The Science of Healthy Spine Movement in Pilates

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Mission of Pilates Philosophy

"Physical fitness is the first requisite of happiness. Our interpretation of physical fitness is the attainment and maintenance of a uniformly developed body with a sound mind, ***fully capable of naturally, easily and satisfactorily performing our many and varied daily tasks with spontaneous zest and pleasure***"

Joseph H Pilates

What are some of our daily tasks?

- Walking
- Sitting
- Reaching
- Squatting
- Lifting
- Bathing
- Toileting
- Intimacy
- Dressing
- Dancing
- Playing
- Sports
- Sleeping
- Cooking
- Cleaning
- Art

"We are built to function well" ***E.Franklin***

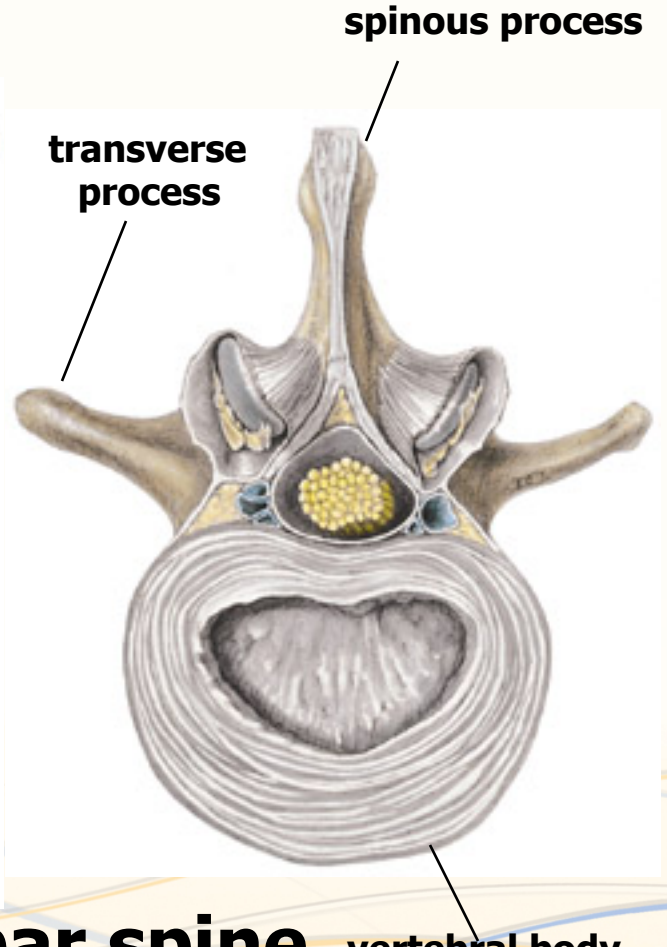
To successfully perform daily tasks

- We must have a clear understanding of the how the body works.
  - Biomechanically
  - Neuromuscularly
  - Psychologically

Bio-Mechanics of the Spine

- Lumbar spine
  - L5-S1
  - L1-L4
  - T/L junction (T11-12, where's the L?)
- Thoracic spine
  - T1-7
  - T8-12
- Cervical spine
  - C3-7
  - A/A & O/A

