#COVID_OPS

(EP IV)

TRAINING THE FASCIAL SLINGS

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"Fascia- The fabric of biological structure, catalyst of movement, and underpinning to optimal performance"

PRESENTATION GOALS

01

Provide broad overview of the fascial system… however, this is not an anatomy presentation

02

Examine some of the mechanical properties of fascia and relating to muscle

03

Discuss the components of training the fascial system

04

Discuss training applications, modalities and variations along w/ how to progress

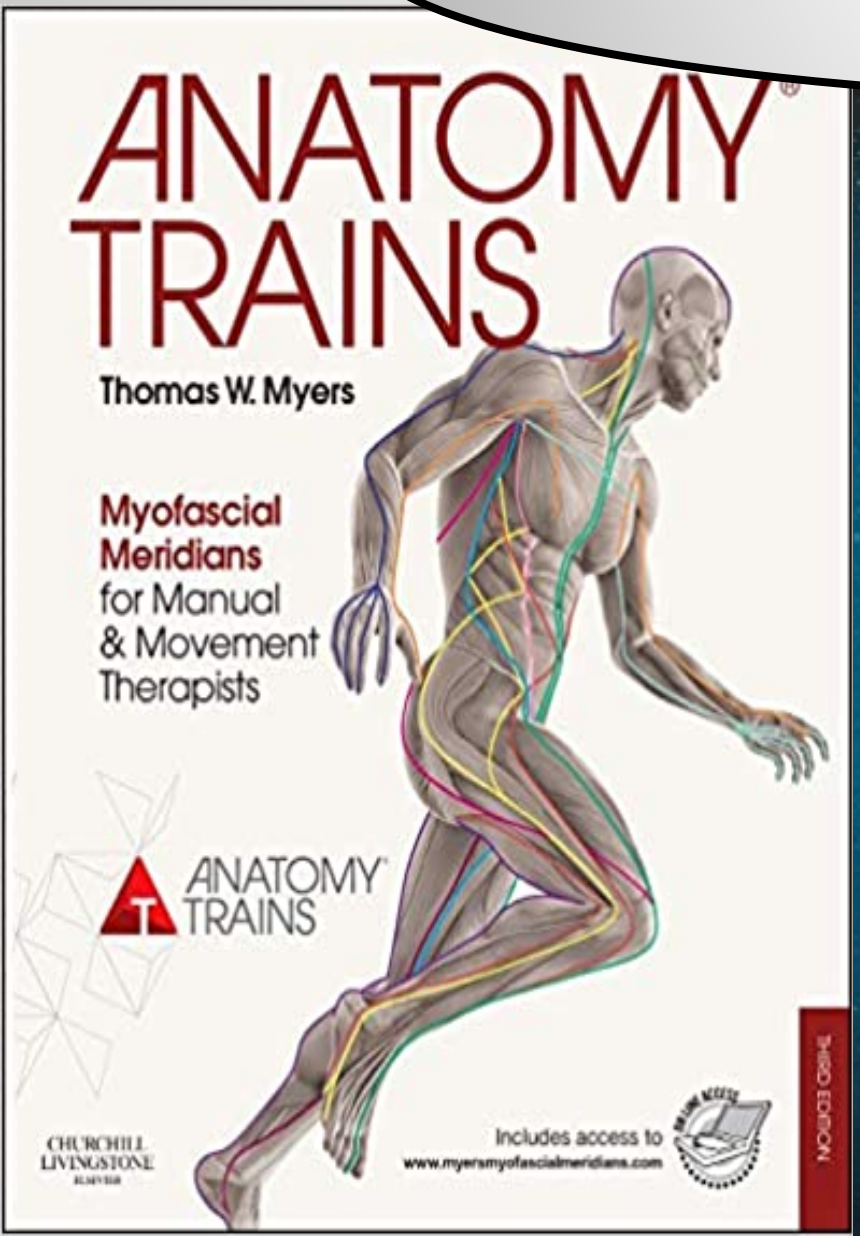
- Fascia is one system of many, it has its roles but does not supersede other systems
- Muscles are still very important… we still need to load heavy, conventional patterns & traditional planes
- My stance is simply that the fascial system is underrecognized, and has a significant contribution to performance and function

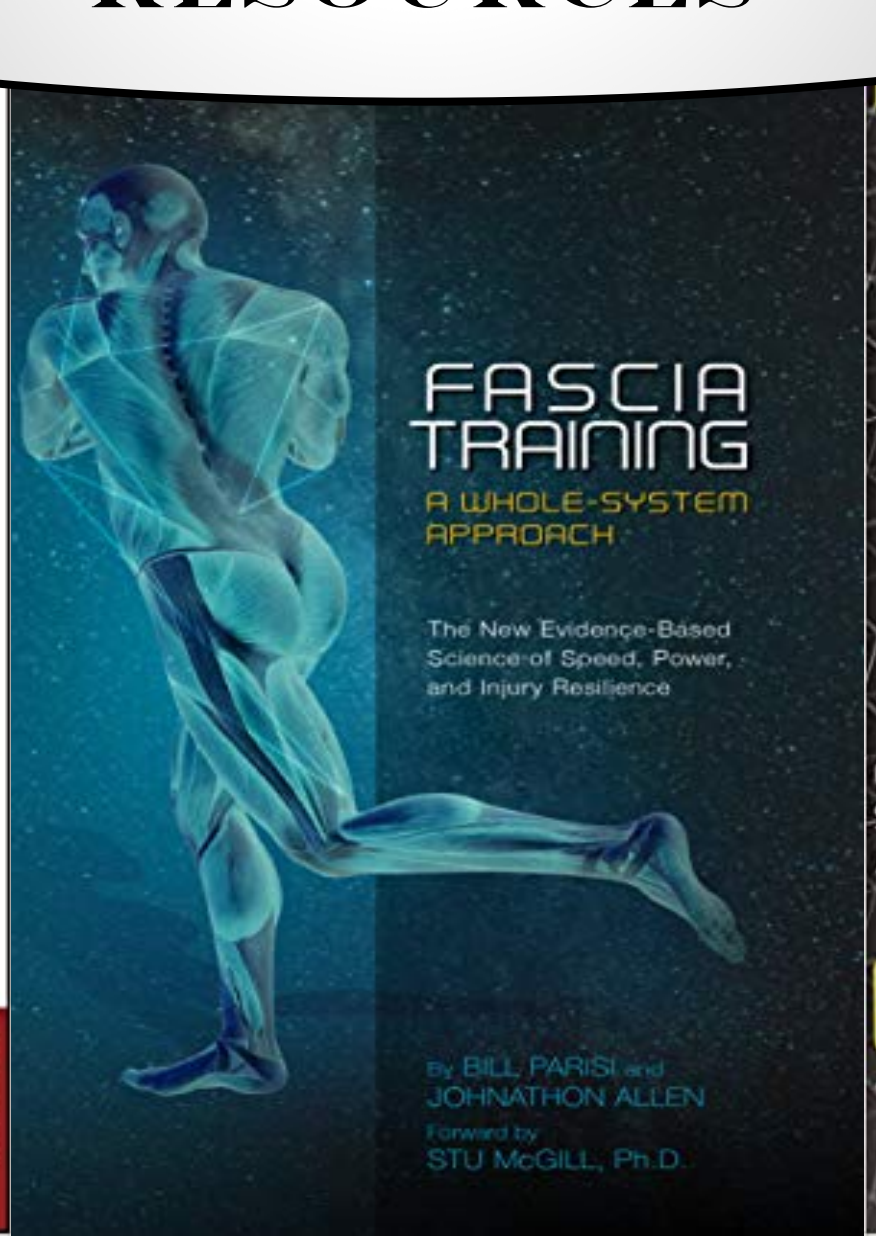
ALLOW ME TO BE CLEAR…

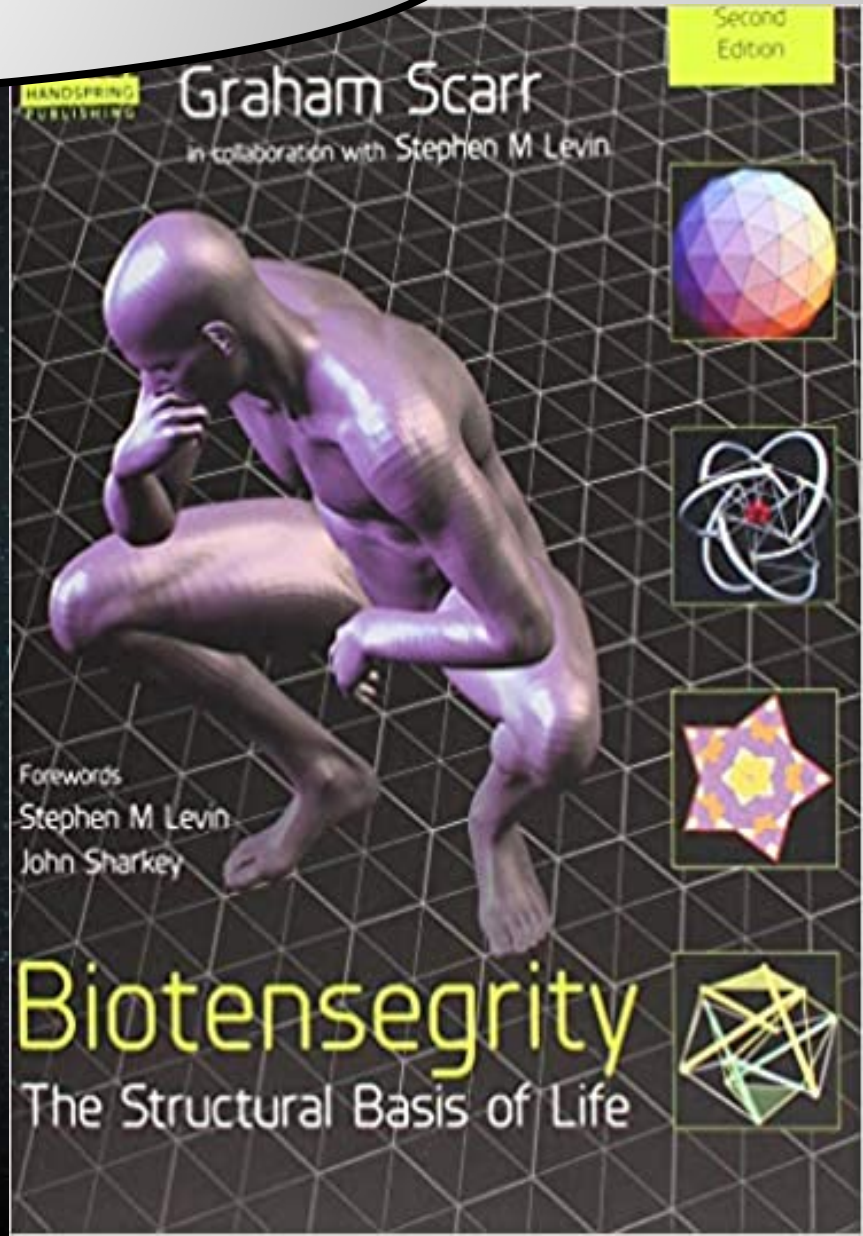
THOUGHT PROVOKING QUOTES…

- "For years, coaches have fixated on increasing power by making athletes stronger without appreciating the significance of the underlying fascia system and how it works to *harness*, *distribute*, and *amplify* force across the body." –**Bill Parisi**
- "Fascial elasticity is important, because most *tearing injuries occur when connective tissue is stretched faster than it can respond*. The greater the imbalance between the muscular and fascial system, the higher the chance for injury." –**Tom Myers**
- "*Be careful with things like stretching*. Use stretching not for mobility, but to tune your fascia system and get it to play with the neurology of pulse-release elastic energy." –**Stu McGill**

MUST HAVE FASCIA RESOURCES







SOME RESEARCH

- -Fukunaga T, Kawakami Y, Kubo K, Kanehisa H (2002) Muscle and tendon interaction during human movements. Exerc Sport Sci Rev 30(3): 106-10
- -Fukashiro S, Hay DC, Nagano A (2006) Biomechanical behav-ior of muscle-tendon complex during dynamic human move-ments. J Appl Biomech 22(2): 131-47.
- -Muller, D. Shleip, R. Fascial Fitness (2014)
- -Renström P, Johnson RJ (1985) Overuse injuries in sports. A review. Sports Med 2(5): 316-333.
- -Sawicki GS, Lewis CL, Ferris DP (2009) It pays to have a spring in your step. Exerc Sport Sci Rev 37(3): 130-138
- -Stecco, A. Stern, M. Fantoni, I. Fascial Disorders: Implications for Treatment (2015)

INTRO TO FASCIA

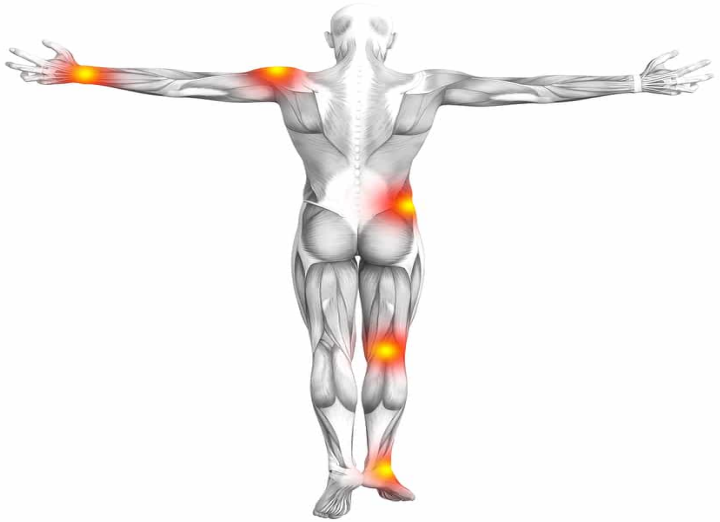
RUDE ROCK

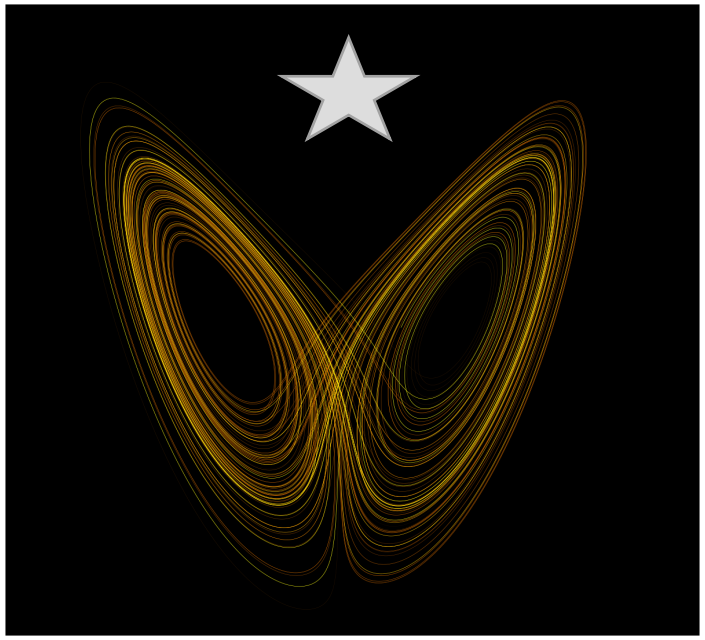
STRENGTH & CONDITIONING

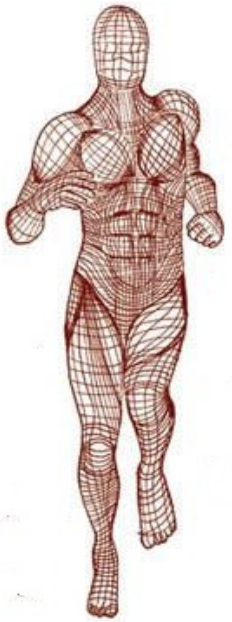
WHAT IS FASCIA?

