Welcome to:

Functional Anatomy *w/ Brendon Rearick, Kevin Carr, and Damion Perry*

- **Translation offered tonight** - hello to our Brazilian friends!
- **Use the Q&A box <u>only</u>** (Do not use: chat, raise your hand, text, email)
- **Brendon:** Facilitator & Student
- **Damion:** Functional Anatomy: what it is and how can it be used to interpret movement and guide your coaching.
- **Kevin:** Defines Functional Training & Functional Anatomy. Then discusses how it is applied to training the hamstrings, core, in single leg training.
- **12 Questions**
- **Post Email w/ Recording & PDF**

Our 5 other recorded webinars in case you missed them:

1. Using Your Assessment to Build Out A Training Program: https://www.youtube.com/watch?v=Qoqawb7VzSY
2. Integrating Rehab and Fitness Webinar: https://www.youtube.com/watch?v=UWVhM97-i5Y
3. Business & Career Q&A: https://youtu.be/tr7uHiR6ivc
4. Nutrition Behavior Change and Habit Formation for Everyone: https://youtu.be/HII3iZWMCF0
5. Conditioning - The What, Why, and How: https://youtu.be/luzVyAxyOik

Next weeks Webinar: How to Read Research with the 3 of us again https://zoom.us/webinar/register/WN_nP8DBblKSoW0krL1vdszoQ

Functional Anatomy

Damion Perry B.S., LMT, CSCS, CFSC

Functional Anatomy

- Study of the body components needed to achieve or perform a human movement or function.
- Primary consideration is not the location of a structure, but the movement produced

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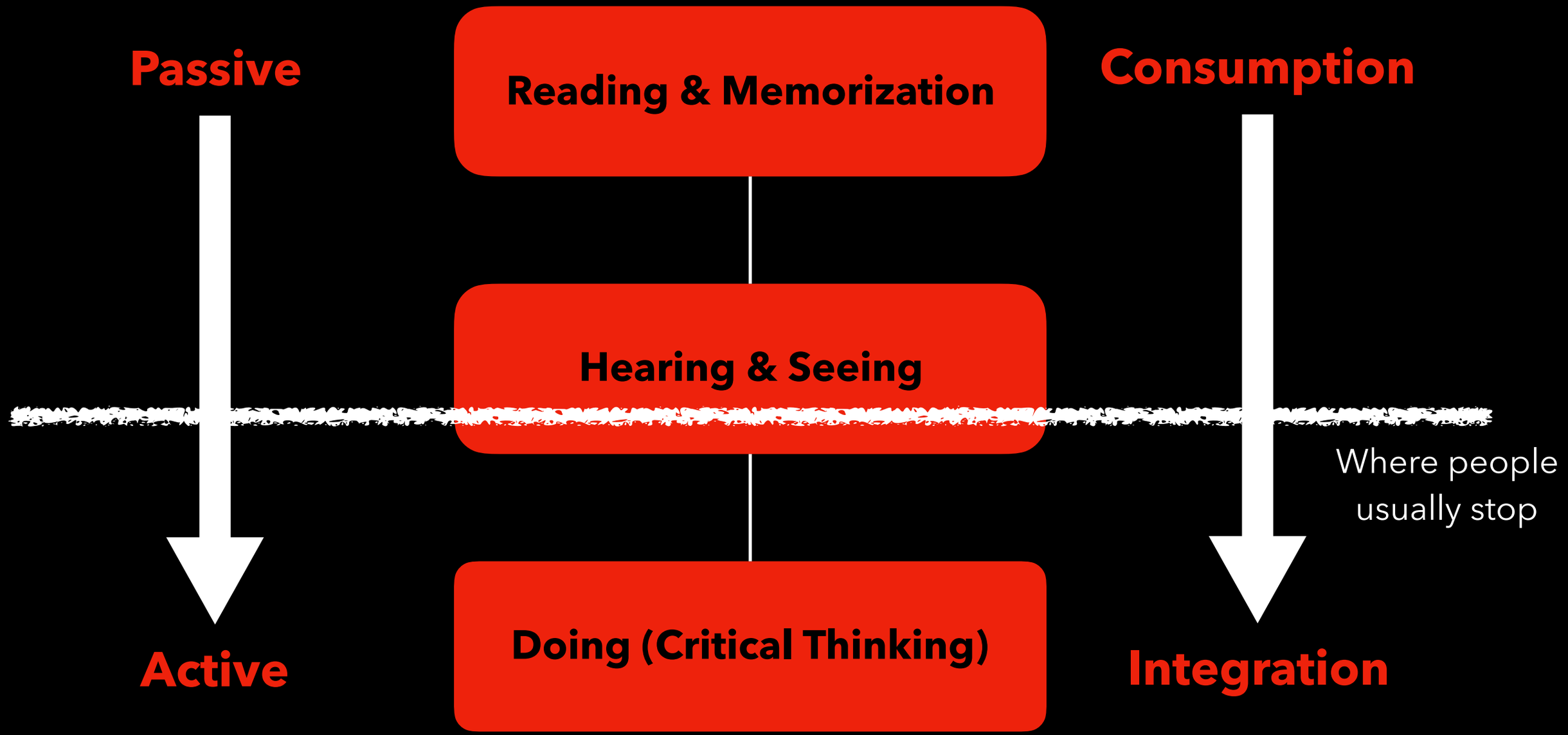
Hamill & Knutzen, 1995. Drawings by Vesalius

Beginner's Mind: Learning Functional Anatomy



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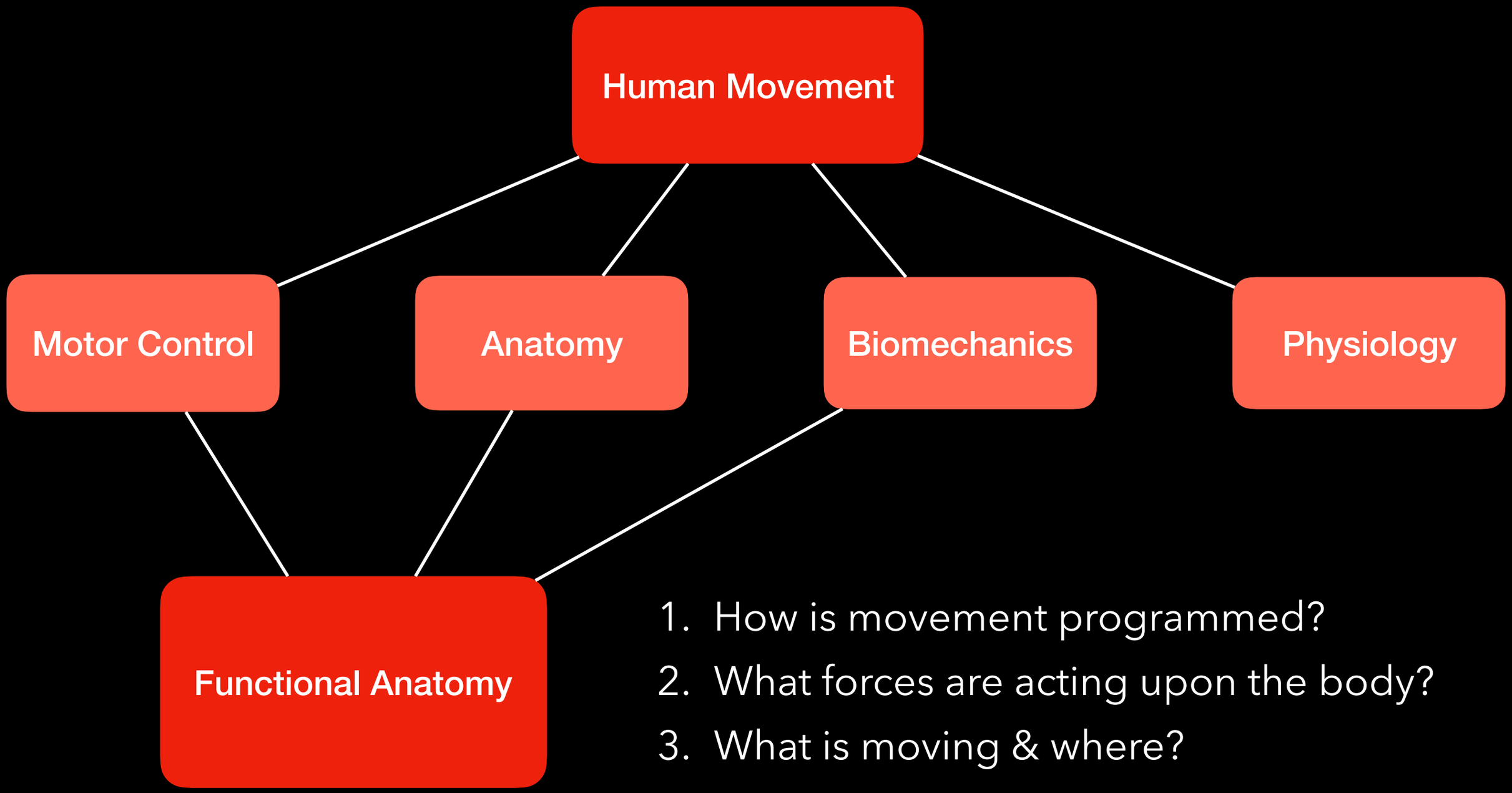
The lens we are looking through

