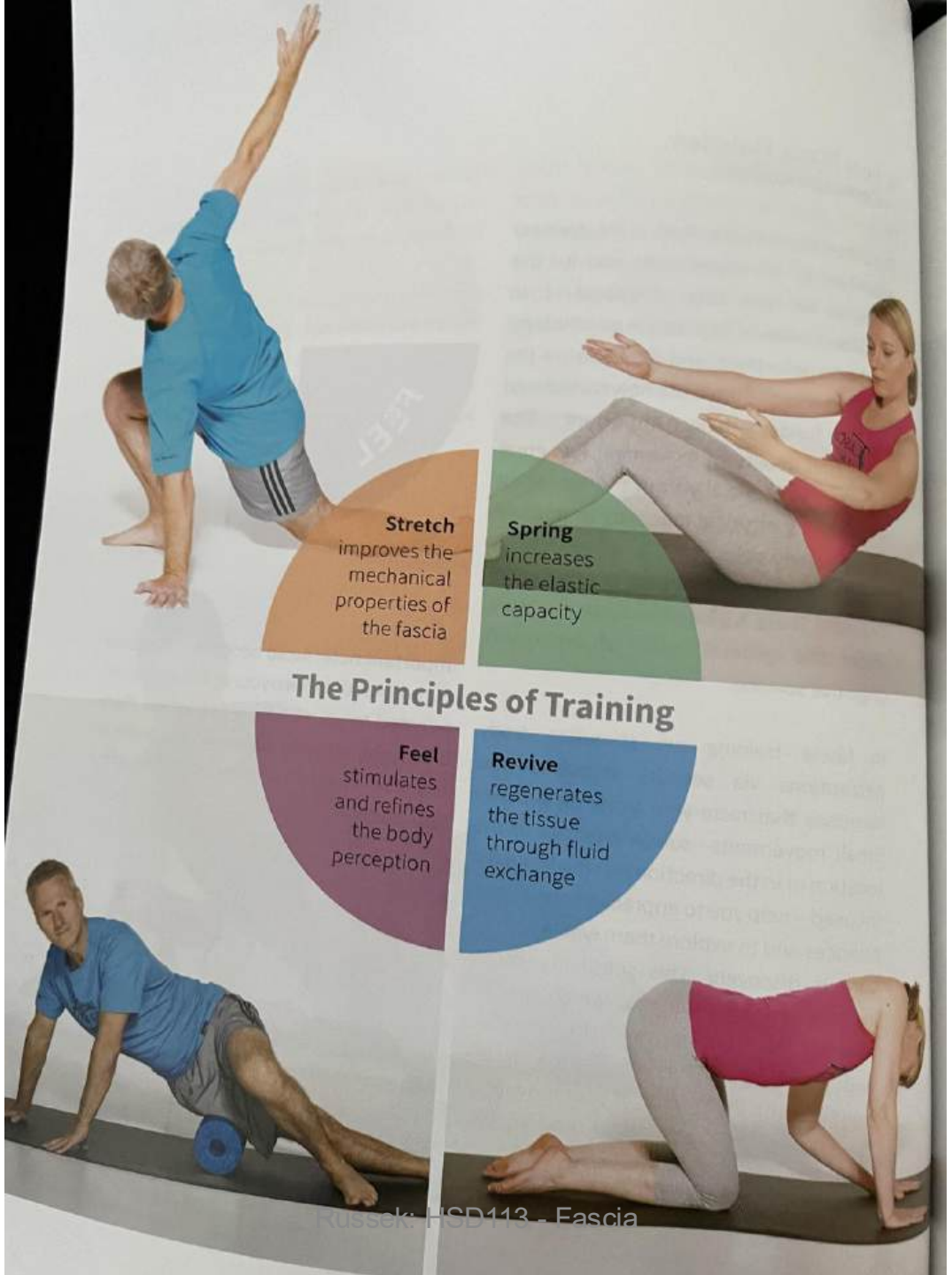
- Spring: gentle rebound



- Feel: proprioceptive training

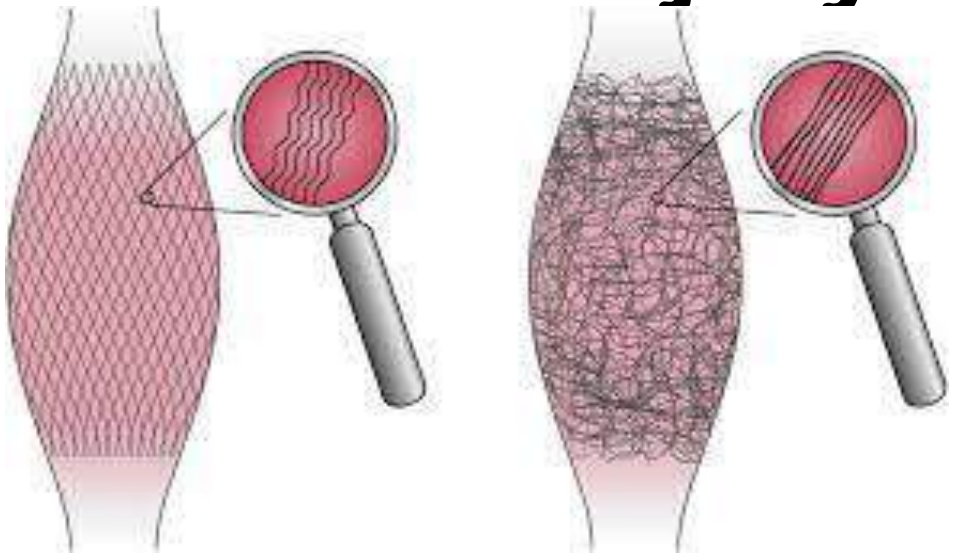
- Revive: massage, foam roller

Schleip, 2017



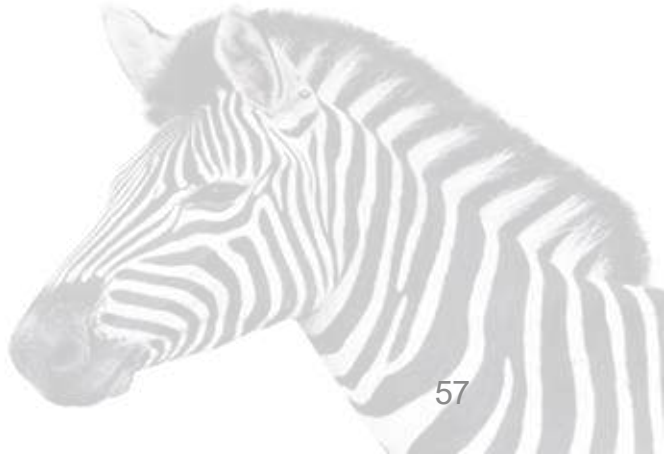
Schleip, 2017

Effects of Disuse & Injury



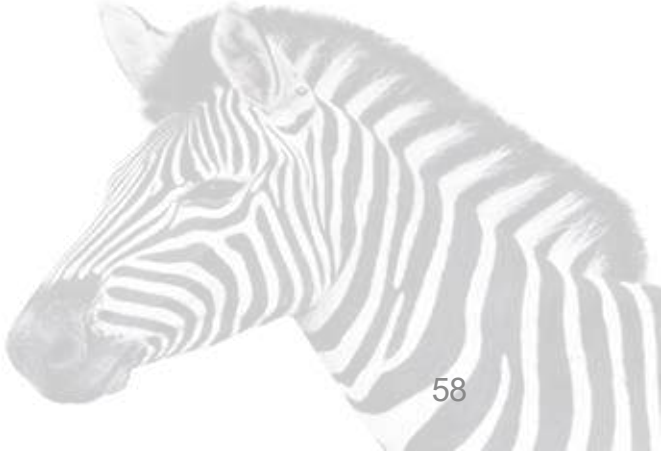
Schleip, 2013

- Immobilized fascia becomes matted
- Loses its crimping and lattice-work structure
- Loses ability to slide and stretch
- Soft tissue injury often affects fascia
- Delayed onset muscle soreness may be due to fascia