- Fascia is an extracellular, collagenous matrix that envelopes every muscle, muscle fiber, soft tissue, cell and structure throughout the human body.
- The fascial system helps to support structure (posture) and is heavily involved in producing movement and managing external and internal forces.
- The main properties of fascia include **plasticity**, **elasticity**, **viscosity** & **remodeling**.
- It has been shown recently that the fascial system has 6x the amount of proprioceptive bodies and nerve fibers than muscles. (T. Myers & B. Parisi)
- Honestly, a very complex, understudied biological system that we still have a shit ton to learn about.

WHEN MOST PEOPLE THINK ABOUT FASCIA...

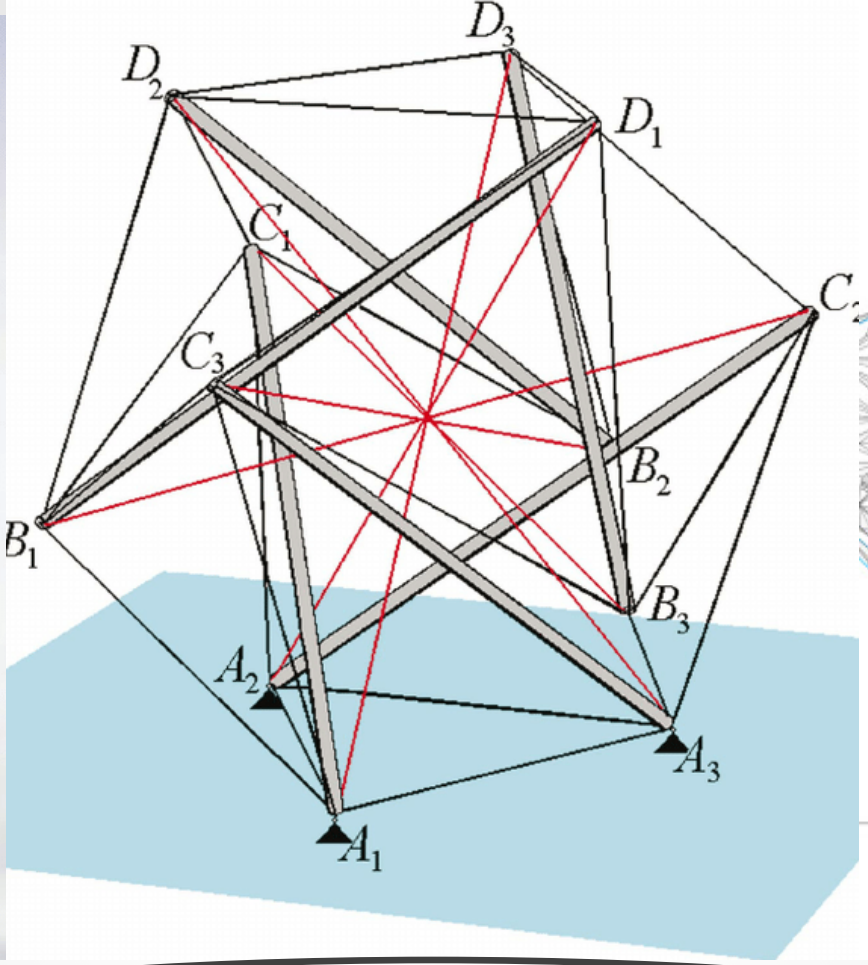


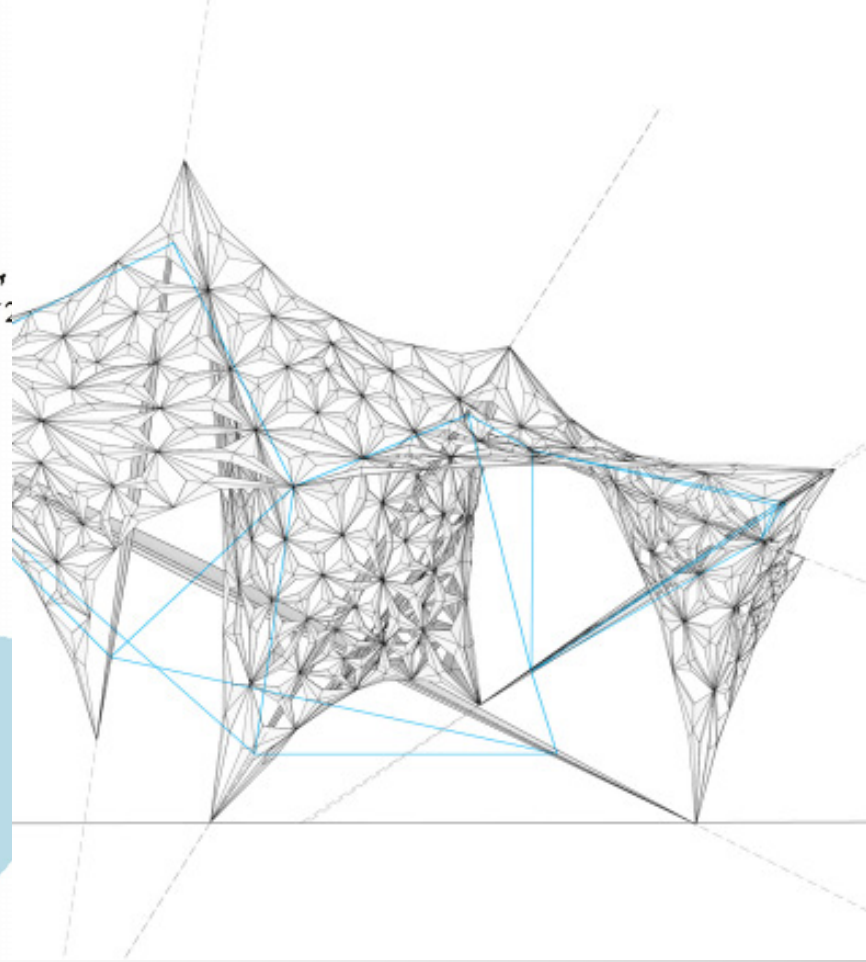




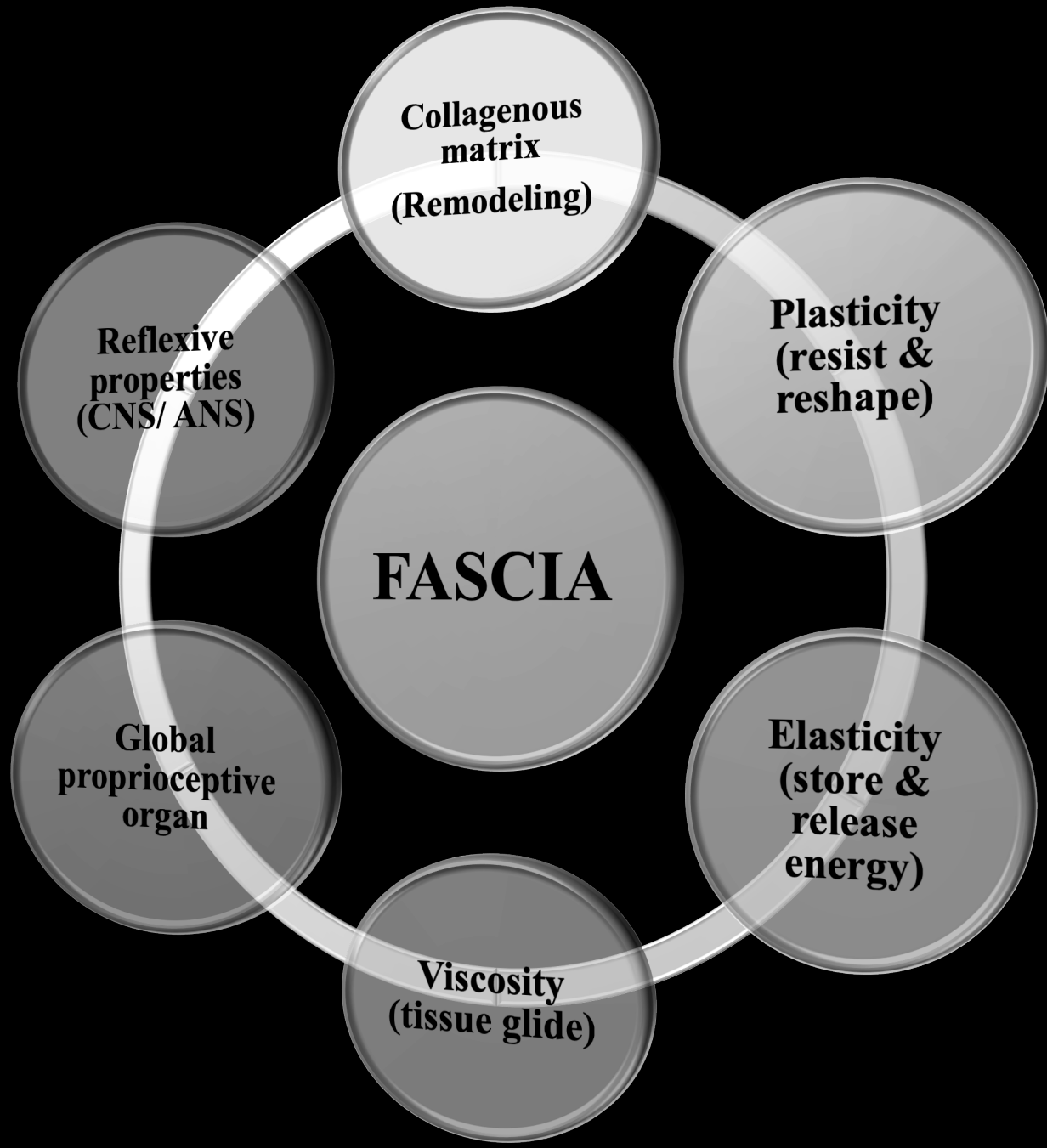
NOTE: Image via Ravenstarshealingroom (WordPress)

WHAT WE SHOULD THINK ABOUT FASCIA…





BIOTENSEGRITY

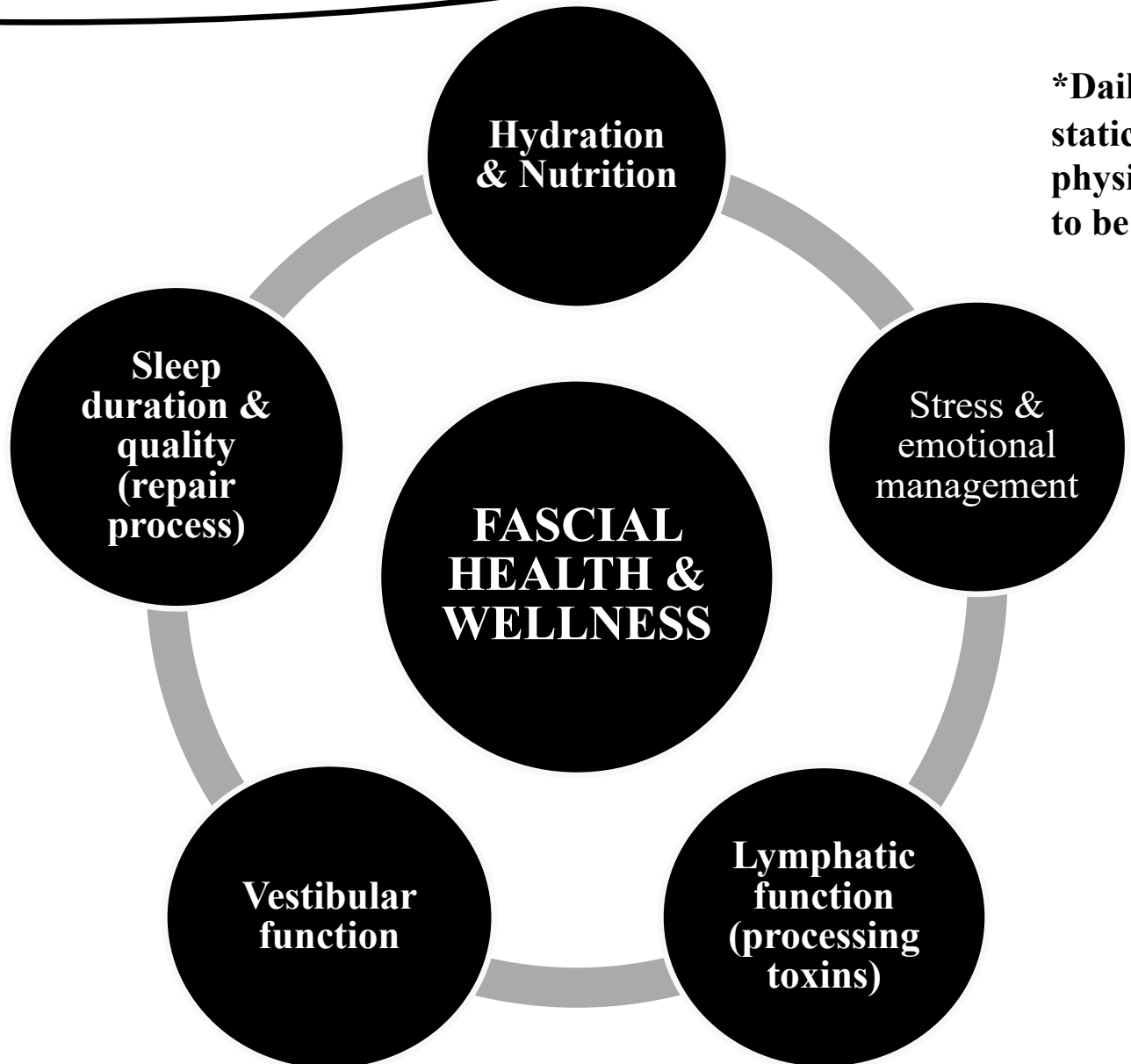

Collagenous matrix (Remodeling)
Plasticity (resist & reshape)
Elasticity (store & release energy)
Viscosity (tissue glide)
Global proprioceptive organ
Reflexive properties (CNS/ ANS)
FASCIA

COMPONENTS

NOTE: Information in chart was adopted from Chris DaPrato of UCSF

Component	Description
Fibroblasts	**Augment and secrete all fibers of areolar connective tissue**
Collagen Fibers	**Strongest and most abundant, cross linking leads to significant tensile strength (think spider web)**
Elastic Fibers	**Rubber-like proteins which allow tissue to return to original shape**
Reticular Fibers	**Connect vessels and nerves; have more give than collagen**
Ground Substance	**Extracellular matrix that holds interstitial fluid via sugar protein molecules that soak fluid up like a sponge; becomes more viscous with increased inflammatory response**