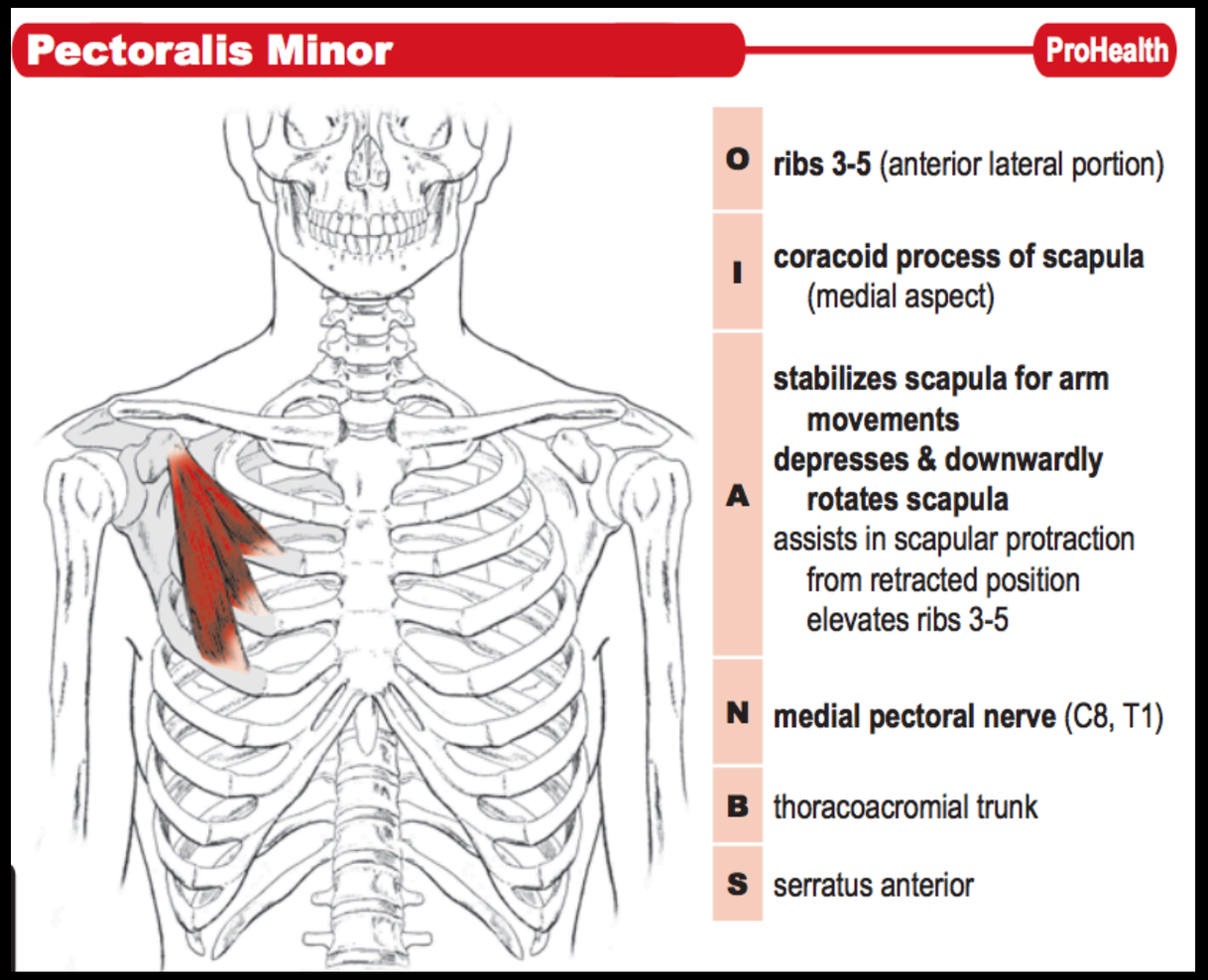


1. How is movement programmed?
2. What forces are acting upon the body?
3. What is moving & where?

Human Movement 101

Simplification of gross anatomy

- **Muscle**
  - ➡ Who
- **Origin & Insertion**
  - ➡ Where
- **Action**
  - ➡ What
- **Nerve Innervation**
  - ➡ When & Why



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Vizniak, 2018

Human Movement 101

Simplification of motor control

Input

Output

1. Stimulus Identification
2. Response Selection
3. **Movement Programming**

Schmidt & Lee, 2014

Human Movement 101

Simplification of biomechanics

Input

Output

(Kinematics & Kinetics)

1. **Where is the body moving in space** and how fast is it going?
2. What internal & external **forces** were acting upon the body while moving

Human Movement 101

Simplification of functional anatomy

Input

Output

1. What muscles acted during the **pattern of movement**?
2. What **plane of motion** did the pattern occur in?

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Muscular Considerations: Movers

- **Agonist**
  - Muscles creating the desired joint movement
- **Antagonist**
  - Muscles that work to produce the opposing joint movement occurring
- **Stabilizer**
  - Acting in one segment so that a specific movement in an adjacent joint can occur.
- **Synergist/Neutralizer**
  - Muscle contracts to eliminate an undesired joint action of another muscle

Agonist: **Deltoid**
Antagonist: **Latissimus Dorsi**
Stabilizer: **Trapezius**
Neutralizer: **Teres Minor**

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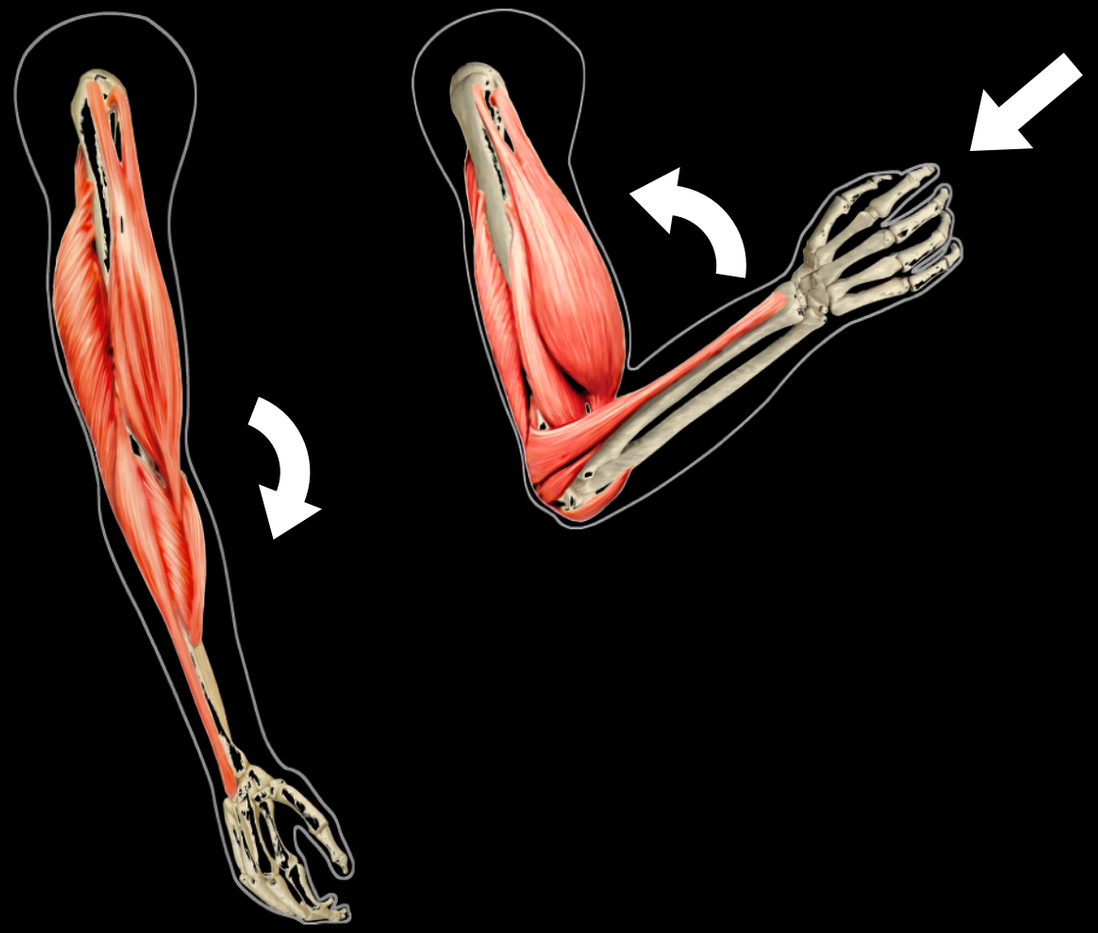
Muscular Considerations: Actions

- **Concentric**
  - Net muscle forces produce movement in the same direction as the change in joint angle
- **Eccentric**
  - Net muscle forces produce movement in the opposite direction of the change in joint angle.
- **Isometric**
  - Muscle is active and develops tension with no visible change in joint position.