Effects of Exercise

- Response to exercise is slower than in muscle because fascial metabolism is slower
- Increased fiber number and crimping
- Increased load capacity and elasticity
  - Shleip, 2013 & 2017
- Foam rolling and nerve glides are ‘exercises’ that also influence fascia



Manual Therapy & Fascia

- Myofascial release

- Massage

- Cupping

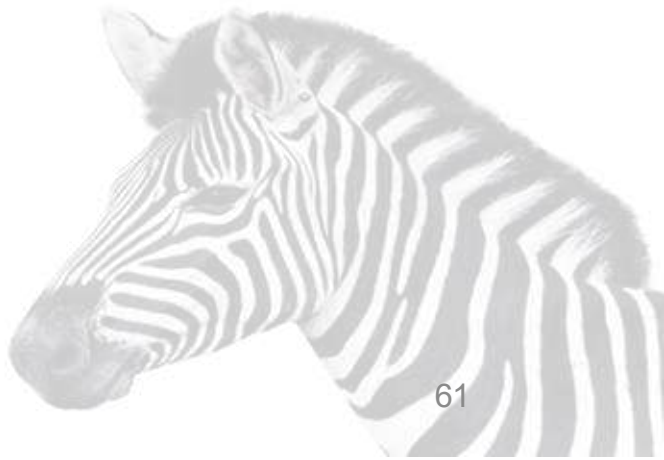
- Instrument assisted soft tissue mobilization

More Fun Fascial Facts

- Full body-movements in yoga, Pilates, Tai Chi, qigong probably mobilize the fascia
- Yoga may stimulate the autonomic nervous system through prolonged fascial stretches
- Fascial interoceptors relay signals to the insula in the brain – the location which modulates our sense of 'self' and emotional state
  - Dysfunction in fascia contributes to depression and anxiety
  - Healthy fascia may relay a sense of wellness
    - Shleip, 2017

Summary

- Our understanding of fascia has changed tremendously in the past 10 years
- The basic science drives functional and clinical importance
- It helps to understand the basic science and clinical implications
- There is a lot we still don't understand!



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- SciShow 5 min YouTube on fascia: https://youtu.be/T-UsSmD7miI
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New References (2025)

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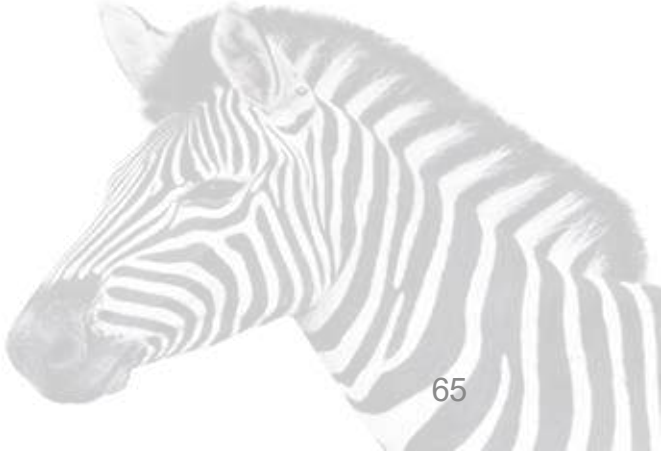
- Wang TJ. Fascia and the Hypermobility Disorders. London: Handspring Publishing; 2026.

Web Resources

- SciShow 5 min YouTube on fascia: https://youtu.be/T-UsSmD7miI
- Fascia in HSD: https://jeanniedibon.com/wellness/fascia-and-proprioception-what-are-they-and-what-do-they-mean-for-those-with-eds/
- Langevin article online: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8304470/
- The Fascia Research Society: https://fasciaresearchsociety.org
- Painscience article on HSD and myofascial pain: https://www.painscience.com/articles/hypermobility-and-

Thank You!



Questions?