HEALTH& WELLNESS FACTORS

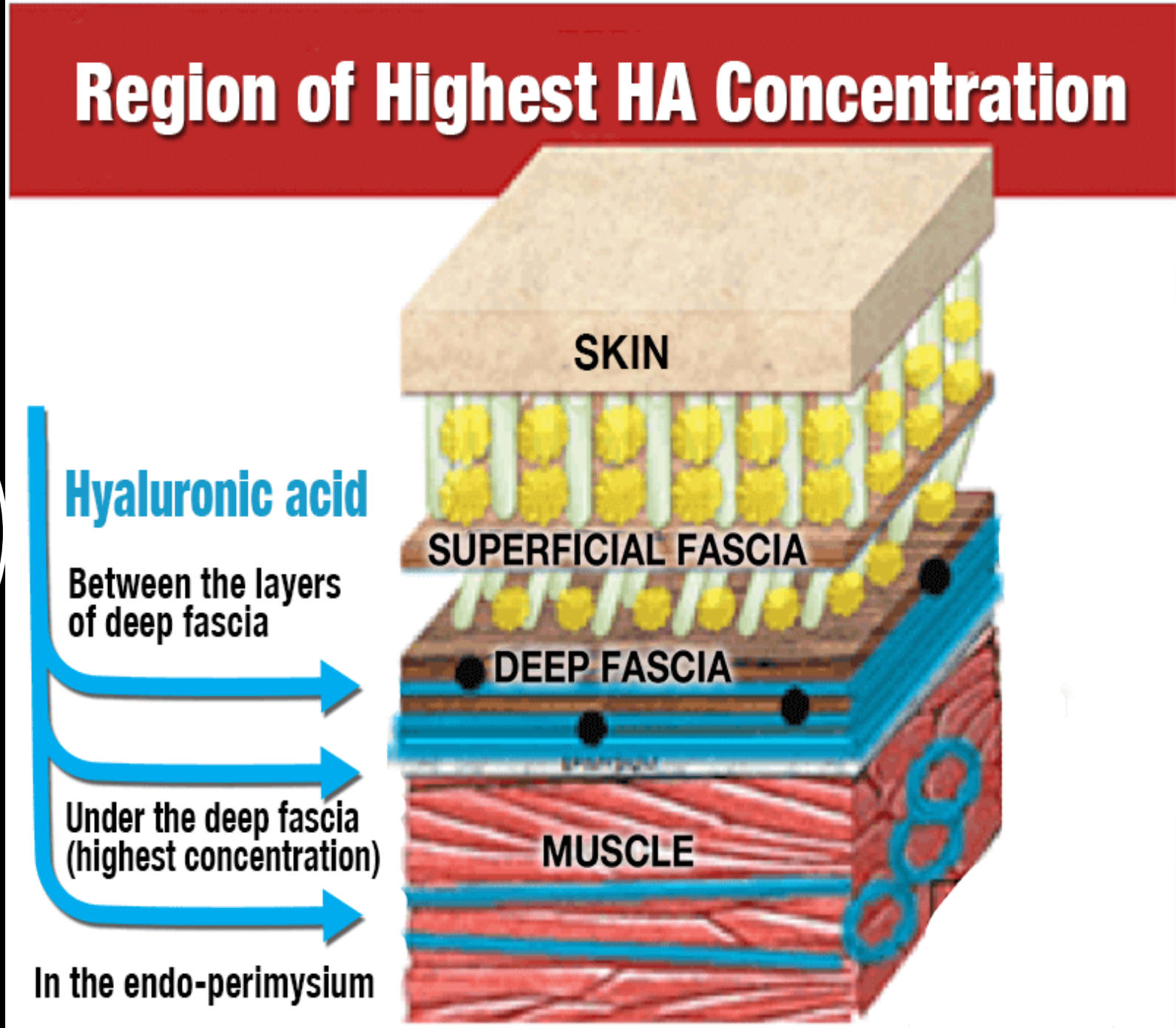


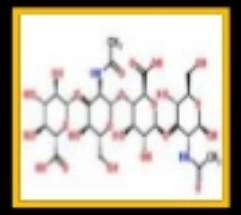
***Daily activity rates, static/working postures and physical demands are also to be considered here**

Note: Image via Structura Body Therapies

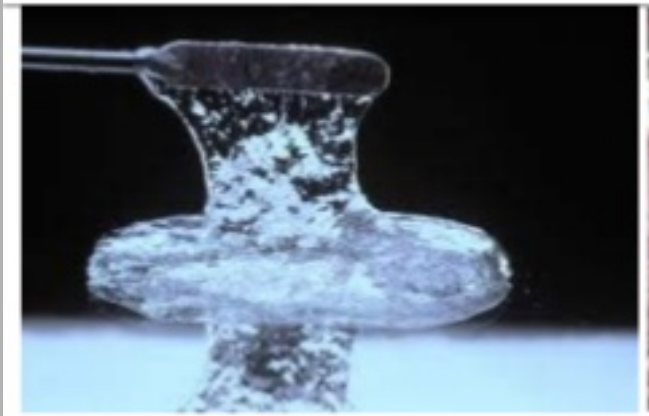
FASCIAL LAYERS

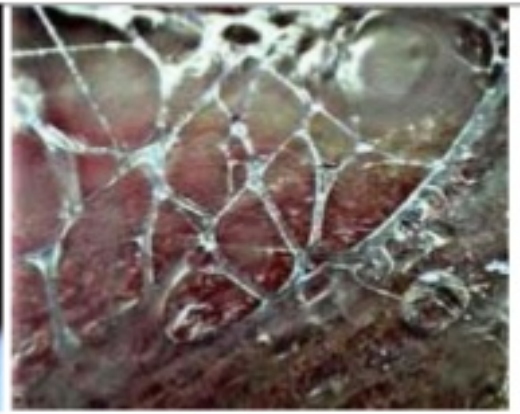
***Perfect demonstration as to why varying velocities matters*

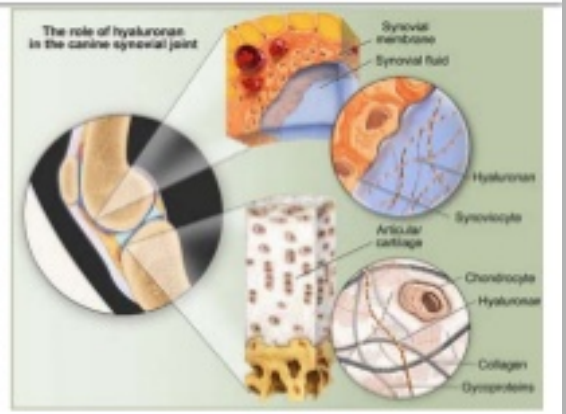




Hyaluronan (hyaluronic acid)







- The average 70 kg person has roughly 15 grams of **hyaluronic acid** in the body, one-third of which is turned over every day.
- It is part of the extracellular matrix, a major component of the synovial fluid, and was found to increase the viscosity of the fluid.
- **Hyaluronic acid** is a component of articular cartilage and skin.

Note: Image via Dr. Leonid Kalichman (via slide share)

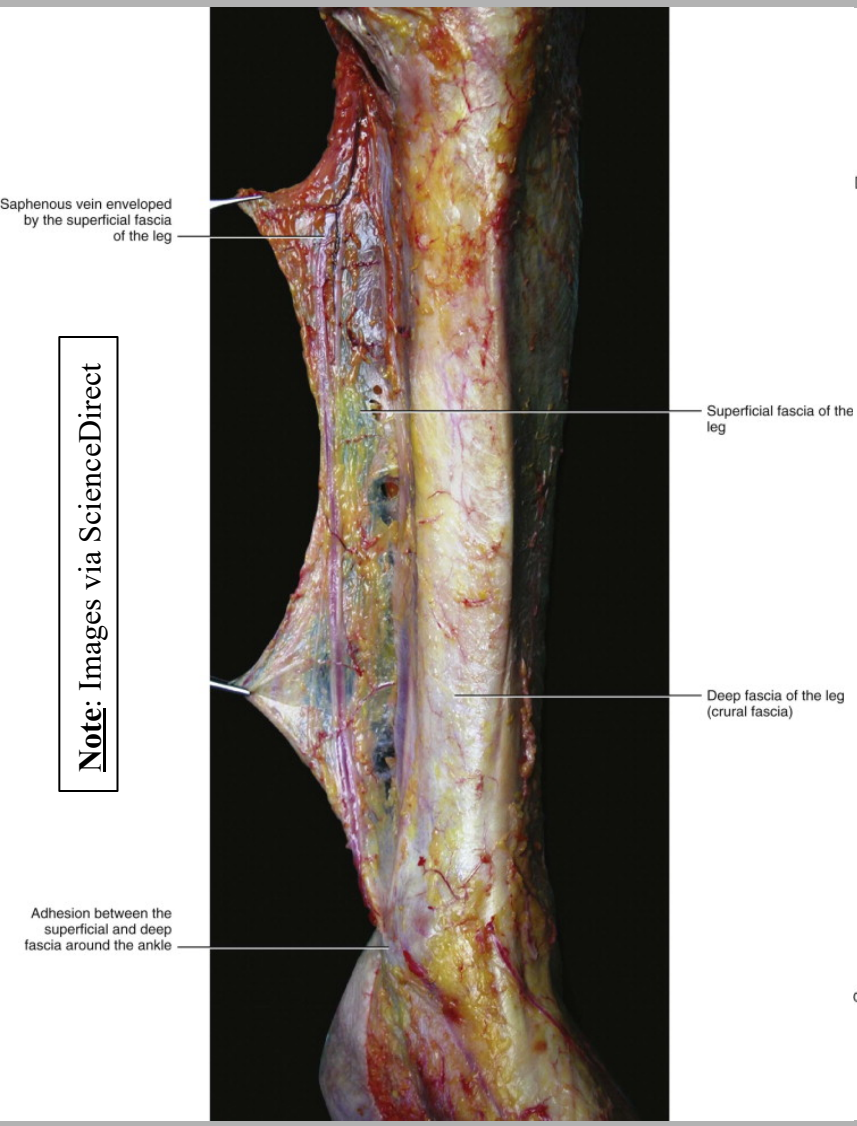
HYALURONIC ACID

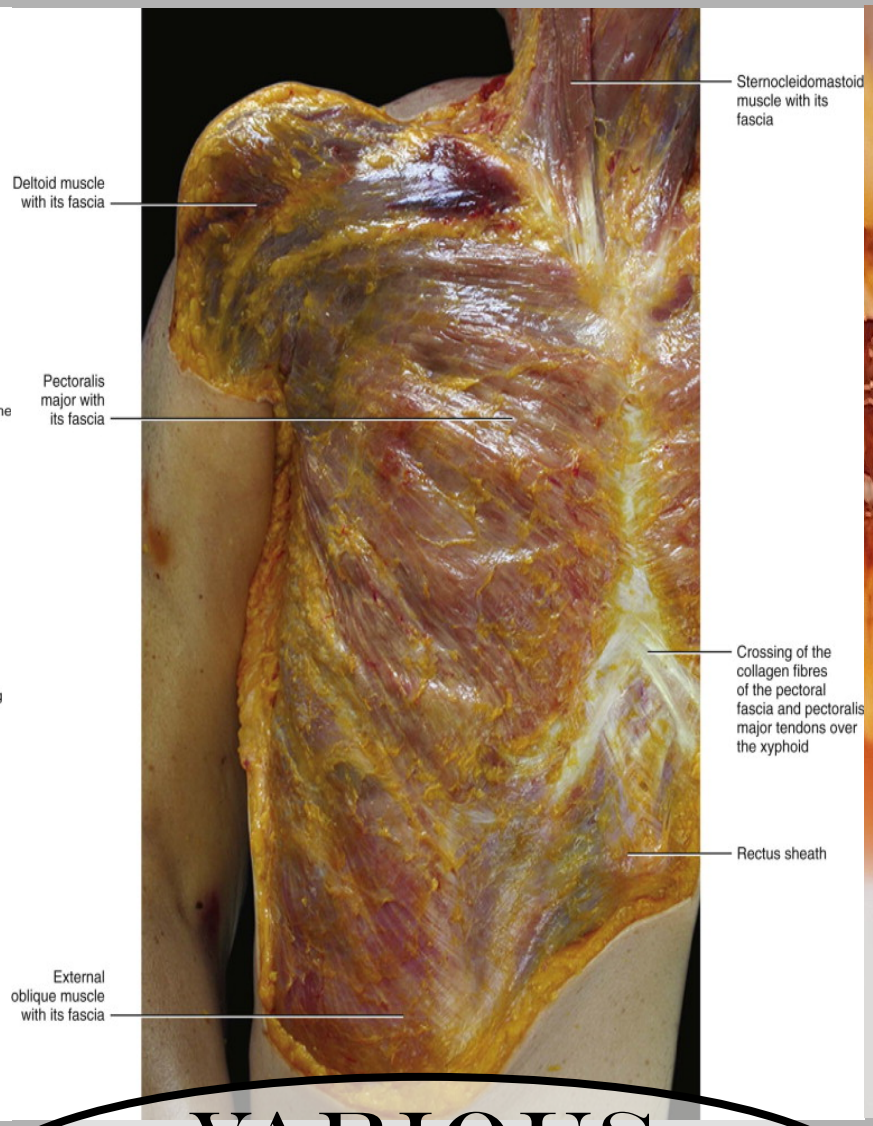
What you should know:

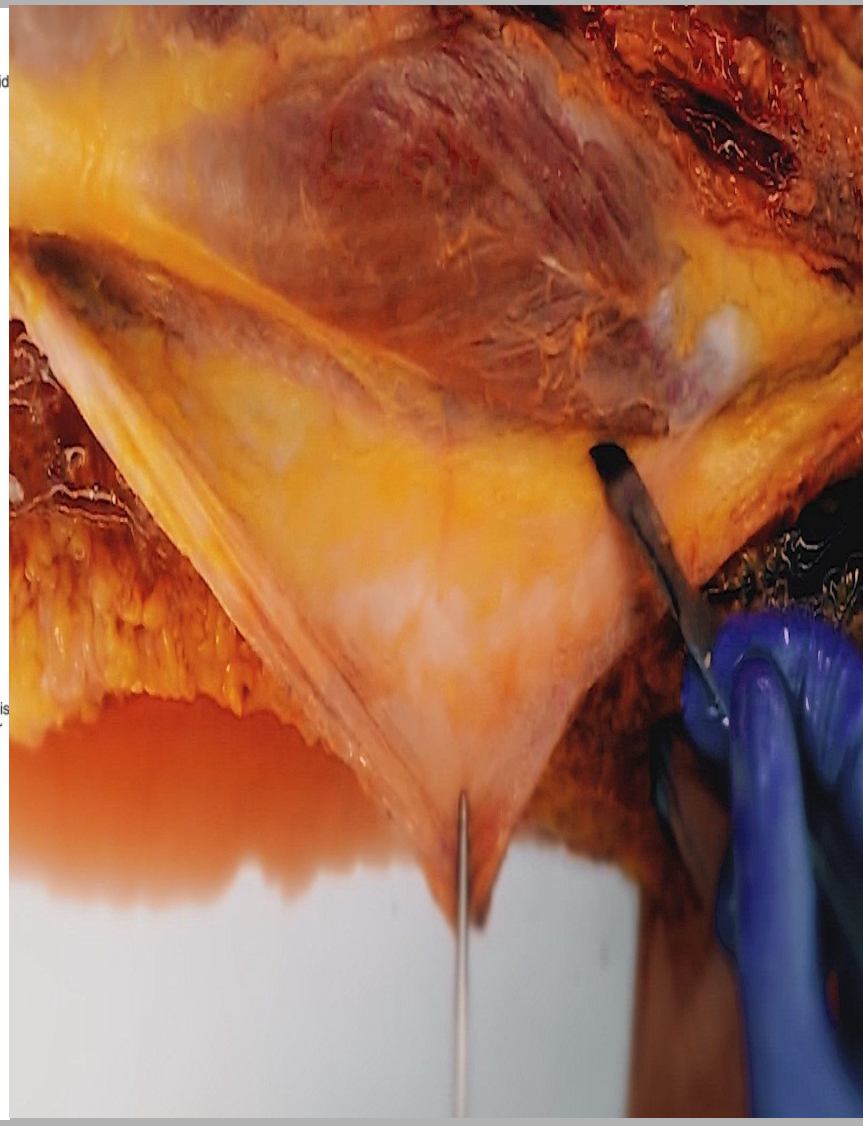
-HA can be like water, or like glue. Paths of motion that get neglected in training become liabilities for injury in action.