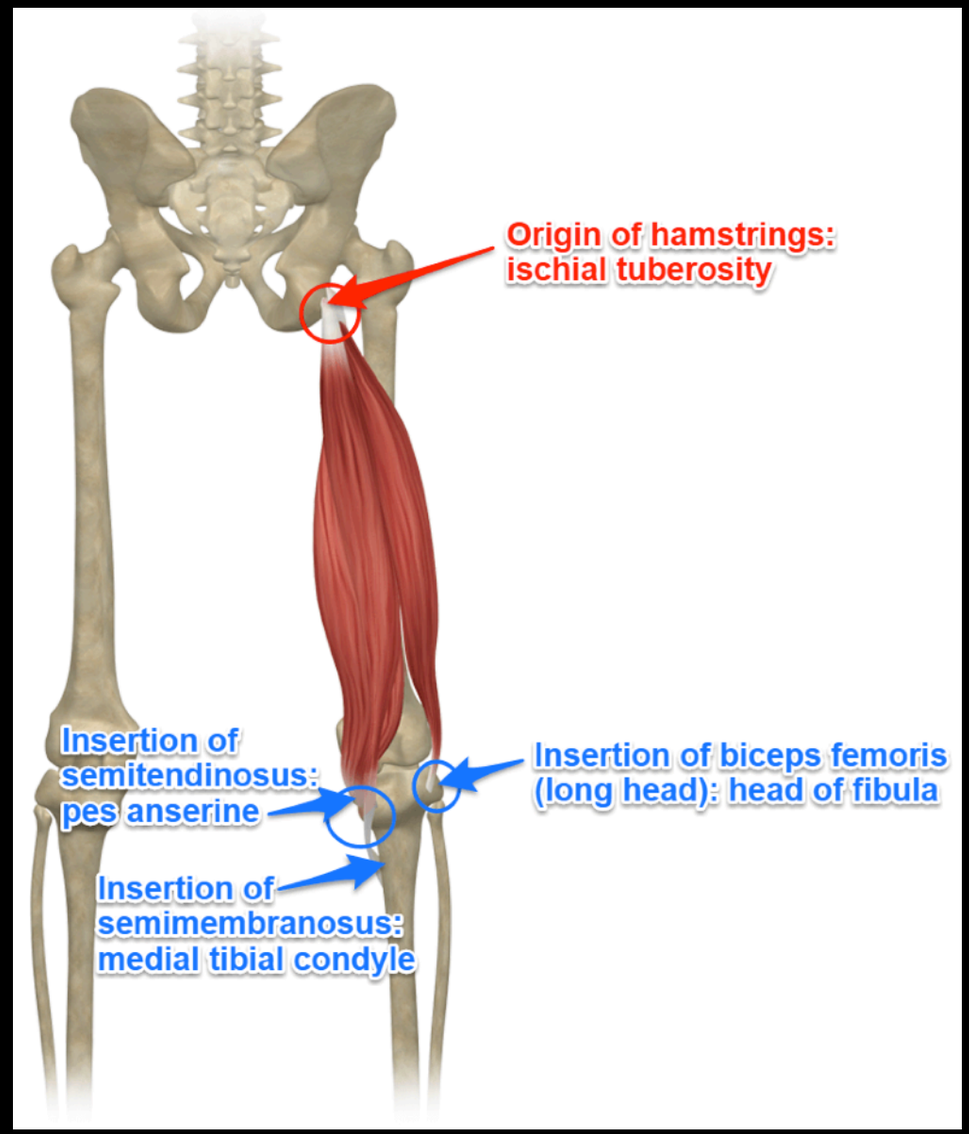
Muscular Considerations: Attachment

Origin

Attachment closest to the middle of the body, more proximal

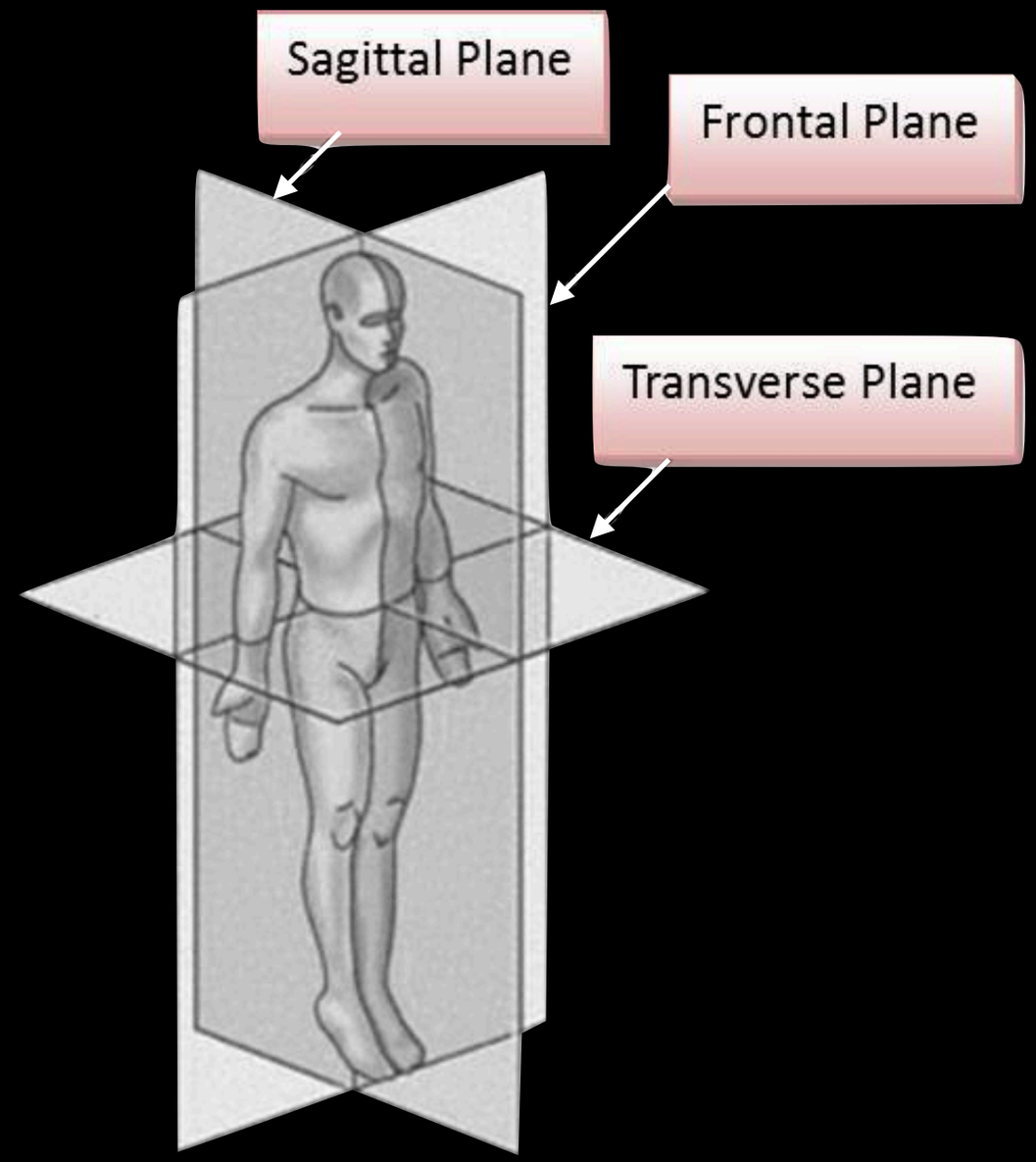
Insertion

Attachment farther from the midline, more distal



Positional Considerations: Planes

	Sagittal Plane	Frontal Plane	Transverse Plane
Division of Body	Right & Left	Front & Back	Upper & Lower
Movements	Flexion, Extension, Dorsiflexion, Plantar Flexion	Abduction, Adduction, Lateral Flexion	Rotation, Pronation, Supination



Classifications of Movement

Movement Program

- Knee Dominant (Unilateral & Bilateral)
- Hip Dominant (Unilateral & Bilateral)
- UB Push (Horizontal & Vertical)
- UB Pull (Horizontal & Vertical)
- Anti-Extension
- Anti-Lateral Flexion
- Anti-Rotation
- *Locomotion*
- *Jumping*
- *Throwing*

Movement Pattern

- Flexion
- Extension
- Adduction
- Abduction
- Rotation

Plane of Motion

- Sagittal
- Frontal
- Transverse

Moment of Force

- Supine
- Side-Lying
- Prone
- Tall Kneeling
- Half Kneeling
- Standing

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Classifications of Movement

	Push-Up	KB Deadlift	SL Squat	Lateral Med-Ball Toss	Adductor Side Plank
Movement Program	Push	Hip Dominant	Knee Dominant	Throw	Anti-Lateral Flexion
Orientation	Horizontal	Bilateral	Unilateral	Lateral/ Staggered	Unilateral
Movement Pattern	Flexion / Extension	Flex / Ext	Flex / Ext, Add/Abd	Rotational	Abduction / Adduction
Plane of Motion	Sagittal	Sagittal	Sagittal / Frontal	Transverse	Frontal
Moment of Force (Position)	Prone	Standing	Standing	Standing	Sidelying

Integration of Concepts: Analysis

	SL Squat
Movement Program	Knee Dominant
Orientation	Unilateral
Movement Pattern	Flex / Ext, Add/Abd
Plane of Motion	Sagittal / Frontal
Position	Standing

Unpacking the SL Squat

Knee Dominant Exercise

- Sagittal Plane
- Standing
  - Hip, Knee, & Ankle Flex/Ext
  - Agonists: Quadriceps
  - Antagonists: Hamstrings
  - Synergist: Glute Max

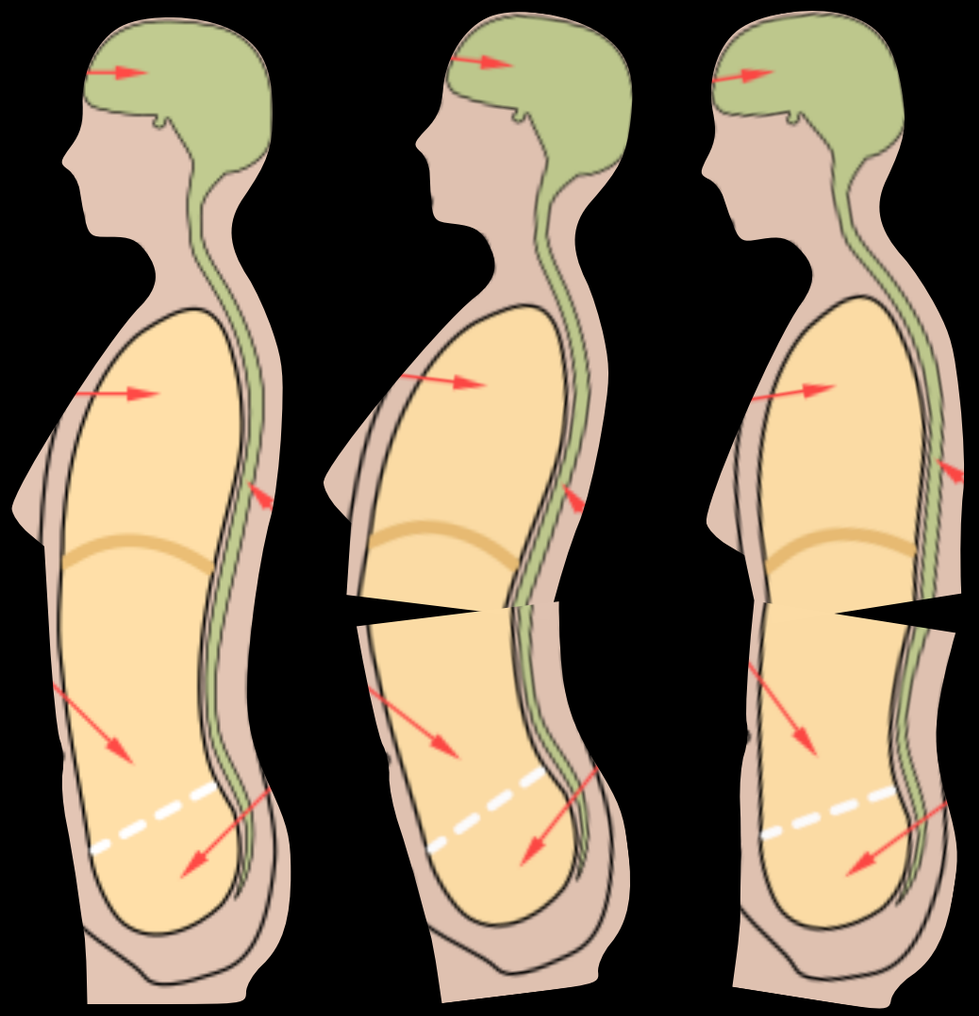
Unilateral

- Frontal Plane Stabilization
  - Synergist: Adductor Magnus
  - Stabilizers: Glute Med/Min

Integration: Positional Considerations

Body Position & Respiration influences position of rib cage & pelvis

Position of ribcage & pelvis influence position of muscle origins/insertions



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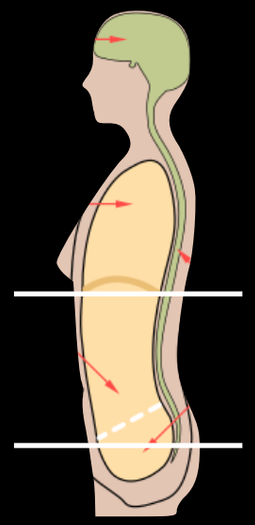
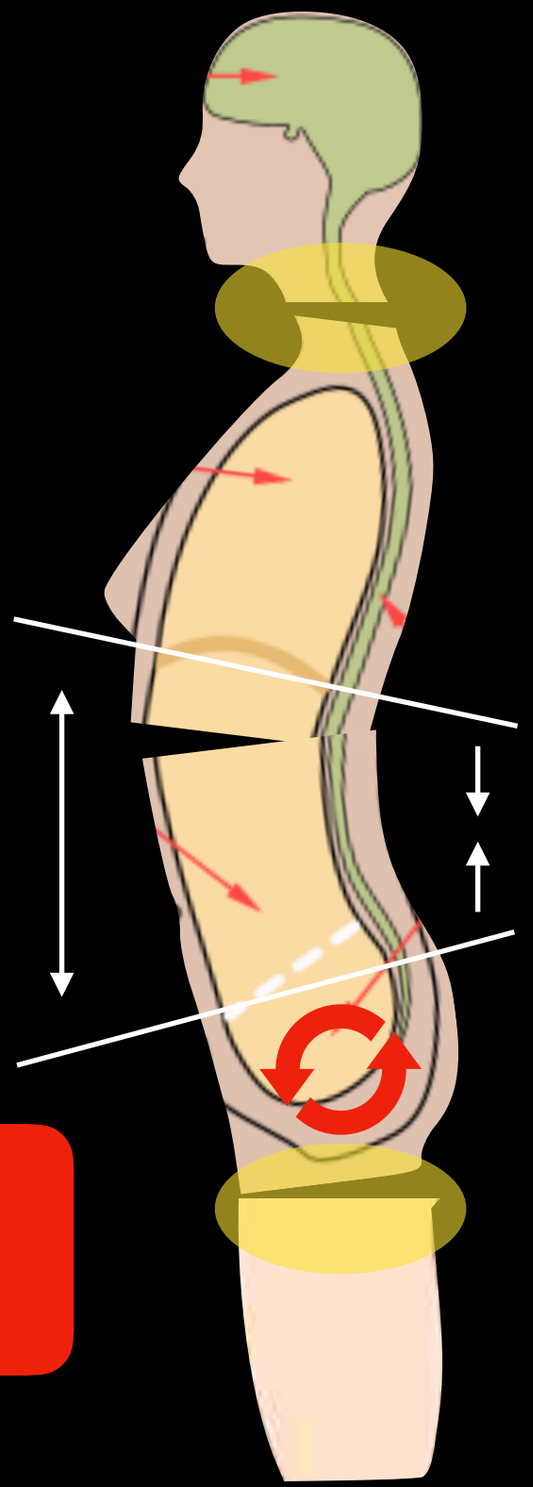
Mechanical Advantage & Orientation

"Neutral"





Abs Eccentric

Lumbar P-Spinals Concentric

Hip Flexors Concentric

Hamstrings Eccentric

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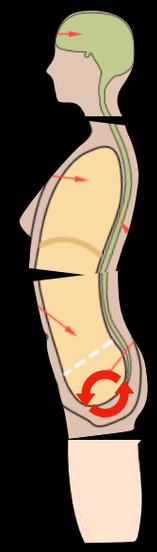
Integration of Concepts: Analysis



	KB Deadlift
Movement Program	Hip Dominant
Orientation	Bilateral
Movement Pattern	Flex / Ext
Plane of Motion	Sagittal
Position	Standing

Troubleshooting w/Functional Anatomy

“My hamstrings are really tight”

“This hurts my back”

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- **Bilateral, Sagittal Plane**
  - ➡Hamstrings, Glute Max, Abs
- **Intervention**
  - ➡ Change starting position to more “neutral"
  - ➡ Motor control exercises to teach, engrain, and “feel” the position

Recommended Reading

- Everything
  …but these may be a good place to start!

- Biomechanical Basis of Human Movement
  - *Hamill, Knutzen, Derrick*
- Essential Clinical Anatomy
  - *Moore, Agur, Dalley*
- Evidence Informed Muscle Manual
  - *Vizniak*

IG: @damion_perry
Email: damionperry3@gmail.com

FUNCTIONAL TRAINING ANATOMY

Kevin Carr
CFSC, LMT

WHAT IS “FUNCTIONAL TRAINING?”

Functional training means we are

PURPOSEFULLY

selecting exercises to improve a specific outcome

and basing those selections on the

structure and function of the human body.

IT’S NOT THIS.

OR IS IT?

For the majority of your clients the
"SPECIFIC OUTCOME"
is actually very general and that is OK.

Feel Better
Improve Movement Quality
Increase Power
Increase Strength
Increase Cardiovascular Fitness

90% OF ATHLETES AND GENERAL POPULATION CLIENTS

Anatomical Anomalies

Extreme End Ranges

Skill Specific Training

Mobility Training
Active Warm-Up/Movement Skills
General Power/Speed
Push/Pull/Hip Dom/Knee Dom/Core
General Aerobic/Anaerobic Conditioning

Balance Training

Unique Energy System Goals

Individual Activities

FUNCTIONAL ANATOMY

"DEAD PERSON ANATOMY"
IS HELPFUL FOR
UNDERSTANDING BASIC
STRUCTURE.

ARTICULATION

PENNATION

POSITION/SIZE

INNERVATION

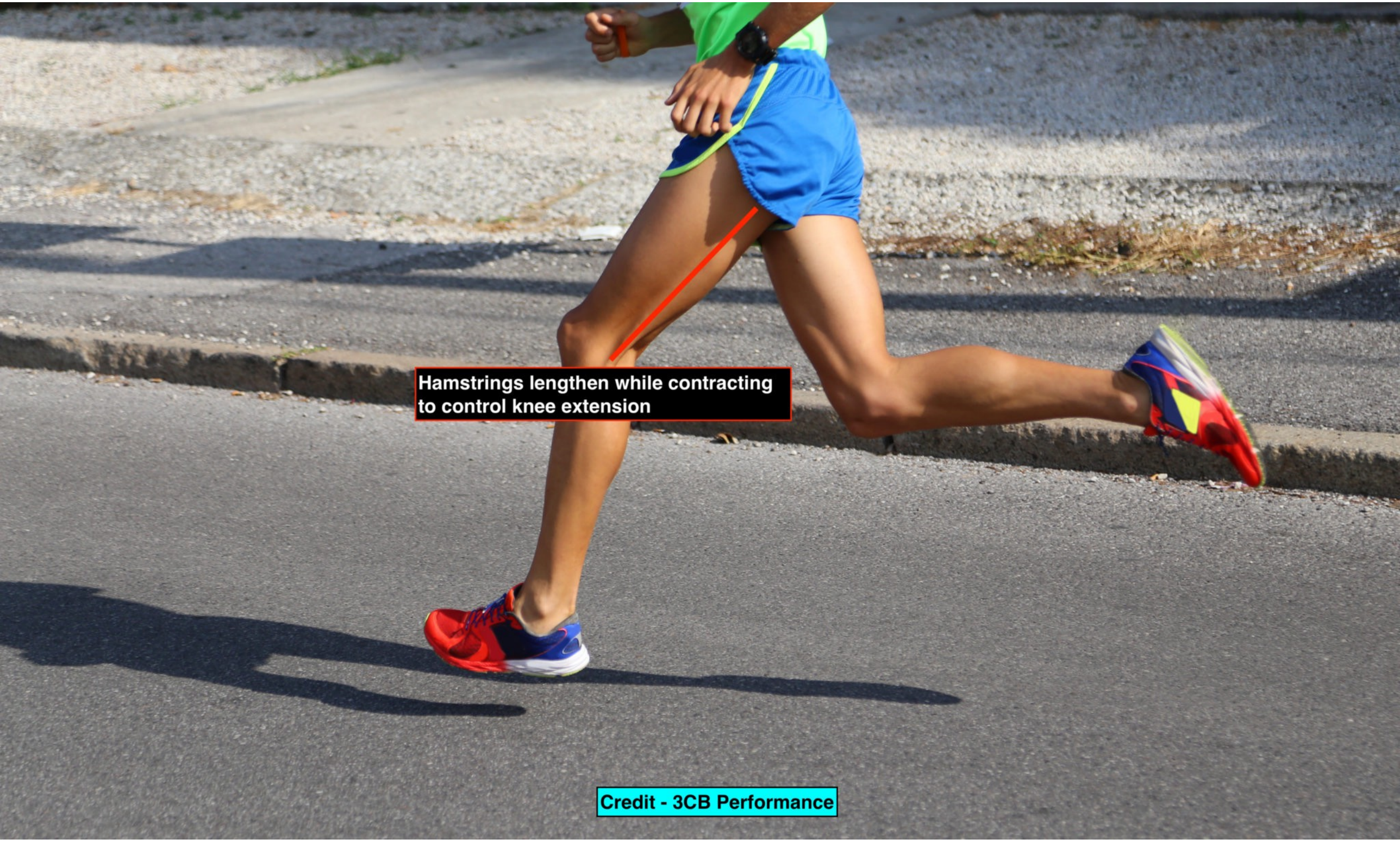
FUNCTIONAL ANATOMY

Origin insertion anatomy is it **MUSCLE** specific

Functional anatomy is it **ACTION** specific

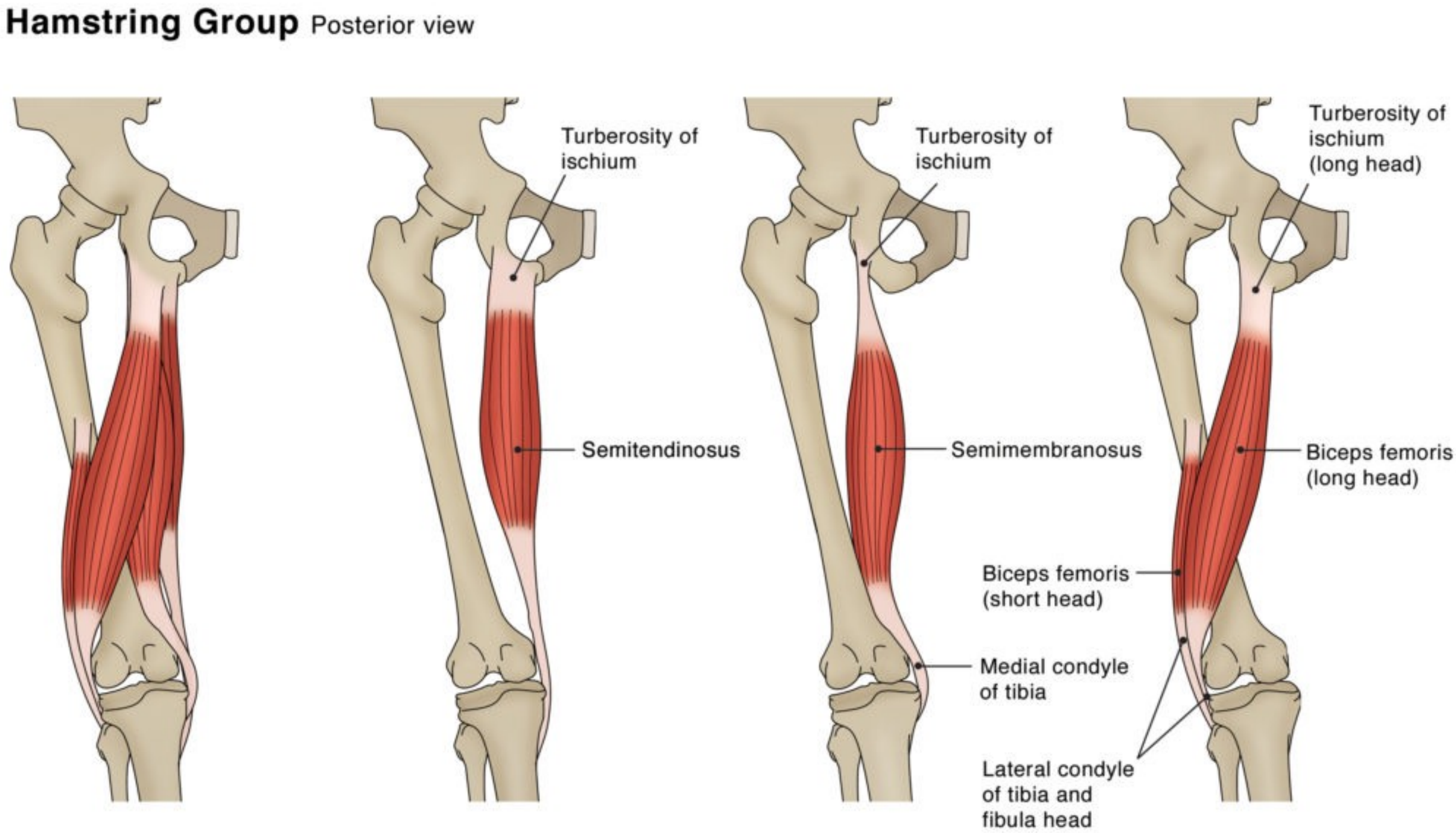
Functional anatomy tells us what groups of muscles do together to create specific actions in specific positions under the force of gravity.