-The best ways to promote HA circulation in training include multiplanar free movement , deep range mobility/flexibility under load, and soft tissue modalities.

Note: Images via ScienceDirect

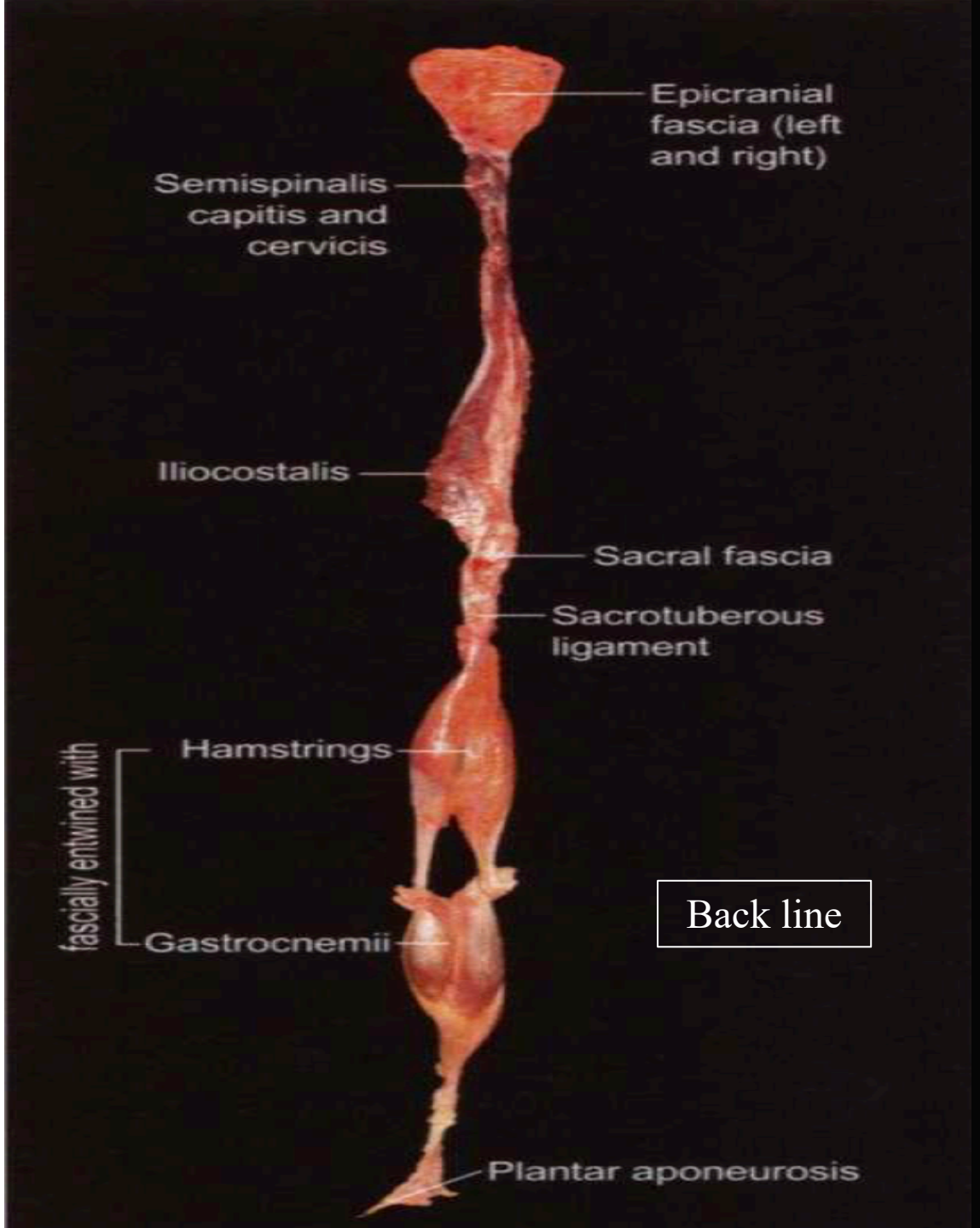


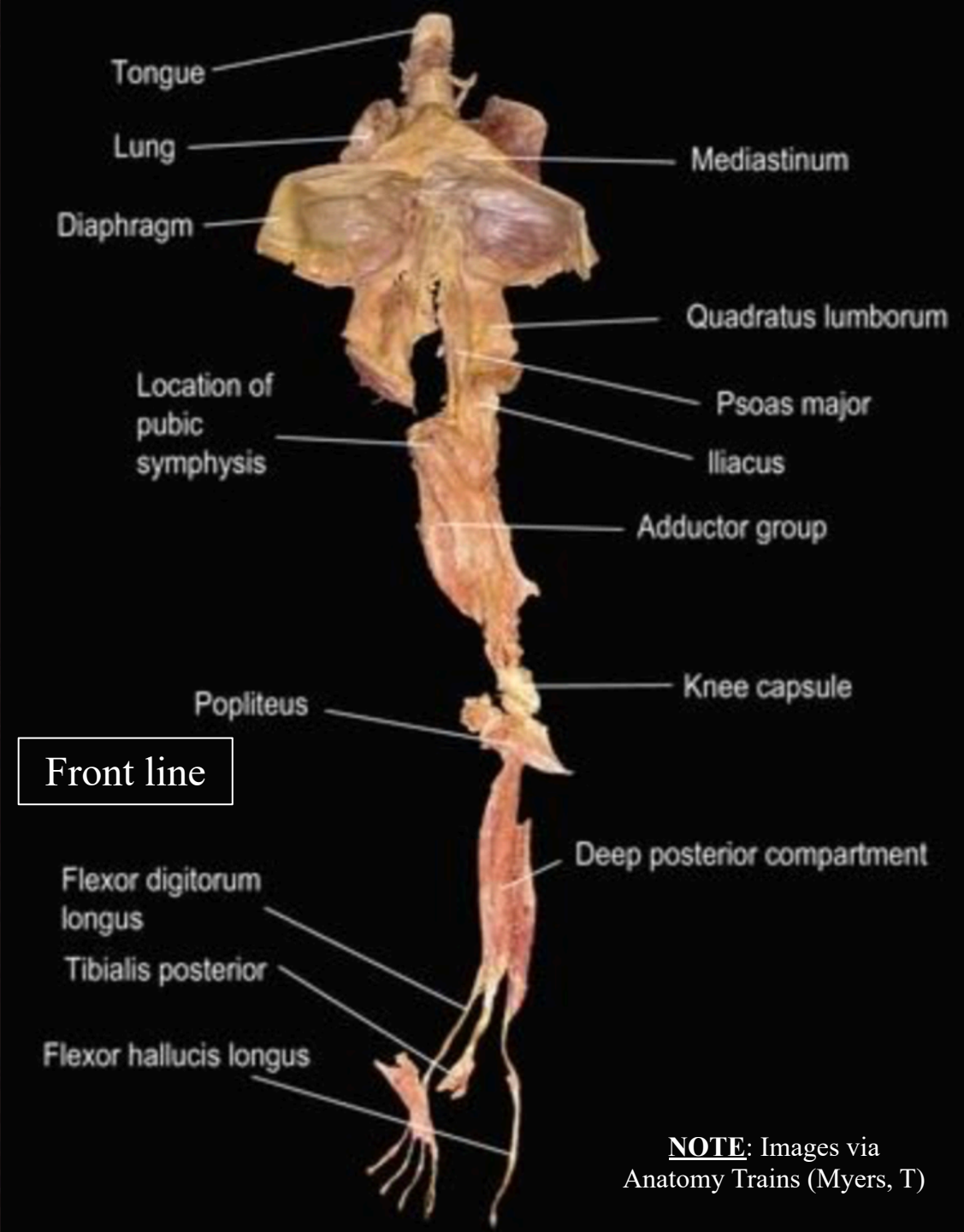




VARIOUS TYPES

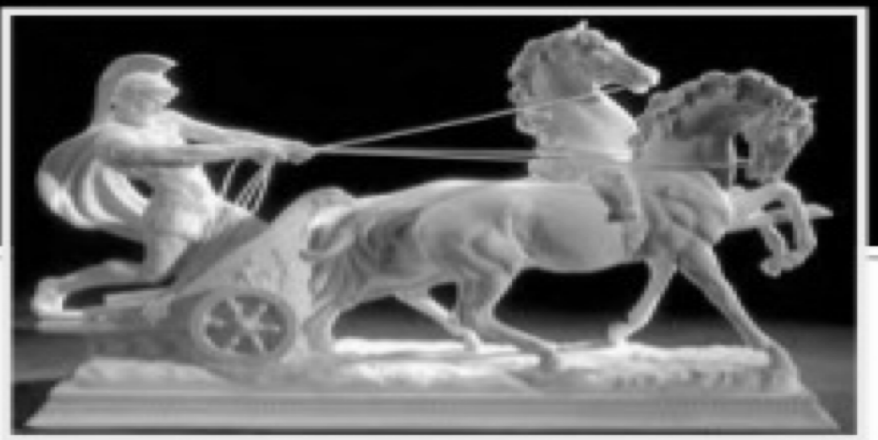
FRONT & BACK LINES

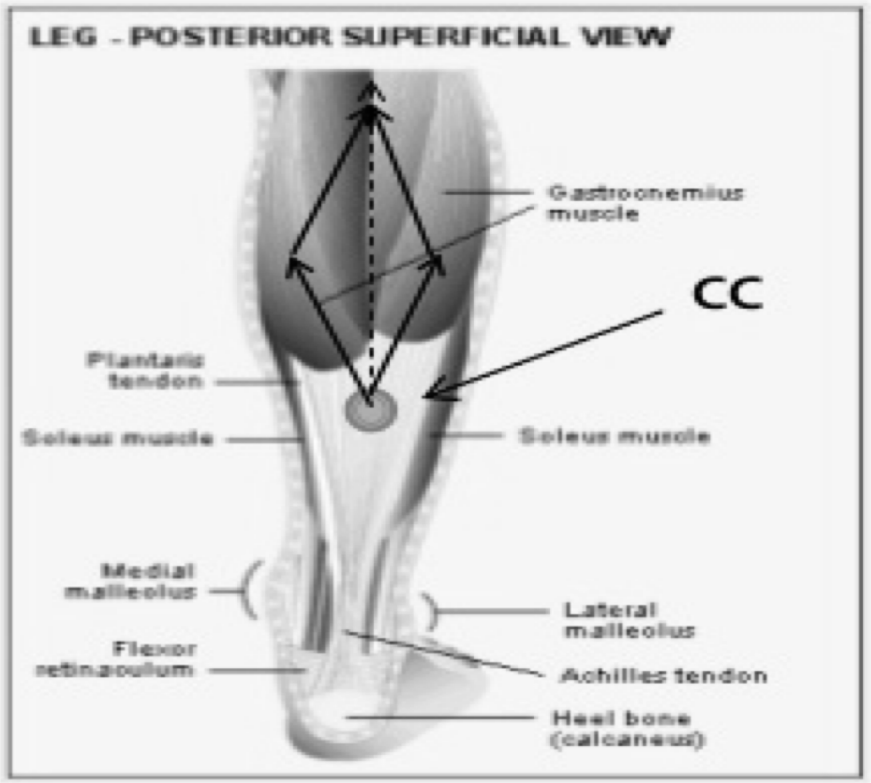




NOTE: Images via Anatomy Trains (Myers, T)

The center of coordination (CC)



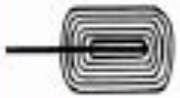


1. Each Myofascial unit has its own CENTER OF COORDINATION (CC)
2. CC = Small areas on the deep fascia where the sum of tensional vectors coincide.
3. Located in epymisium

Property	Description	Training Application
Elasticity	Ability to store and release kinetic energy	-Catapulting, rebounding (forefoot running) -Ballistic stretching under load -Oscillatory & perturbative loading
Plasticity	Ability for tissue to reshape and reform (elasticity + viscosity)	-Deep, long isolated stretches under load -Soft tissue modalities
Viscosity	Ability for tissues to glide smoothly across one another	-Hi plyometric/impact forces -Oscillatory/ballistic stretching -Submaximal global movement patterns
Remodeling	Ability to adapt and respond to chronic demands	-Consistent, heavy loading -Deformation (i.e. body tempering) -Responds to consistency (positively or negatively)

FASCIA BIG FOUR

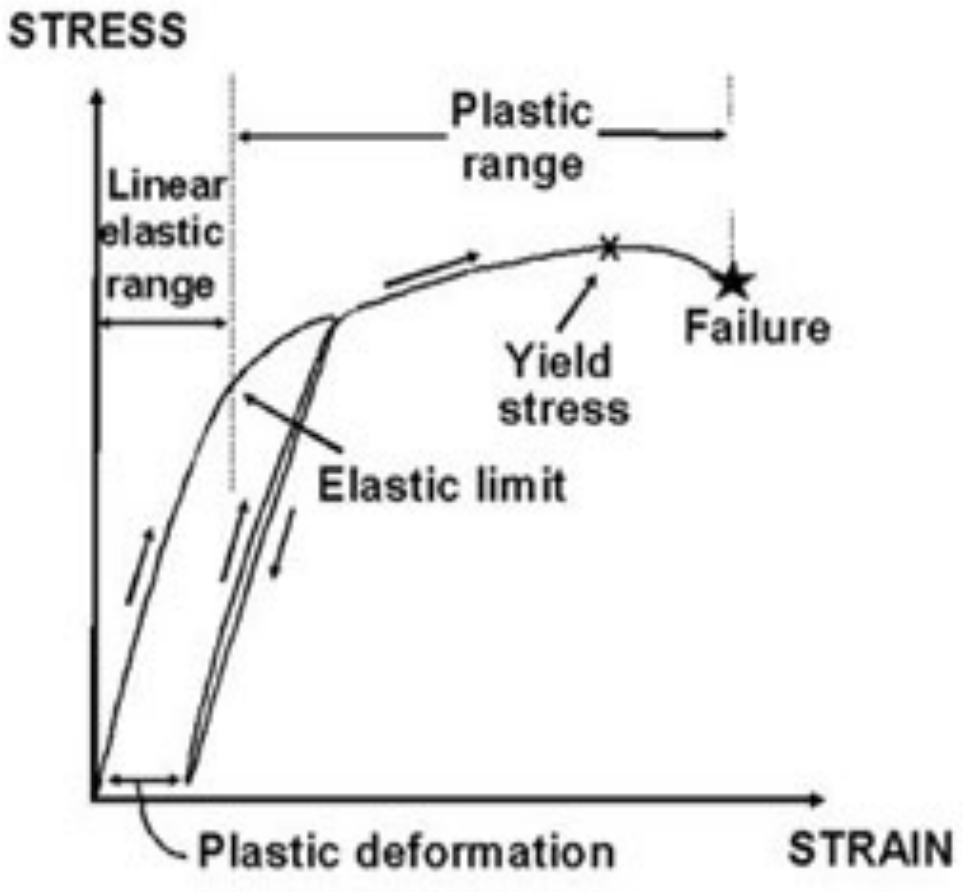
NOTE: Body tempering was stolen from Donnie Thompson