EXAMPLE 1: HOW SHOULD WE TRAIN THE HAMSTRING?

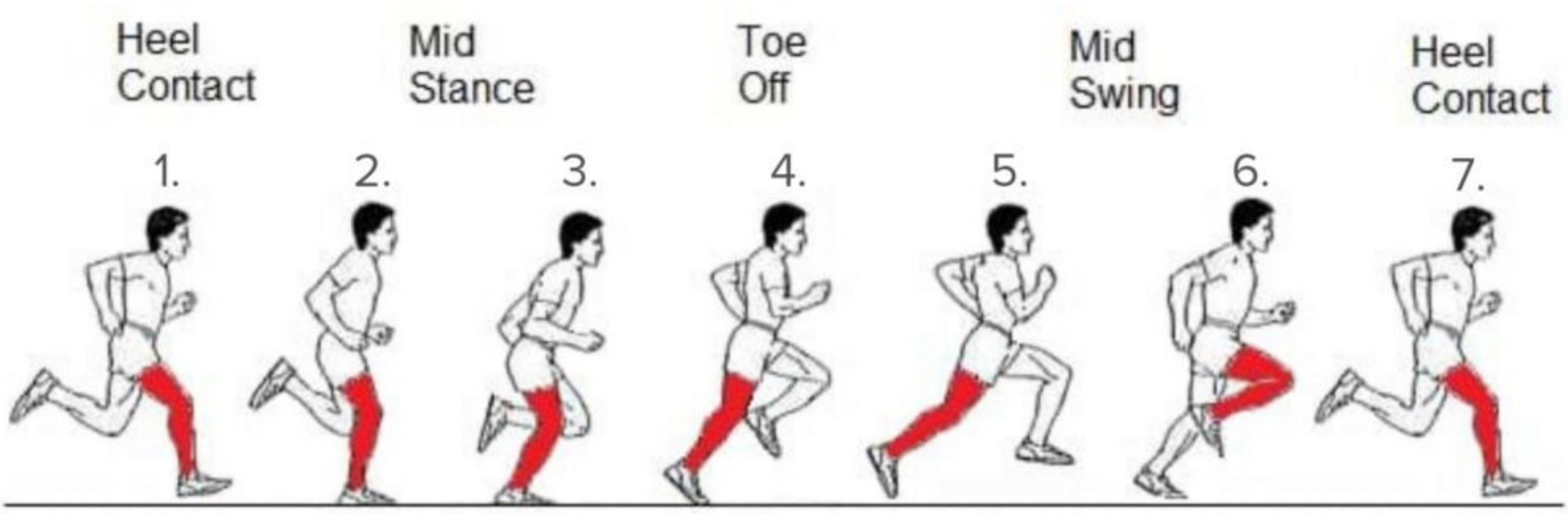


WHAT DO WE KNOW ABOUT HAMSTRINGS IN SPORT?

- Biceps Femoris is the most commonly injured.



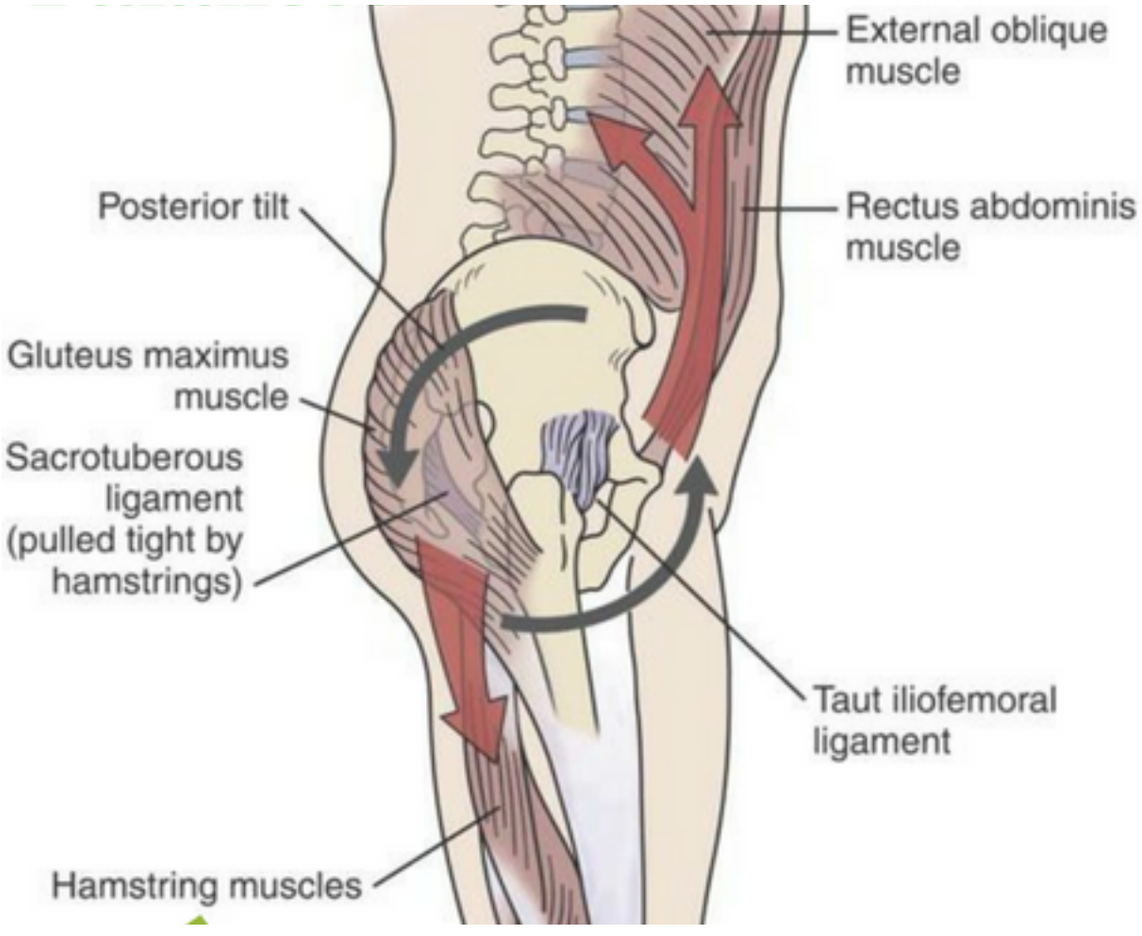
- Most commonly injured during the terminal swing phase of gait.
- High Eccentric Load Decelerating Lower Leg
- Stabilization of the Pelvis before Foot Strike
- High Velocity Hip Extension

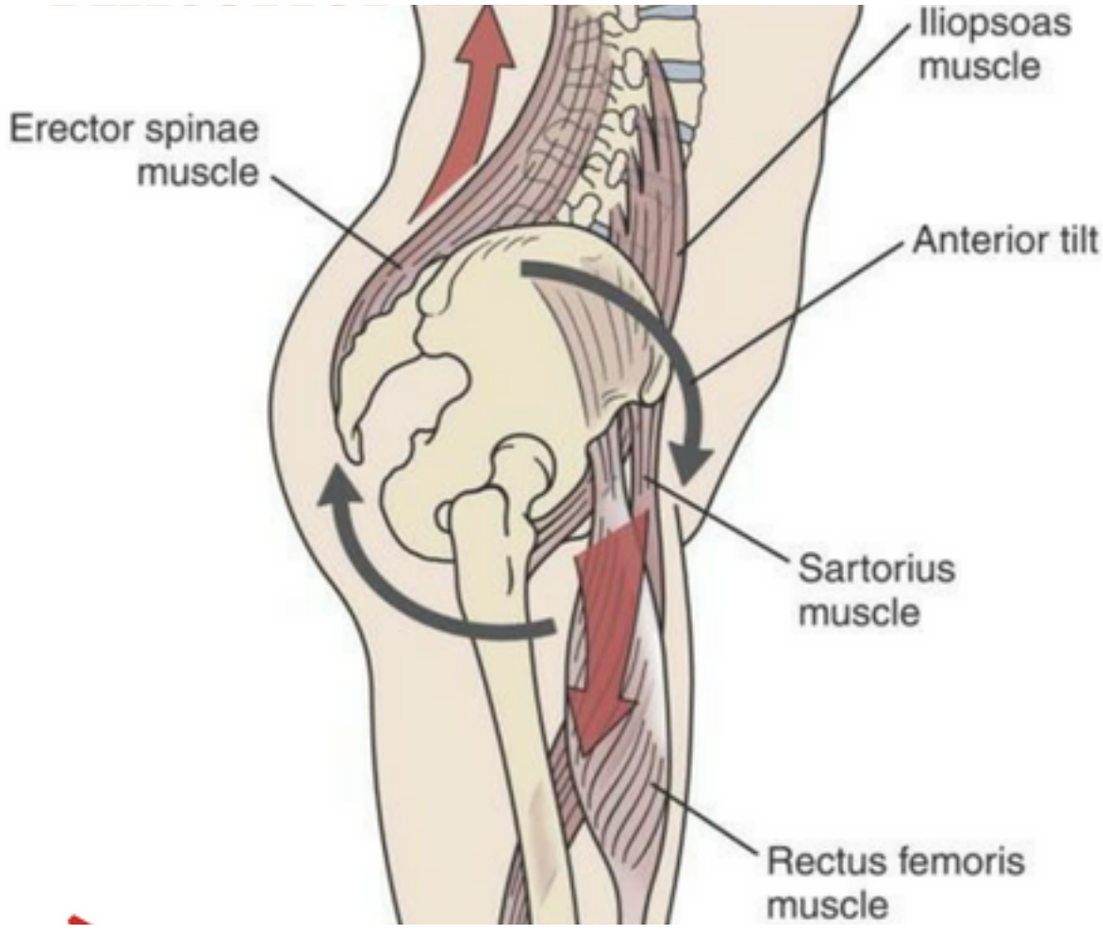


Athletes suffering from hamstring strains presented with:

-

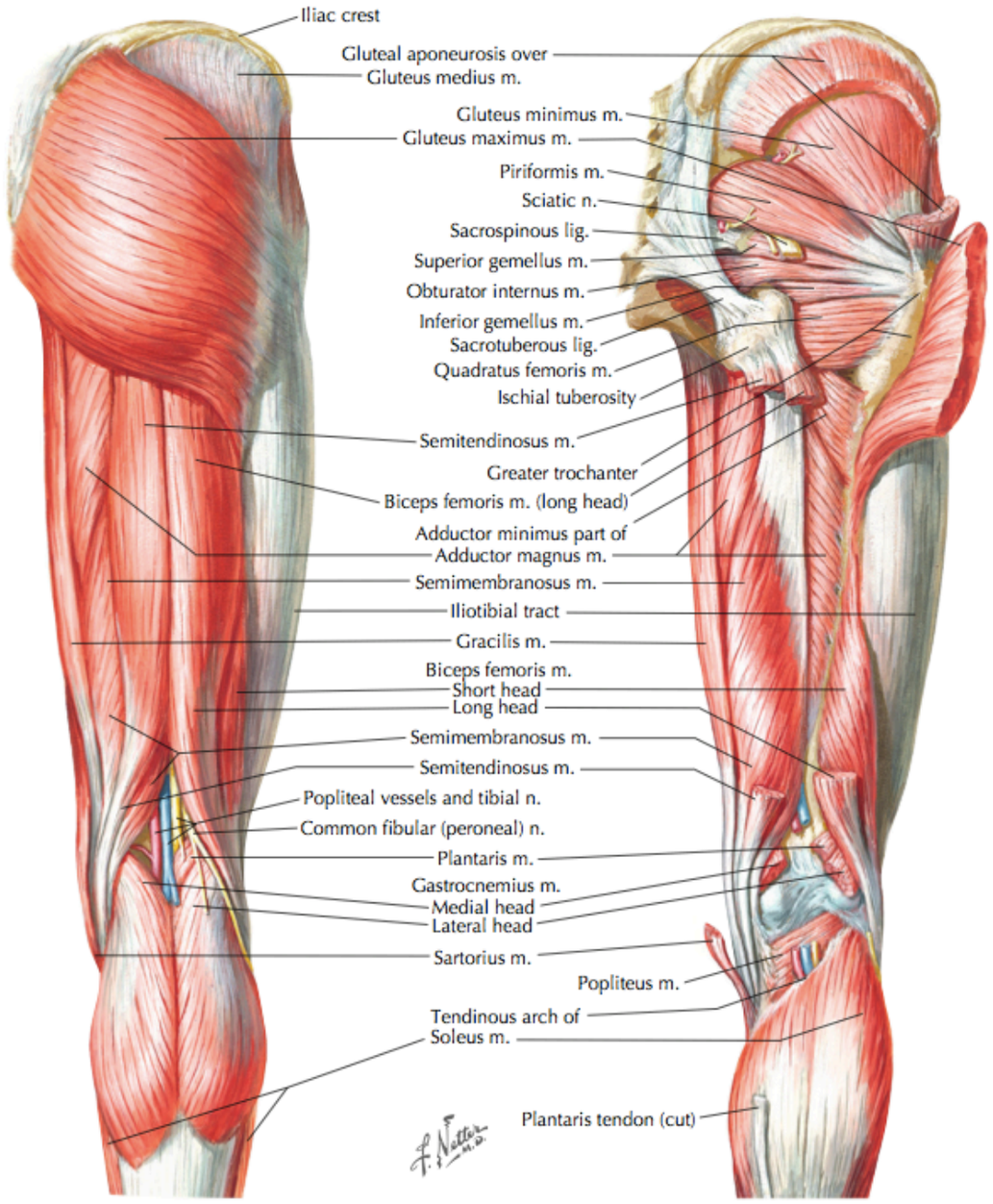
- Increased Hip Flexion/Anterior Tilt/Medial Knee Rotation

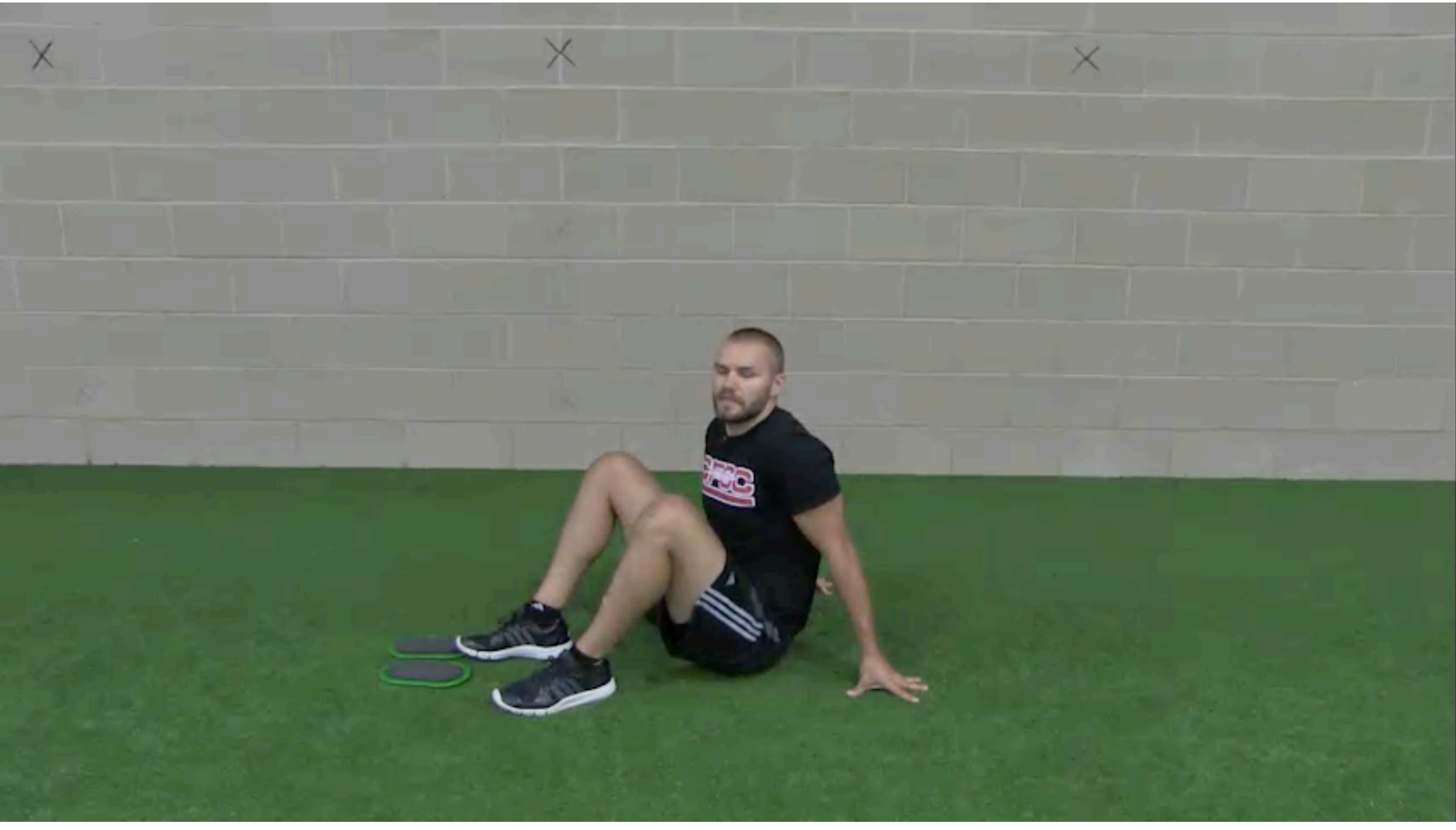




Athletes suffering from hamstring strains presented with:

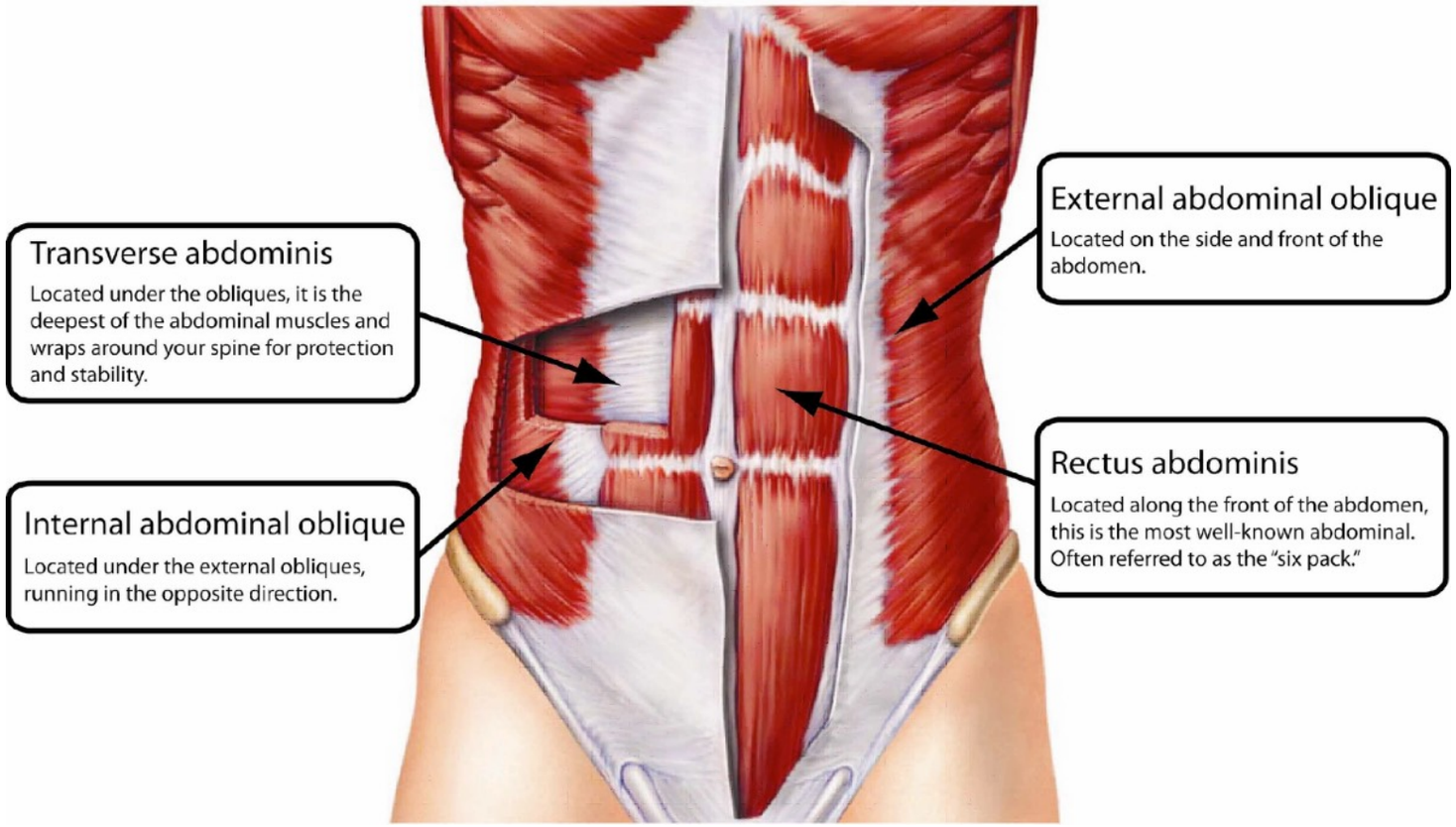
- Reduced Bicep Femoris when compared to Ipsilateral Glute

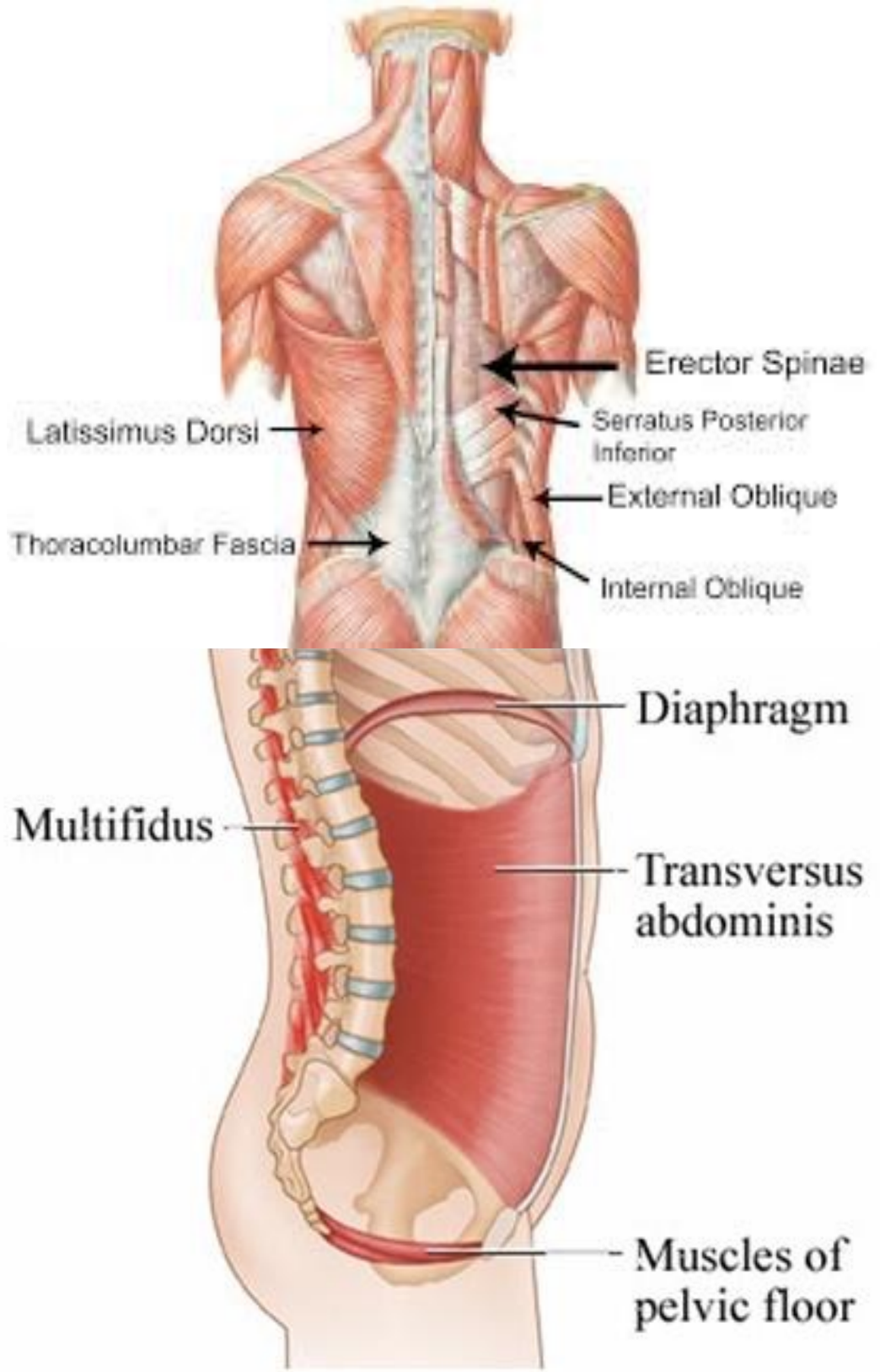





halfway
SCLE
ILK

EXAMPLE 2: WHAT DO CORE MUSCLES REALLY DO?



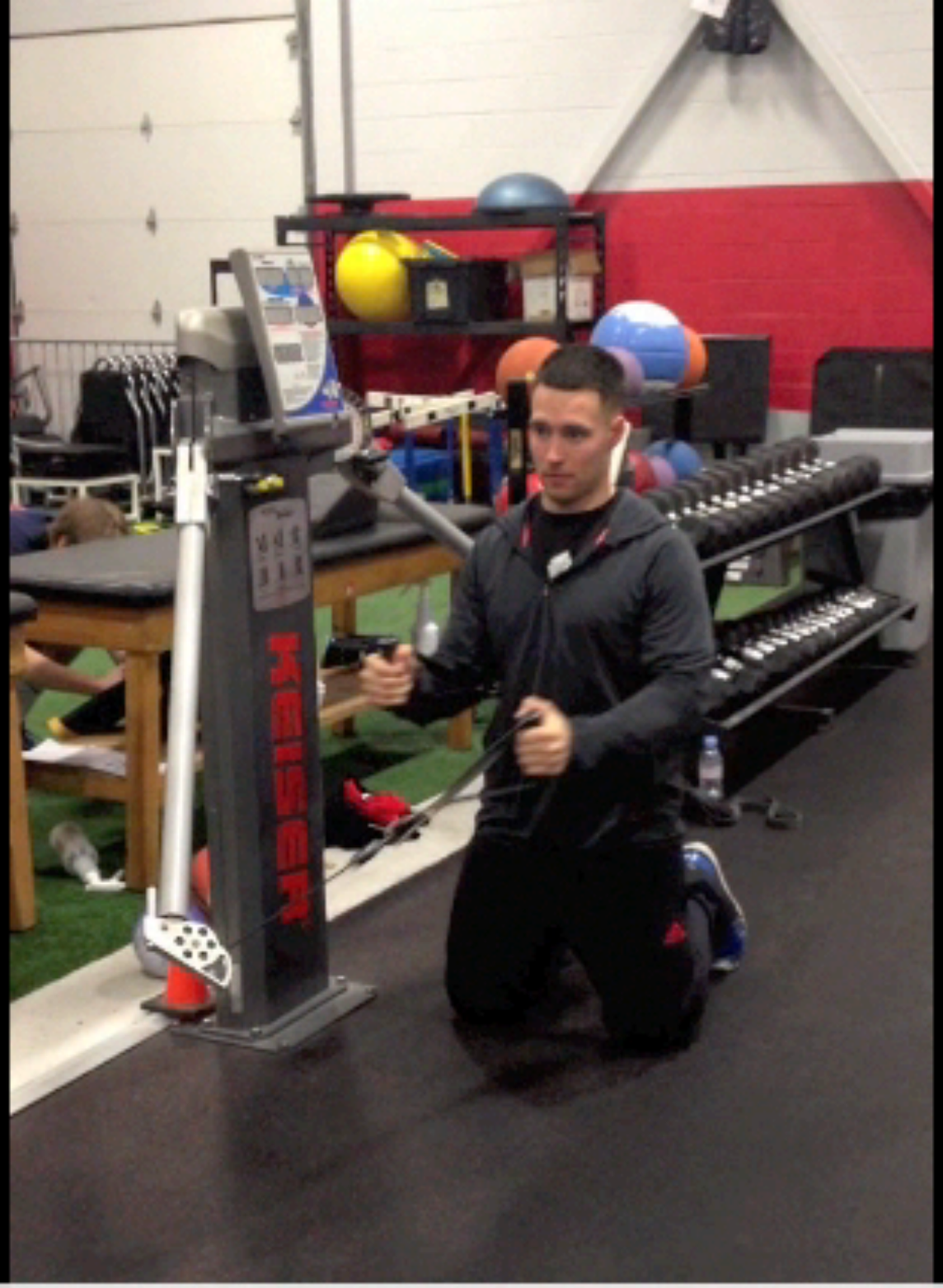


- Power Production isn't nearly as much about producing motion through the trunk as it is controlling it.

- We need to transfer force from the legs to the hands.

- Huge Impulse forces with relatively small amounts of motion.

Phase 1: Tall Kneeling



Tall Kneeling Push/Pull


MUSCLE
MILK
BODYBYBOYLE
144
165
159
120

EXAMPLE 3: WHAT IS IN SINGLE LEG STANCE?