Receptor type	*Preferred location*	*Responsive to*	*Known results of stimulation*
Golgi  Type I b	• Myotendinous junctions • attachement areas of aponeuroses • ligaments of peripheral joints • joint capsules.	Golgi tendon organ: to muscular contraction. Other Golgi receptors: probably to strong stretch only	**Tonus decrease** in related striated motor fibers.
Pacini & Paciniform  Type II	• Myotendinous junctions • deep capsular layers • spinal ligaments • **investing muscular tissues.**	**Rapid pressure changes** and vibrations	Used as proprioceptive feedback for movement control. (**sense of kinesthesia**).
Ruffini  Type II	• Ligaments of peripheral joints, • Dura mater • outer capsular layers • and other tissues **associated with regular stretching.**	Like Pacini, yet also to **sustained pressure.** Specially responsive to **tangential forces** (lateral stretch).	**Inhibition of sympathetic activity.**
Interstitial 	• **Most abundant** receptor type. Found almost everywhere, even inside bones. • Highest density in periosteum.	Rapid as well as sustained pressure changes. 50% are **high threshold units**, and 50% are **low threshold**	Changes in **vasodilation** plus apparently in **plasma extravasation.**

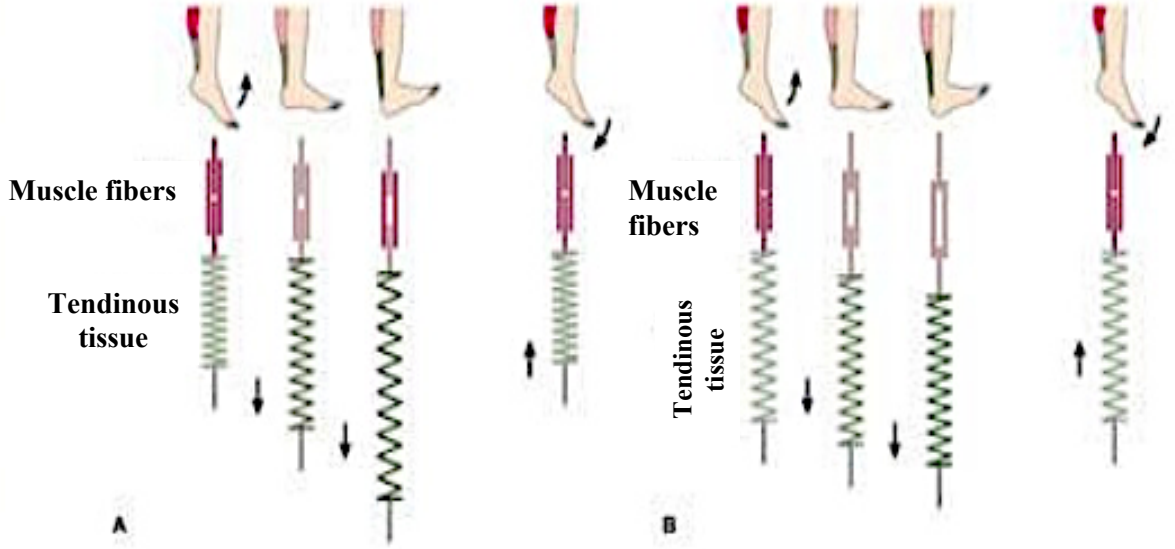
MECHANORECEPTORS FOUND IN FASCIA

(ELASTICITY)

NOTE: Image via NSCA Essentials



NOTE: Image via Functional Training Academy



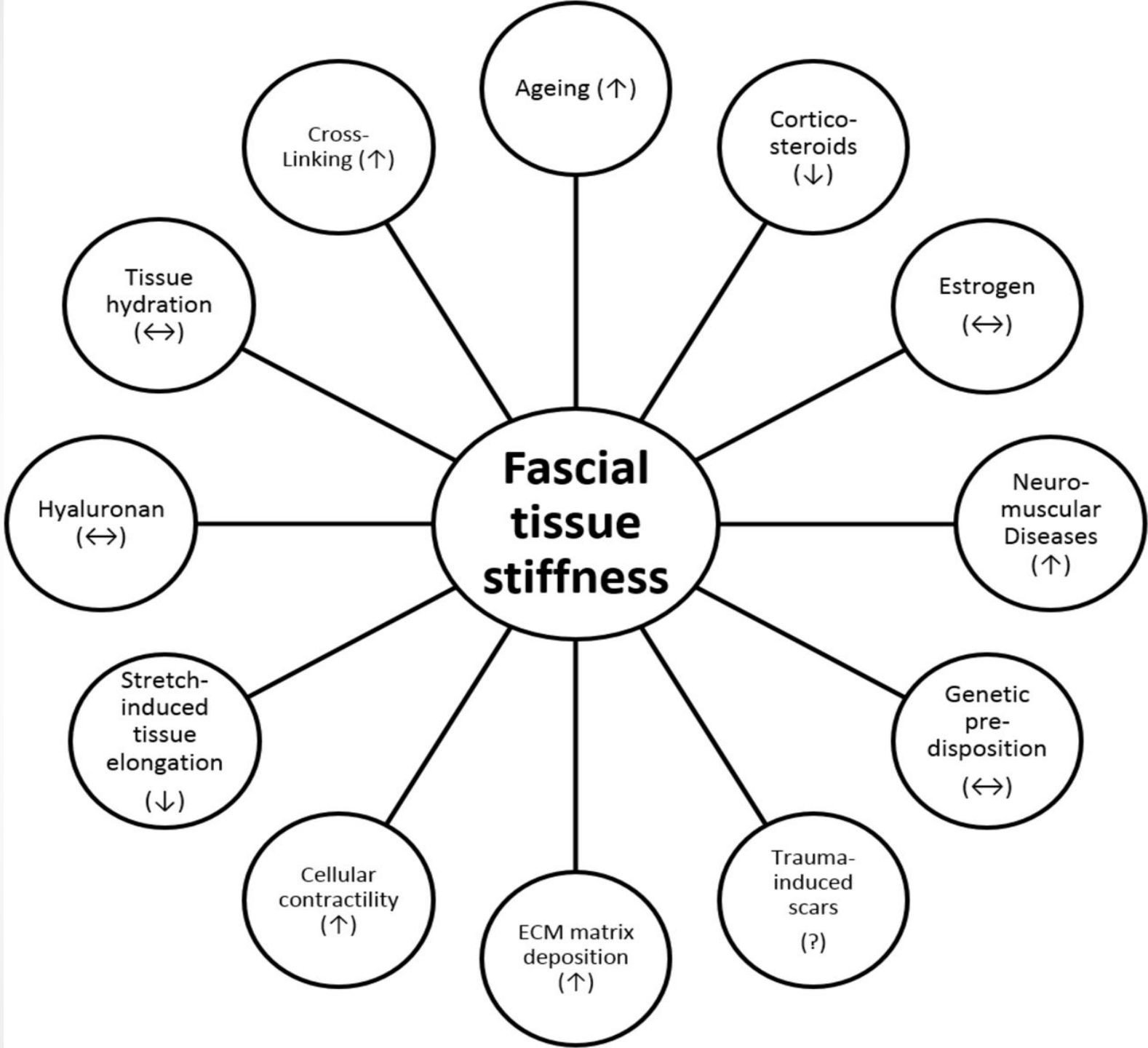
(A) Length changes of fascial elements and muscle fibres in an oscillatory movement with elastic recoil properties

(B) Changes during conventional muscle training. The elastic tendinous (or fascial) elements are shown as springs, the myo-fibres as straight lines above.

It has been determined that human fascia has a similar kinetic storage capacity to that of kangaroos and gazelles (Sawicki et al. 2009).

PLASTICITY

VISCOSITY


Fascial tissue stiffness
Ageing (↑)
Cross-Linking (↑)
Cortico-steroids (↓)
Tissue hydration (↔)
Estrogen (↔)
Hyaluronan (↔)
Neuro-muscular Diseases (↑)
Stretch-induced tissue elongation (↓)
Genetic pre-disposition (↔)
Cellular contractility (↑)
ECM matrix deposition (↑)
Trauma-induced scars (?)

REMODELING

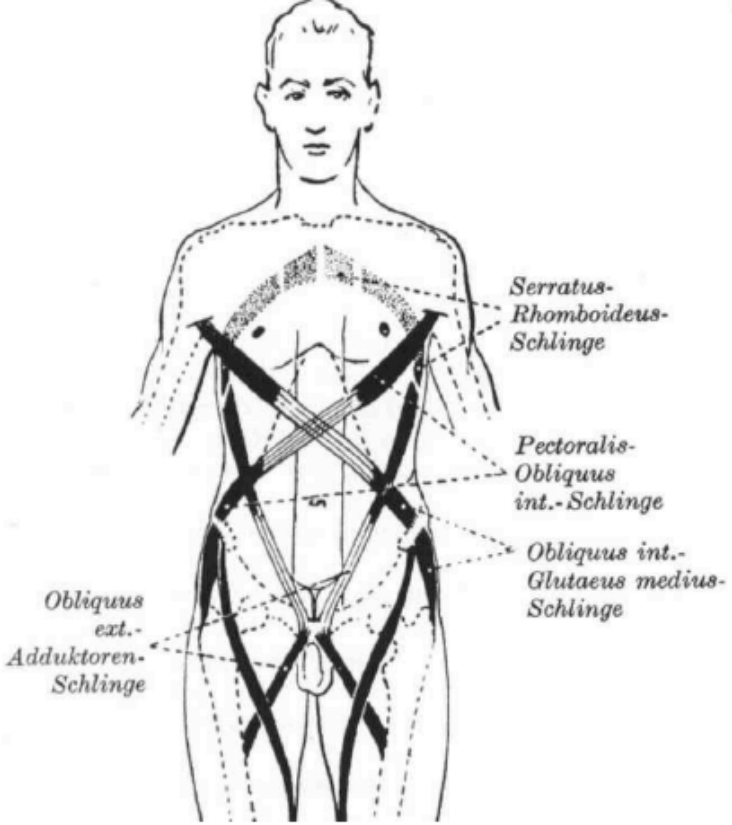
“Remodeling cannot occur until enough new collagen fibers have been laid down.”

-T. Myers

TRAINING CONSIDERATIONS

RUDE ROCK

STRENGTH & CONDITIONING



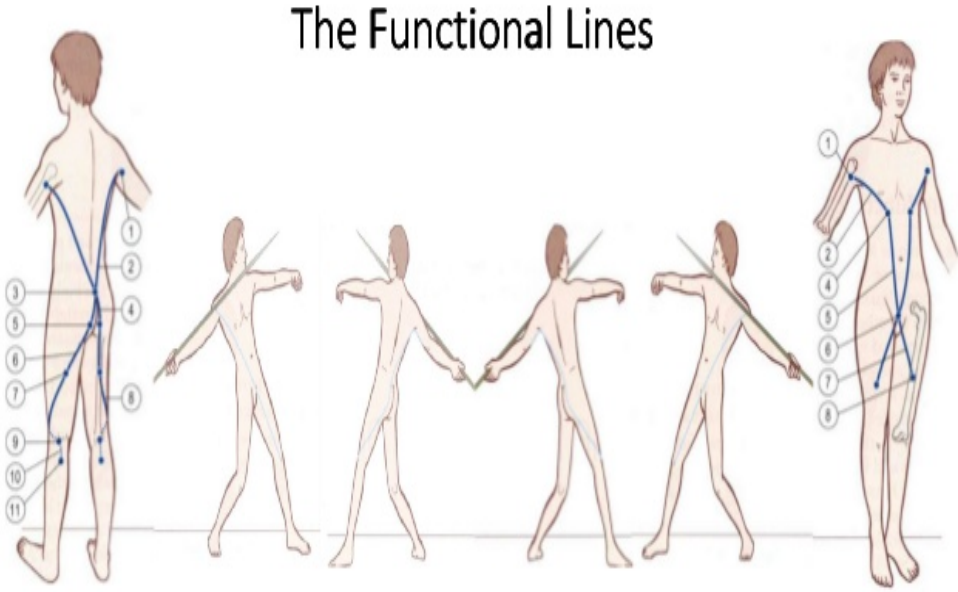


Fig. In. 22 The German anatomist Hoepke detailed some 'myofascial meridians' in his 1936 book, which translates into English as 'Muscle-play'. Less exact but similar ideas can be found in Mollier's *Plastische Anatomie* (Mollier 1938). (Reproduced with kind permission from Hoepke H, Das Muskelspiel des Menschen, G Fischer Verlag, Stuttgart 1936 with kind permission from Elsevier.)