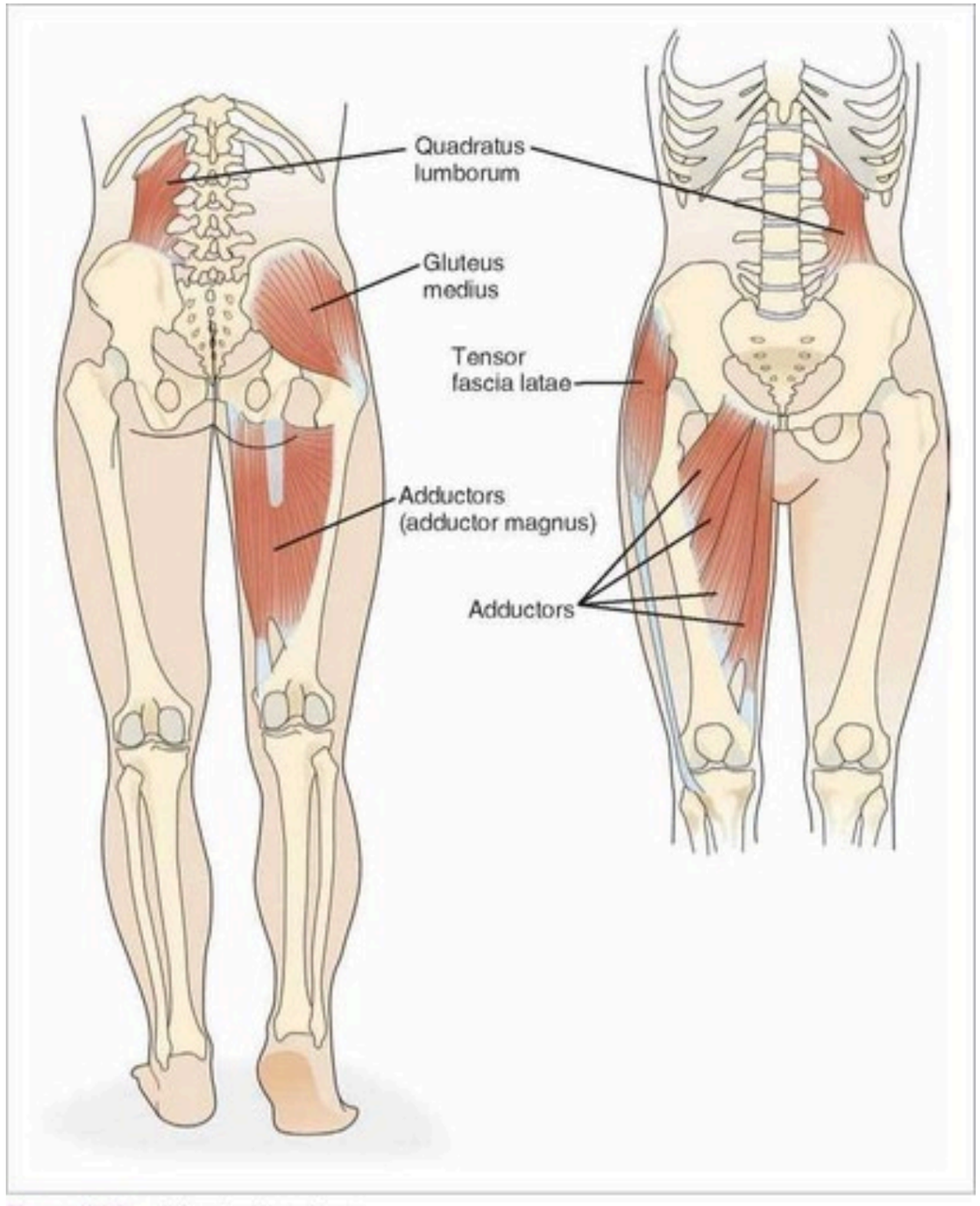


Figure 2.21 Lateral sub-system.

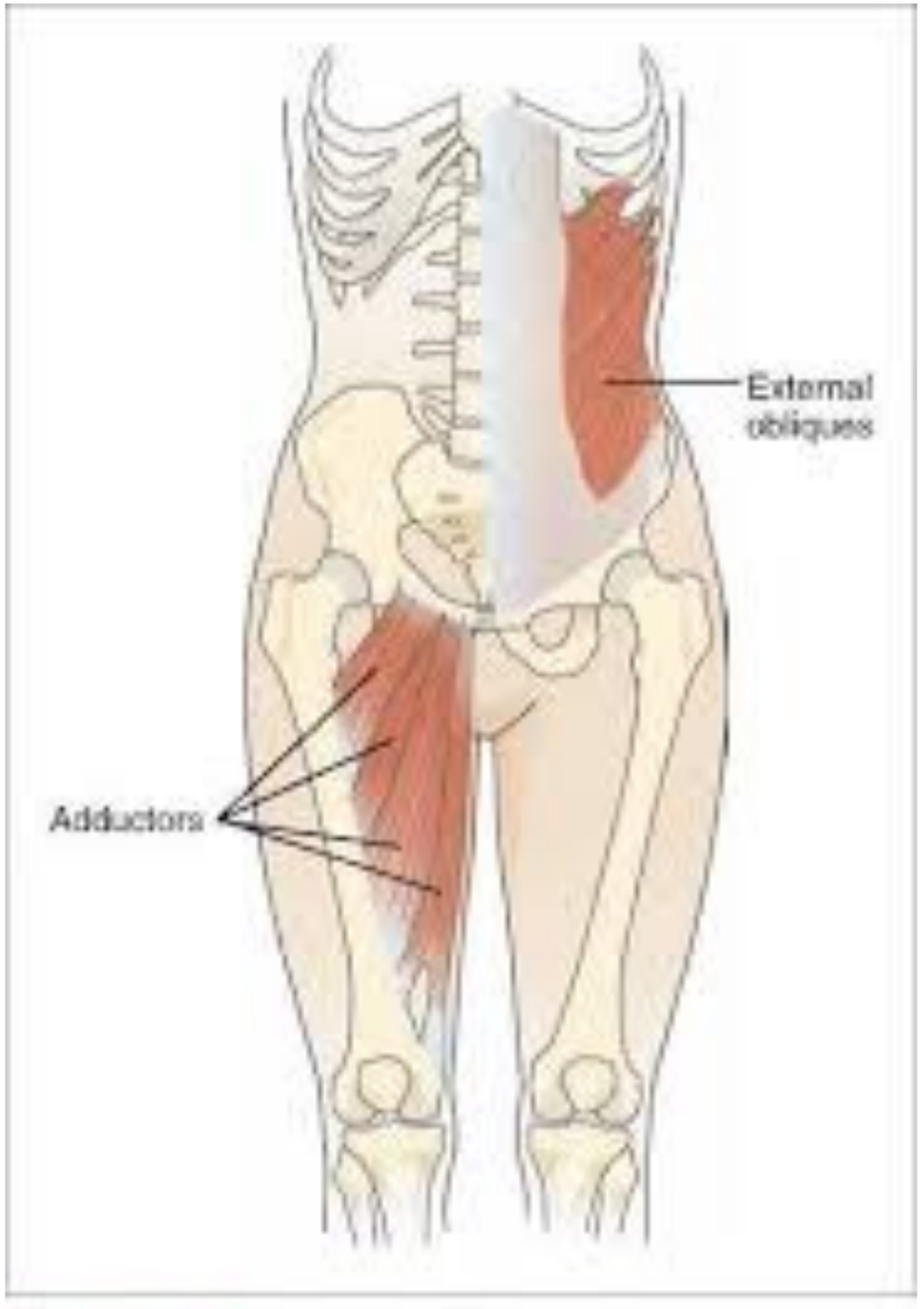


Figure 2.20 Anterior oblique sub-system.

SAGITTAL PLANE DOMINANT

MULTI-PLANAR FORCES

EVERYTHING CHANGES ON ONE LEG

- Global Movement still in Sagittal Plane
- Local Stability in Frontal/ Transverse Plane
- Position Dictates Function
  - Pelvis over Femur
  - Femur over Tibia
  - Tibia over Foot

RECOMMENDED READING

Kinesiology of the Musculoskeletal System: Foundations for Rehabilitation 2nd Edition - Donald A. Neumann

Human Locomotion: Conservative Management of Gait-Related Disorders - Tom Michaud

Diagnosis and Treatment of Movement Impairment Syndromes - Shirley Sahrmann

WHEN BUILDING PROGRAMS ASK YOURSELF:

WHAT IS THE FUNCTION THAT I WANT TO IMPROVE?

WHAT ARE THE MUSCLES/JOINTS DOING DURING THAT FUNCTION?

HOW CAN I PROGRESSIVELY IMPROVE CONTROL/CAPACITY IN THOSE TISSUES TO IMPROVE THAT FUNCTION?

Is Trap Bar Deadlift not just a Functional Leg Press?

- More freedom of motion (Spine & Hips)
- More set up options/positioning options
- Grip training
- Upper back engagement
- Core Engagement
- Neurological, Skeletal, Cardiovascular

Therefore, I would deem Kettlebell or Trap Bar Deadlift to be more “Optimal” for transfer to life and sport, fitness & performance.

Joel Anderson What's the "So what?" of functional anatomy?

Tawnya Nguyen Since the word functional is thrown around a lot, what determines something as “functional”

Diane Ruggiero

How can I use functional anatomy to design better exercise programs for my clients?

Daniel Jo

How you specifically view functional anatomy in context of acute/chronic injury rehab?

Gabriele Gambino

Which muscles are most activated during the SLDL to stabilize the pelvis?

Anthony Ferrante

How to connect the site of pain with the actual problem. For example - neck pain with a shoulder problem? Low back pain with hip?

Tyler Campbell

Assessing and diagnosing poor foot/ankle function and what common issues are found up the chain as a result?

Sarah Carr

How does it apply to powerlifting?

Sean Cryan

What is the biggest misconception regarding functional anatomy as it relates to training?

Ericka San Juan

What is the greatest advantage of knowing functional anatomy compared with just the gross anatomy?

Brandon Hood

What are your favorite resources to help learn AND apply functional anatomy knowledge?

Recommended Reading

Anatomy Trains: Myofascial Meridians for Manual and Movement Therapists
by Thomas W. Myers

Movement Functional Movement Systems: Screening, Assessment, Corrective Strategies by Gray Cook

The Best Kept Secret: Why People Have to Squat Differently: https://themovementfix.com/the-best-kept-secret-why-people-have-to-squat-differently/

Assessment and Treatment of Muscle Imbalance: The Janda Approach

Fascial Dissection: https://www.anatomytrains.com/courses-trainings/fascial-dissection/

Gray's Anatomy of the Human Body (30th Edition)

TRAINING TO PREVENT HAMSTRING INJURIES by Kevin Carr

Contact Us

Brendon Rearick
IG: @coachbrendonrearick
Website: www.brendonrearick.com
Email: brendonrearick@gmail.com

Kevin Carr
IG: @kev_in_carr
Website: www.movement-as-medicine.com
Email: coachkevincarr@gmail.com

Damion Perry
IG: @damion_perry
Email: damionperry3@gmail.com

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