ALWAYS HAVE BIG PICTURE IN MIND

NOTE: Images via Anatomy Trains

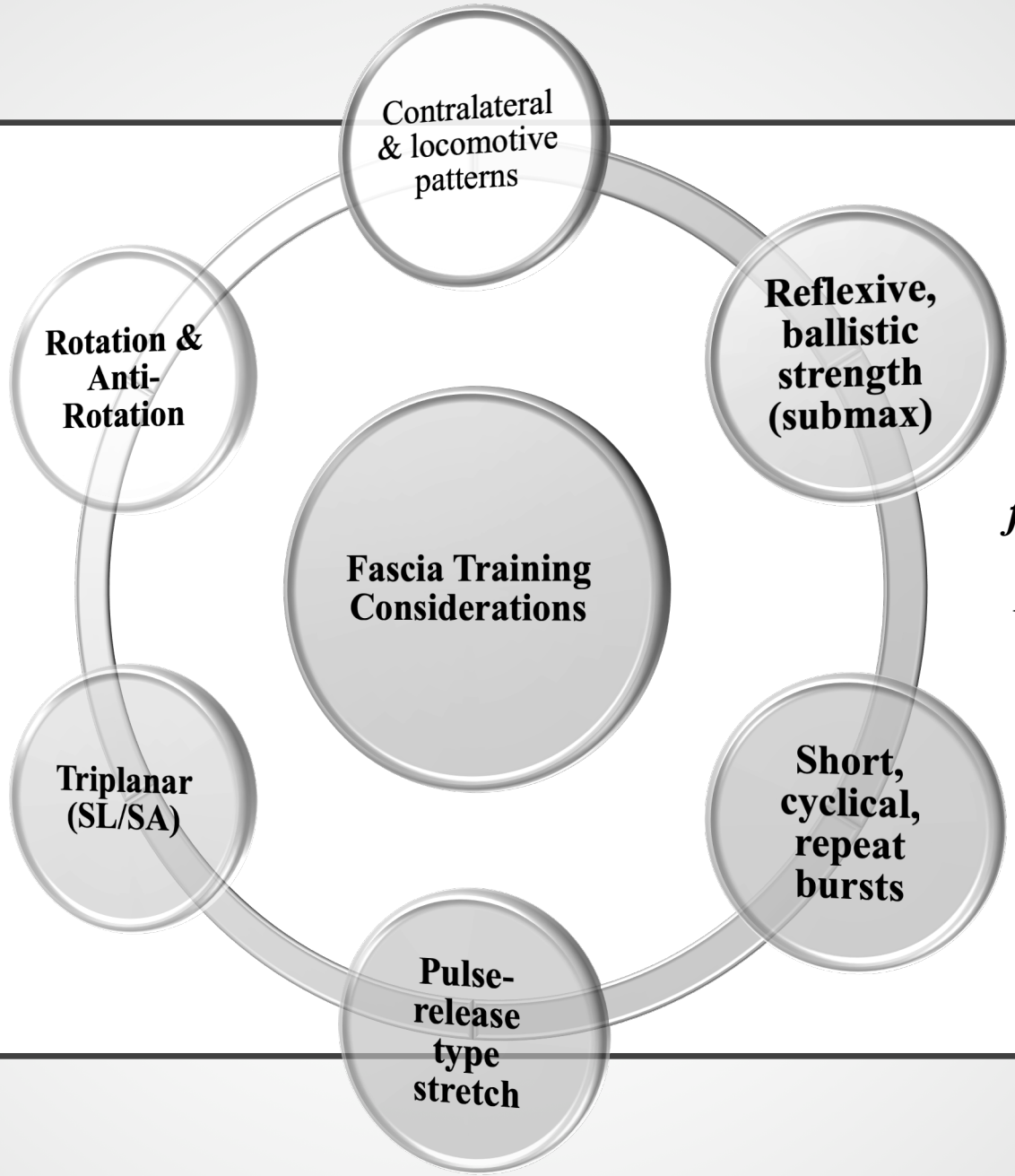
IN ACTION...

PRINCIPLE TRAINING POINTS

Neural Adaptations = 2-4 wks.
Muscular Adaptations = 5-8 wks.
Fascia Adaptations = 1-3 **yrs**.

PRINCIPLE	DESCRIPTION
1.) Multiplanar	-Challenge multiple planes in isolation -Look to blend or combine cardinal planes -Find new vectors
2.) Varying speeds under varying loads (emphasis on higher speeds w/ submax load)	-Fascial tissues responds differently to different velocities, we get benefits from each -Submax loading is optimal for fascia adaptations
3.) Rhythmic, dynamic type actions	-Reflexive strength/stretch -Low intensity plyos -Bound, skip, hop, throw
4.) Contralateral & unilateral-based movement	-Locomotive & primitive patterns -Emphasize positional strength -Triplanar stability
5.) Accommodating stimulus	-Challenge proprioception/vestibular systems -Oscillatory & perturbations for neural bandwidth -Band tension w/ offset and indirect loading

TRAINING FASCIA



"Stretch away fascial elasticity, all you're left with is muscle."

-Stu McGill

1.) SLOW & STEADY

-Introductory motor control

-Movement awareness

-Eccentric emphasis

-Basic/simple

2.) TEMPOS/ POSITIONAL

-Introductory to isometric emphasis

-Emphasis on resisting **force**

-Stress individual weaknesses & deficiencies

3.) MULTI-PLANAR

-Introduce new vectors

-Blending of cardinal planes

-Introduce combination patterns

4.) CHANGE STIMULUS

-Introductory to oscillatory & perturbation stimulus

-Emphasis on resisting **torque**

-Develop ability to tolerate variability

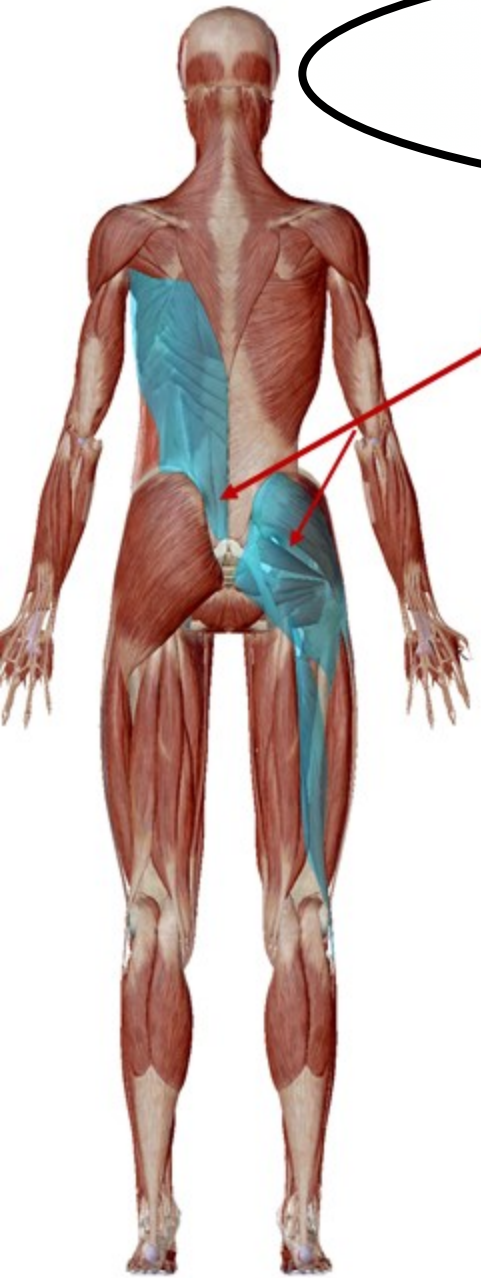
PROGRESSING SLING MOVEMENTS

PROGRESSIONS

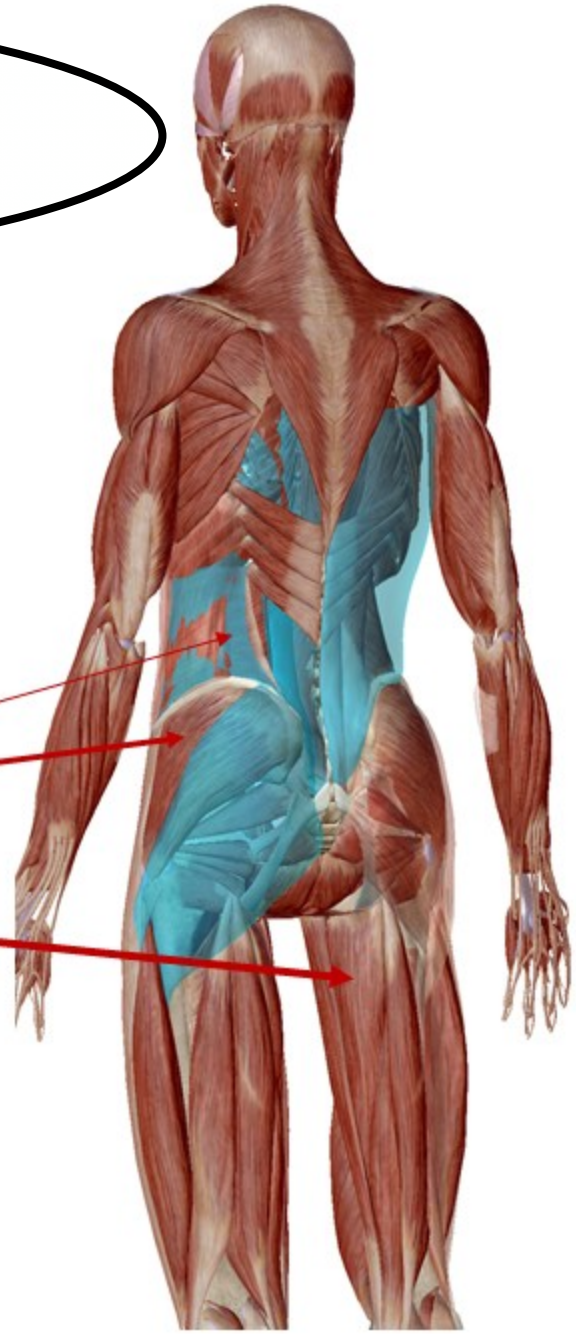
Carries	Crawling	Lunge	Step-Up	Chop
Walk backwards	Multi-directional	Pendulum	DB Goblet	Palloff Press w/ Reach
SA Hold w/ Reach	Stationary w/ ISO	Pulsing	Ipsilateral Load	Golfer w/ ISO
Offset/Unbalanced Load	Band Offset	Multiplanar w/ offset load	SA w/ Press	Band Over the Shoulder w/ forward step
Perturbations/ oscillatory	Accommodating Resistance	Lunge w/ rotation	Adding rotational step	Dynamic w/ reflexive stimulus (heavy band)
Eyes closed	Eyes closed w/ inverse pattern	Perturbations/ oscillatory	BB Uneven	Add Perturbations

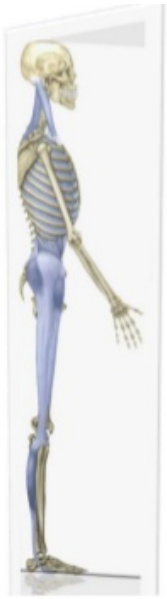
FOUNDATIONAL MOVEMENTS W/ SLING EMPHASIS

FOUR PRIMARY SLINGS



1. **DEEP LONGITUDINAL SLING:**
ERECTOR SPINAE, DORSAL SACRAL LIGAMENTS, GLUTEALS, BICEPS FEMORIS
2. **POSTERIOR LONGITUDINAL SLING**: GLUTEALS & CONTRALATERAL LATISSIMUS DORSI
3. **ANTERIOR LONGITUDINAL SLING:**
ADDUCTORS, IPSILATERAL INTERNAL OBLIQUE, CONTRALATERAL OBLIQUE.
4. **LATERAL SYSTEM**:
ADDUCTORS
GLUTEUS MEDIUS
QUADRATUS LUMBORUM





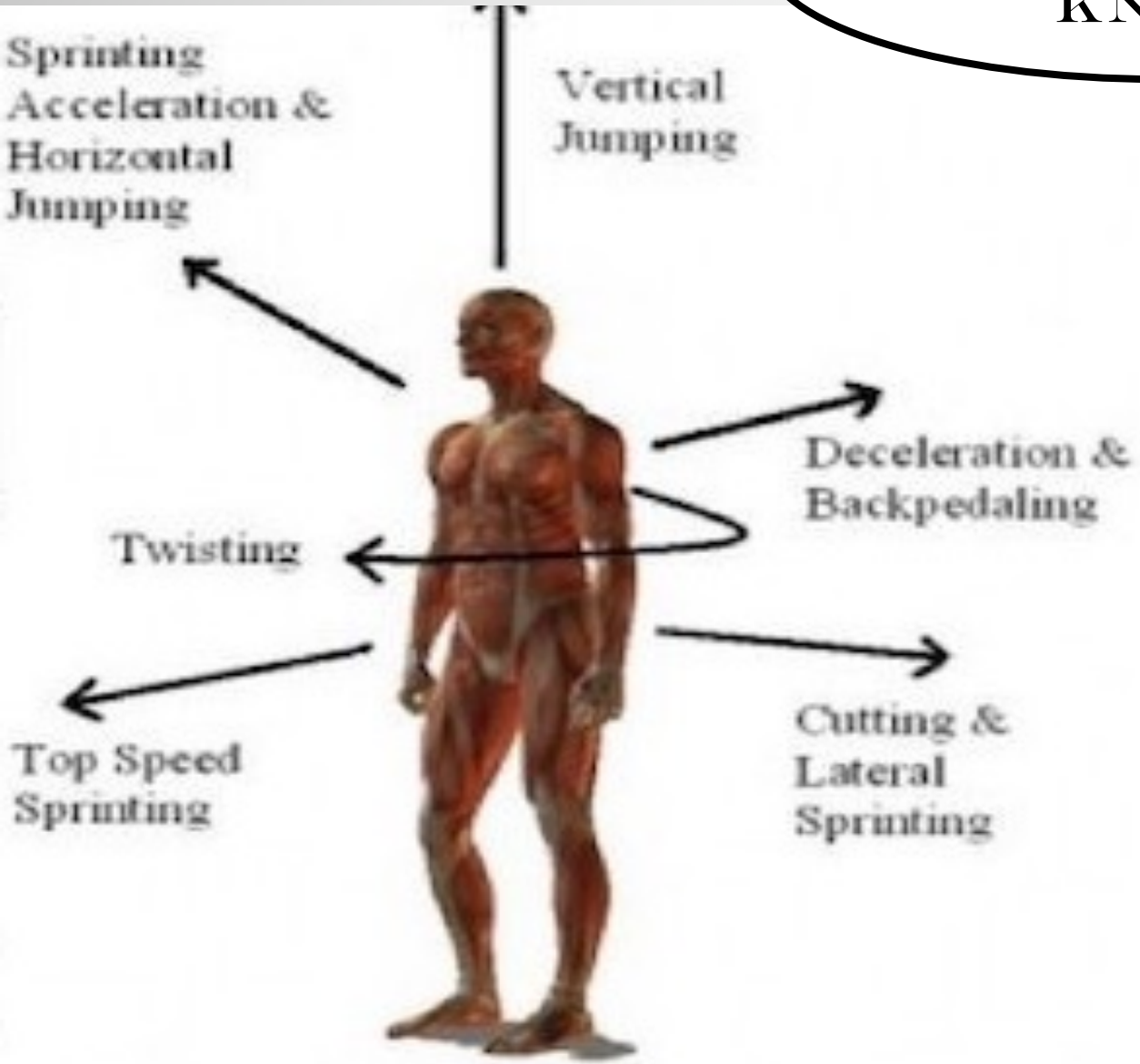
NOTE: Image via NKT

Sling Subsystem	Includes	Examples
Anterior Sling	Internal oblique + contralateral adductor	-Deadbug variations -Lunge w/ chop -1/2 TGU
Posterior Sling	Lat + contralateral glute	-Birddog variations -Reverse crawl -Post sling holds/rows
Lateral Sling	Adductors + ipsilateral glute + QL	-Side plank variations -Hip Hikes -Lateral bounding

SLING SUBSYSTEMS

APPLYING TO WHAT WE KNOW

NOTE: Image via MSU Exercise Science



The Six Load Vectors in Sports

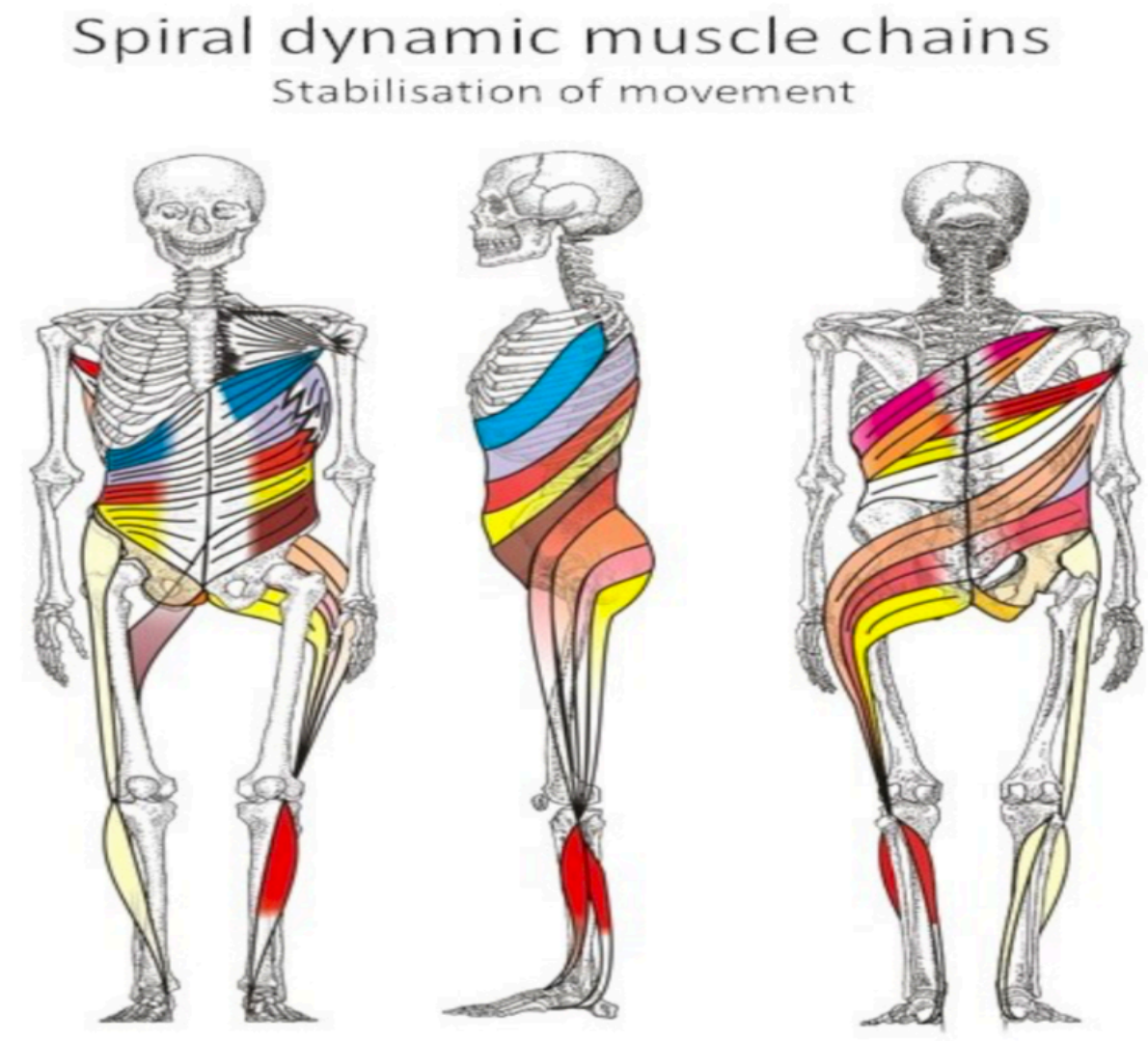
NOTE: Image The Prehab Guys

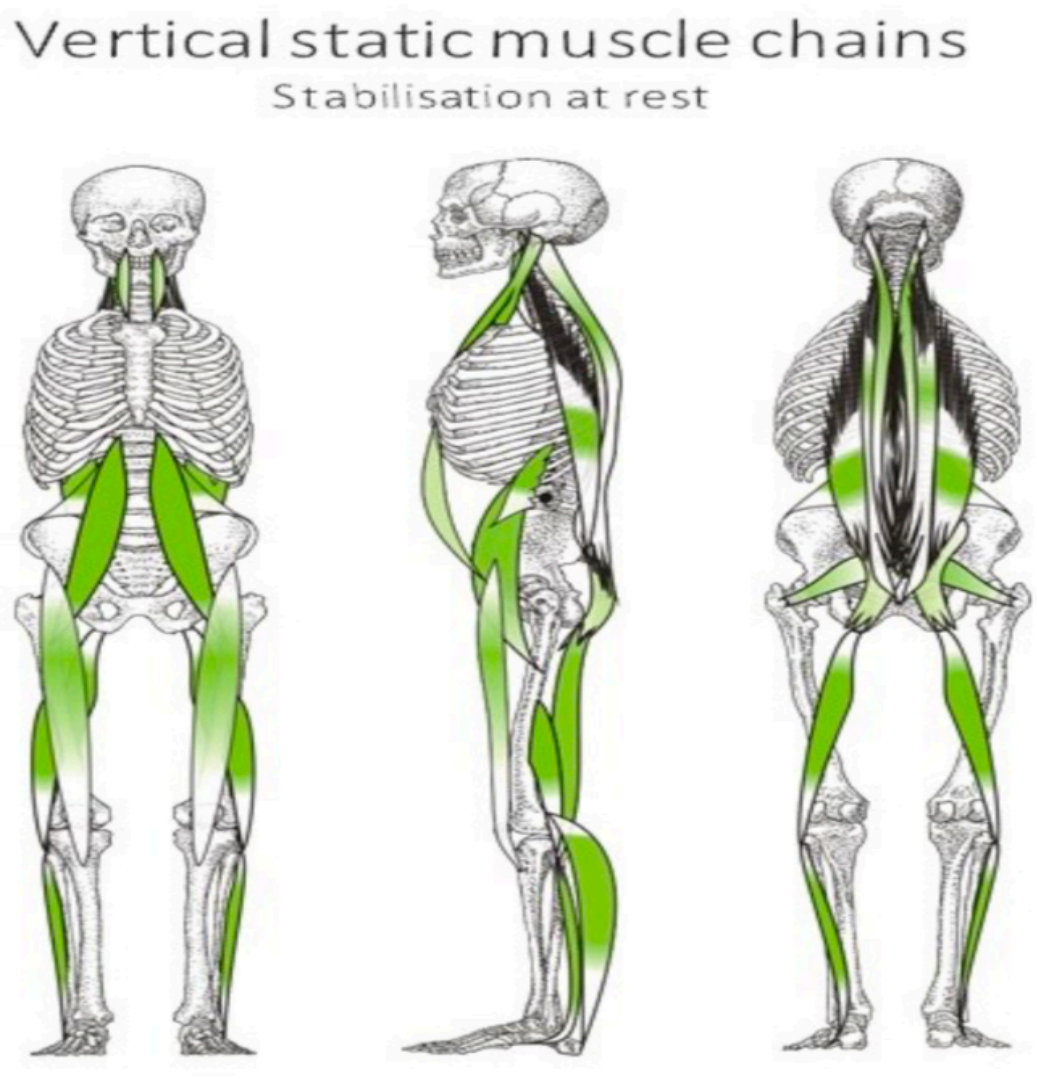
anterior oblique sling

posterior oblique sling

SPIRAL CHAINS

NOTE: Image via NKT





TRAINING APPLICATIONS

RUDE ROCK

STRENGTH & CONDITIONING

AS ALWAYS, IT STARTS WITH THE ASSESSMENT

"When the athlete shows you what they need, give them exactly that."

Individual athlete deficiencies/weaknesses

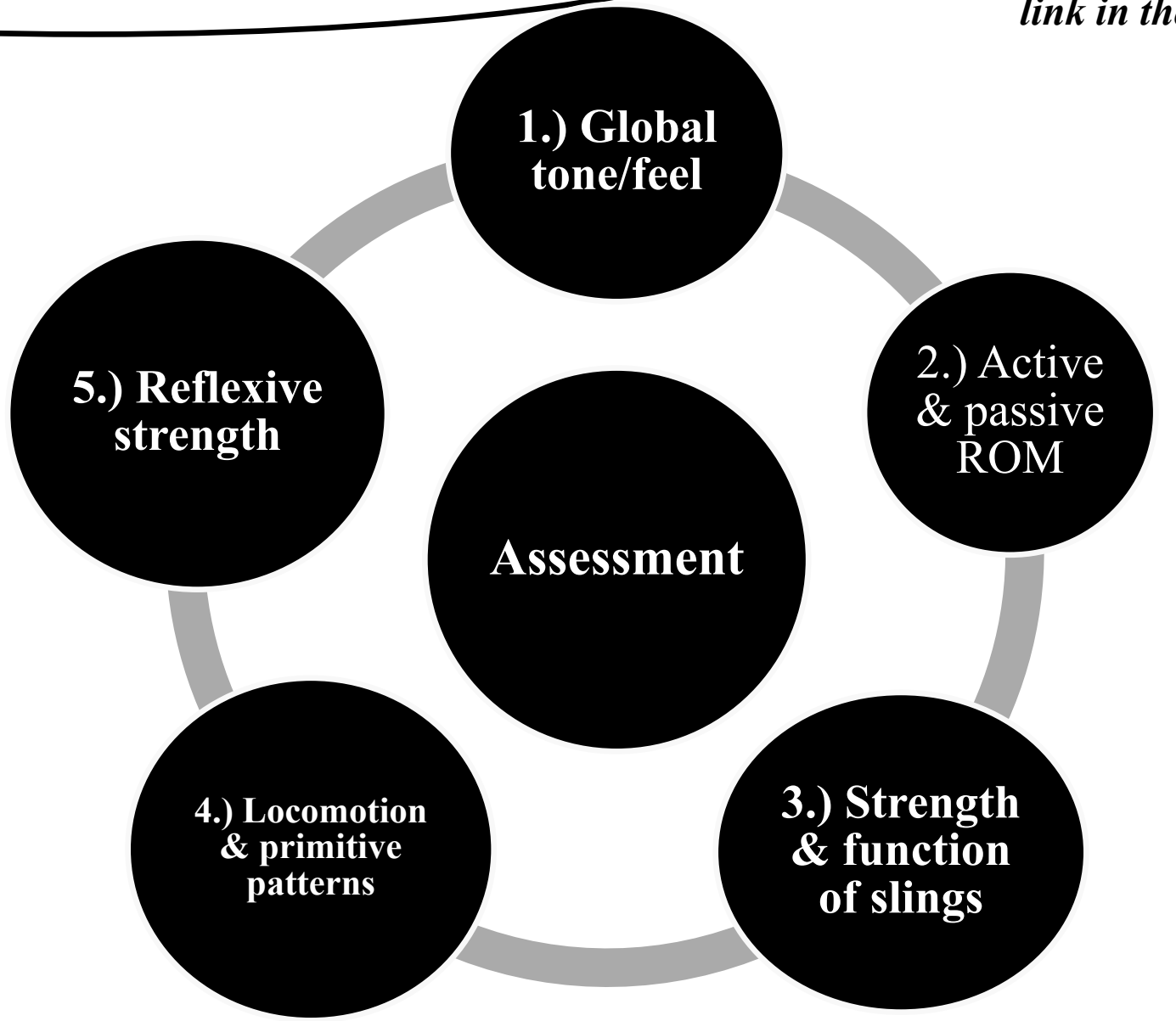
- Anterior/posterior/lateral sling
- Flexion/extension/rotational intolerance
- Compensatory/disrupted patterns following injury
- Proprioceptive/motor control/coordination

Specific demands of sport or duty

- Unique elements and signatures of movement
- Rotational & anti-rotational
- Vectors of force
- Speeds of movement

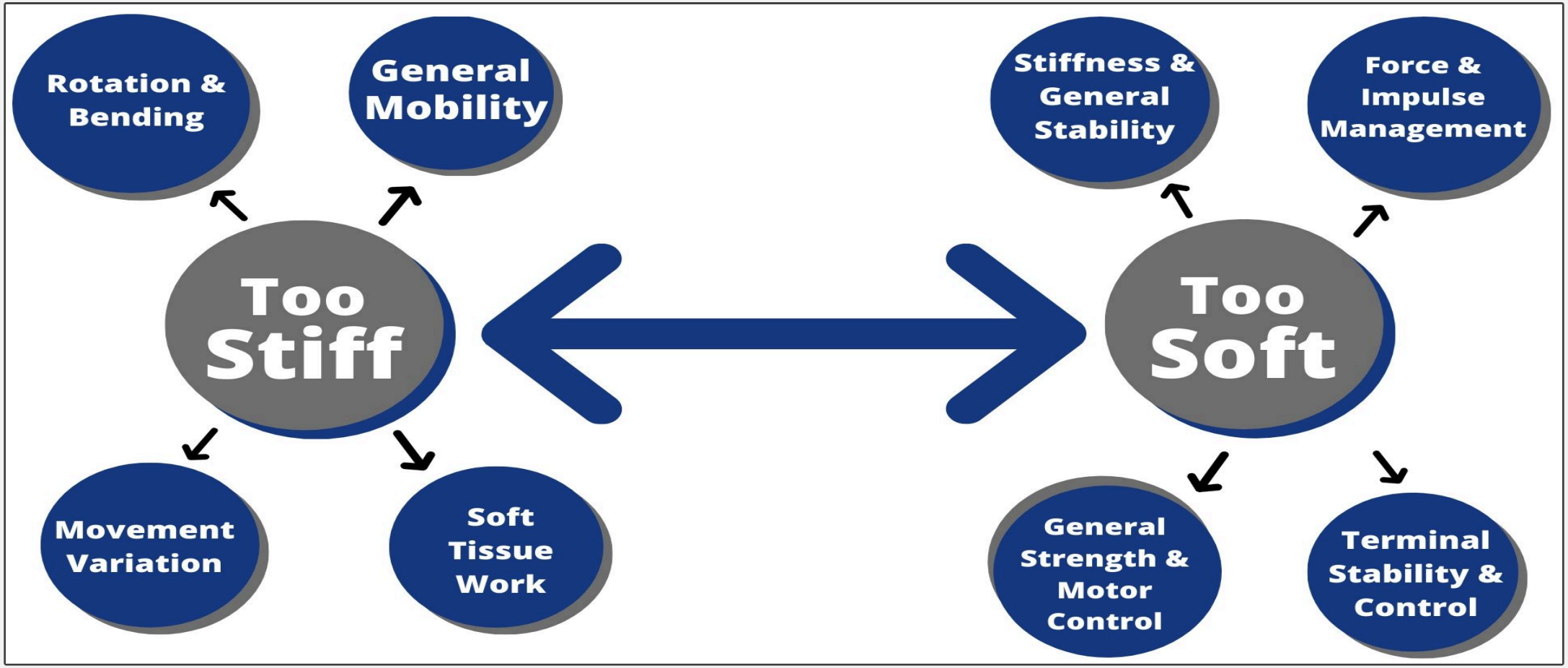
ASSESSING FASCIA

Where is the weak link in the chain?



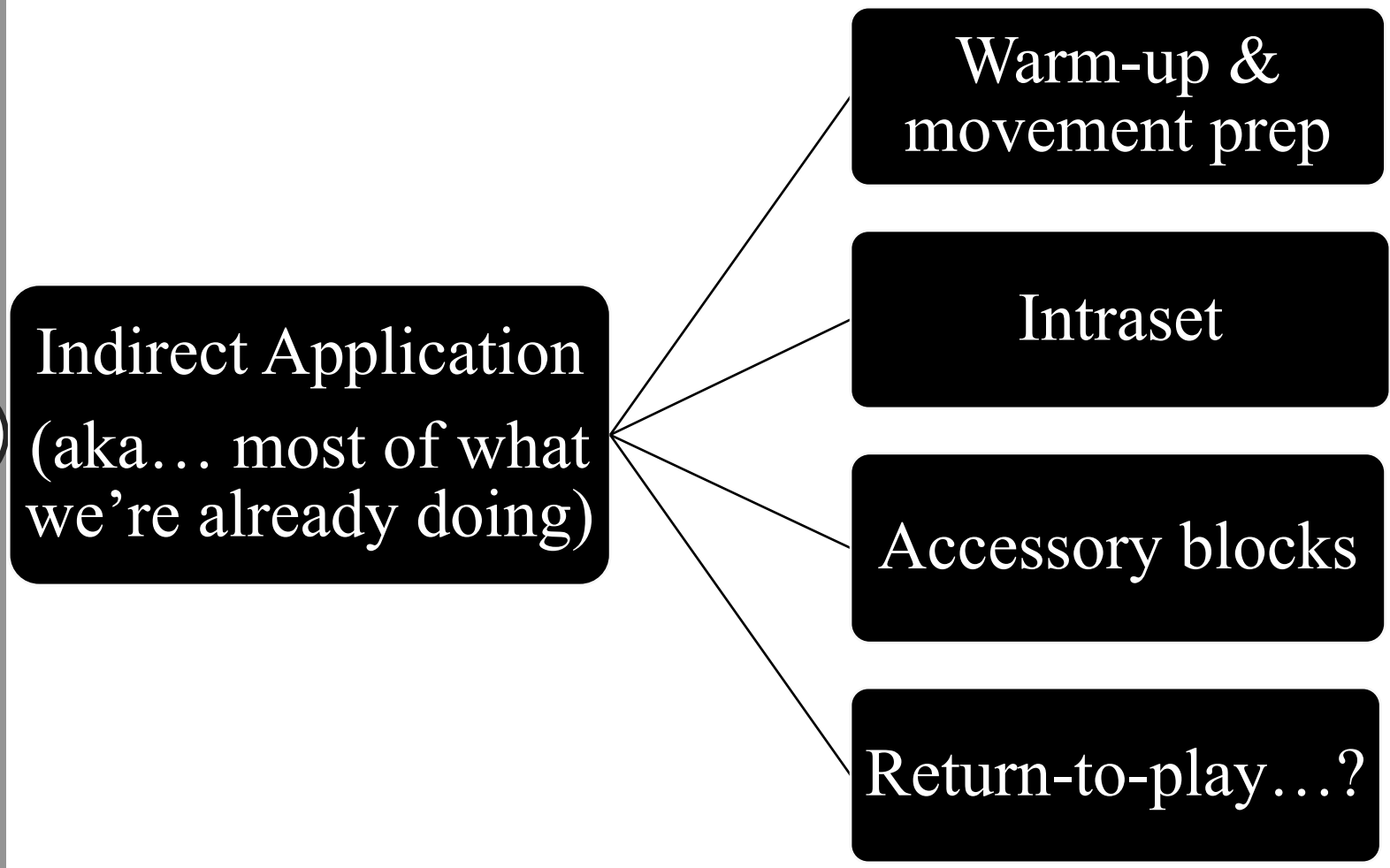
MY BIGGEST POINT OF INTEREST

"Is this athlete <u>more likely</u> to be injured because they are too stiff to avoid it, or too soft to endure it?"



WHERE DOES IT FIT?

The better question being…
*where is it **needed**?*



WARM-UP & MOVEMENT PREP

***Overall goal*: Facilitate the training session by mimicking muscle groups, speeds, and vectors**

Main Criteria

- Tissue glide & hydration (temperature)
- Tissue activation
- Proprioceptive alertness

Examples

- Low intensity skips
- Multi-directional band walks
- Tempo lunges

INTRASET

<u>Overall goal</u>: Saturate training block/session by implementing non-competing, non-fatiguing movements beneficial to the athlete

Main Criteria

- Isolated/independent strength patterns
- Tissue potentiation
- Terminal stability & motor control

Examples

- Deadbugs/birddog variations
- Multi-directional plank variations
- Pulsing movements

ACCESSORY BLOCKS

<u>Overall goal</u>: Saturate training block/session by progressively and rationally layering foundational training movements to drive individual training adaptations

Main Criteria

- Adding ranges of motion
- Blending cardinal planes
- Modifying tempo, position
- Adding new external stimulus/loading parameter

Examples

- Unilateral RDL/bent row
- Band offset push-up
- Oscillatory OH press

**RETURN-TO-PLAY PROTOCOLS

***Overall goal*: Exploit shortcomings of conventional rehab, seek to integrate conventional strength applications while accommodating for present deficiencies**

Main Criteria

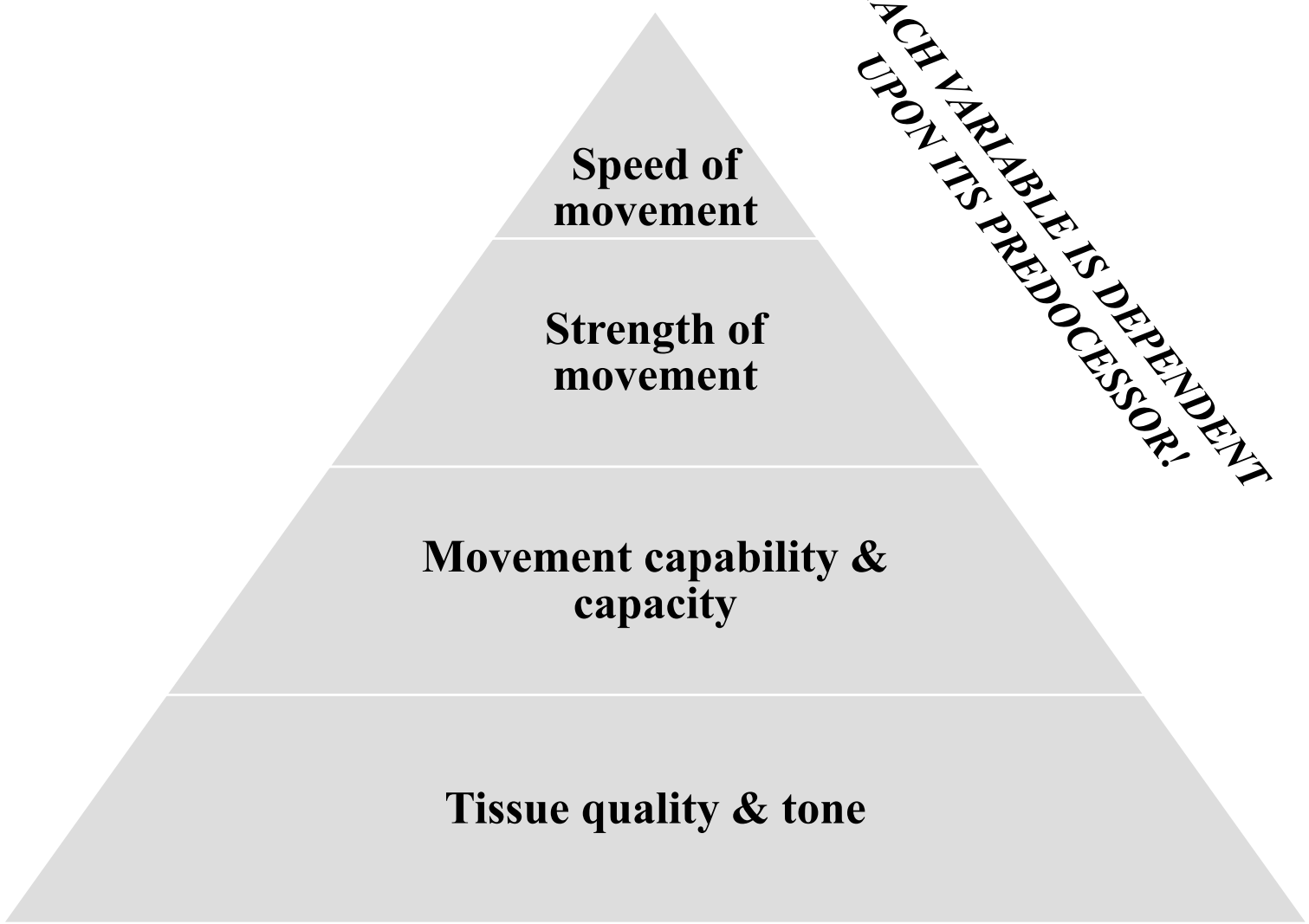
- Restore and optimize athlete movement signatures
- Mitigating compensatory/faulty patterns
- Improve force acceptance and movement tolerance
- Improve force expression and kinetic transfer

Examples

- Wide range of loading parameters
- Wide spectrum of movement combinations
- “Rep without rep” concepts

HIERARCHY OF NEEDS

***NOTE*: Hierarchy contents are loosely adopted from the work of Al Vermeil, Dan Pfaff and others**



QUICK NOTE ON STRETCHING

Generally Speaking

- Dynamic Stretching = Favorable for most
- Static Stretching = Probably not the best
- Ballistic = Likely favorable for most
- **Coefficient of restitution = how long something can deform and return to shape

Thoughts to consider

- Eroding elasticity (0.8-1.2 sec. @ end range)
- Stretching is PROPRIOCEPTIVE
- Immobility = fascial adhesions

VIDEO ANALYSIS

RUDE ROCK

STRENGTH & CONDITIONING

ANTERIOR CHAIN

- Deadbug Variations
- TGU Variations
- Palloff press Variations

POSTERIOR CHAIN

- Birddog Variations
- Posterior Sling Holds
- Glute Bridge Variations

LATERAL CHAIN-RESISTANT STRENGTH

- Side-Plank Variations
- Band Anti-Movement
- Jammer Throws

LATERAL CHAIN-EXPRESSIVE

Chop Variations

MB Throw Variations

Lateral Bounds

REFLEXIVE

Jump Rope

Jump, hop, skip, bound

Myotatic type stimulus

PERTURBATION & OSCILLATORY

- Carry Variations
- Inertia Wave/Battle Rope
- Impulse Throws

OFFSET & UNBALANCED METHODS

DB Uneven Variations

BB Offset Variations

BB Offset + Accommodating Resistance

BRINGING IT ALL TOGETHER

RUDE ROCK

STRENGTH & CONDITIONING

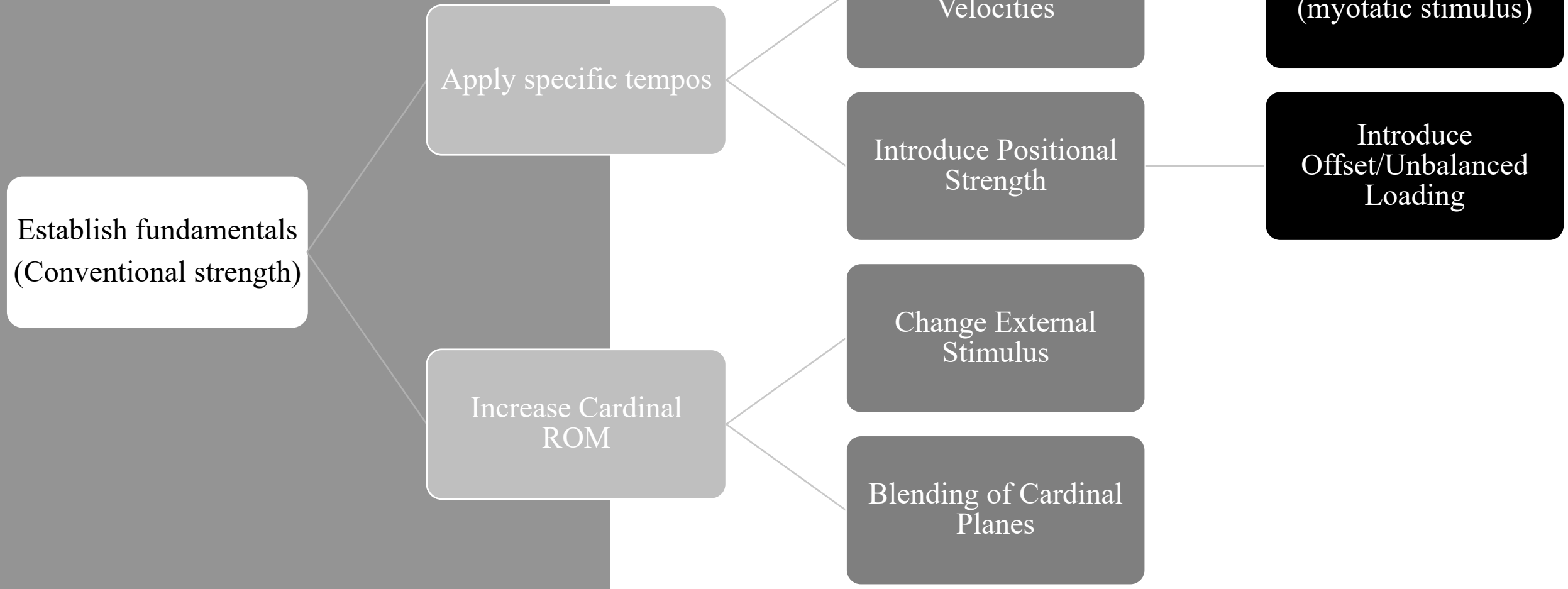
PRIMARY TAKEAWAY POINTS

What is fascia?	Variables in training	Return-to-Play
• Extracellular, collagenous matrix • Envelopes every muscle, muscle fiber, soft tissue, cell and structure • Non-Newtonian fluid	• Multiplanar, multidirectional • Challenge both common and uncommon vectors	• Fascia is a major variable in both injury manifestation and recovery/repair
• Helps to support structure (posture) • Heavily involved in producing movement • Managing external and internal forces • Kinesthetic awareness	• Wide spectrum of speeds • Higher velocity movement suites neural mechanical properties • Slower, longer movements suite plastic and viscous properties	• The athlete should be observed and analyzed from multiple biological systems independently and collectively
• The main properties of fascia include **plasticity**, **elasticity**, **viscosity & remodeling** • Has **6 x** the amount of proprioceptive bodies & nerve fibers than muscle	• Also, a wide spectrum of external loading should be considered as the properties respond uniquely here as well	• We want to ultimately build resiliency and robustness, with the constructs of reducing rate of re-injury or performance degradation

FASCIA BIG FOUR

Viscosity	Plasticity	Elasticity	Remodeling
• H2O or glue? • Density distribution • Fluid dynamics	• Collagen fibers • P= V + E • Stress = force/accel	• E = Stress / strain • E = compliance	• "We are what we repeatedly do" • Product of time and consistency
• Adhesions • Glide • Friction	• Coefficient of restitution • Basis of postural deformation	• Tears occur when tissue is stretched faster than it can respond	• Tissue wellness factors • Greater imbalance w/ muscles = increased injury
• Soft tissue • Low-Level Plyos • Low intensity inertial	• Proprioceptive & vestibular stimulation • Motor control & stability • Ballistic/pulsing	• Amortization • RFD (F/ time) • Reflexive strength	• Heavy external load • Time under tension • End-Range stretching

TRAINING PROGRESSION



THANK YOU FOR YOUR TIME! I HOPE YOU WERE ABLE TO GET SOMETHING OUT OF THIS.

PLEASE BE SMART, AND STAY SAFE DURING THESE TIMES OF UNCERTAINTY

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