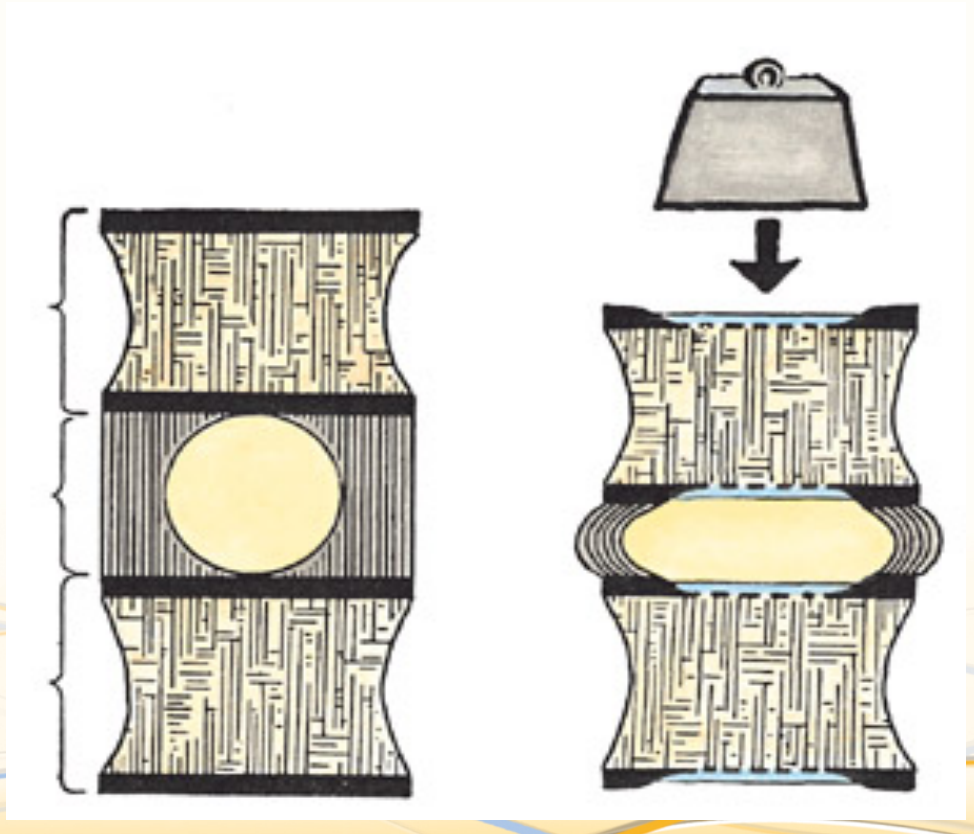
Axial Elongation/Core Control:
Anatomy

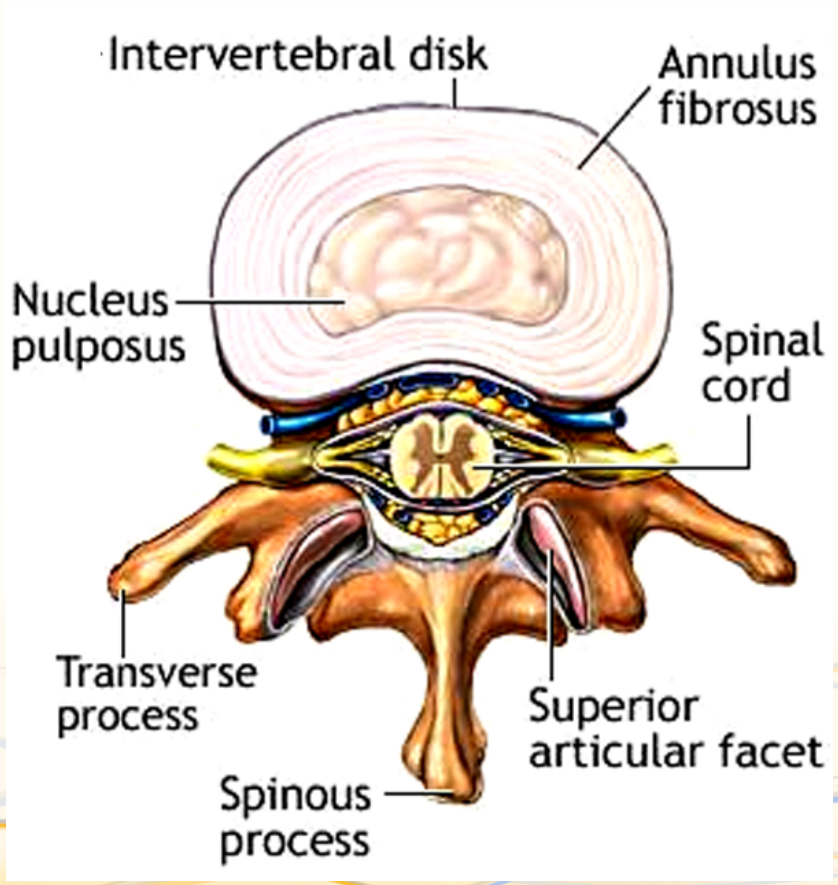


Lumbar spine

Axial Elongation/Core Control:
Anatomy

- The Intervertebral Disc

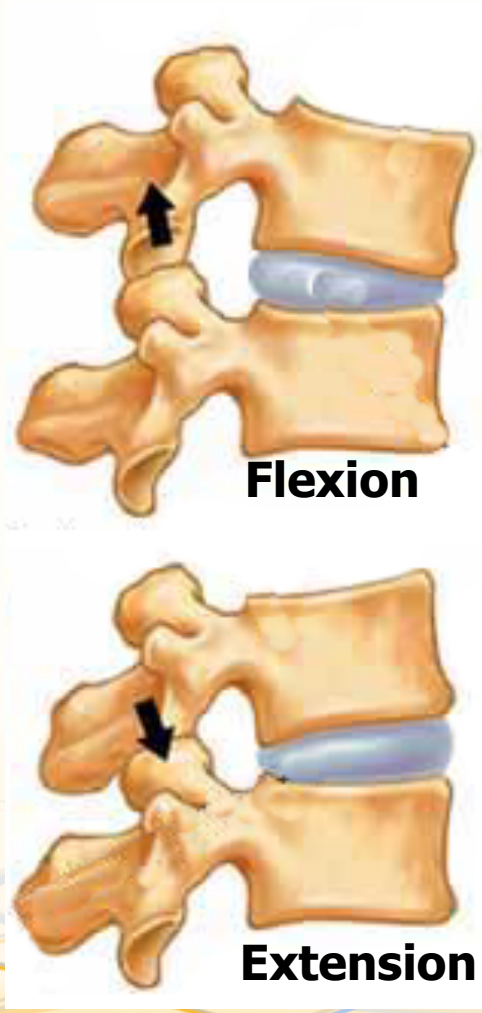




Axial Elongation/Core Control: Bio-mechanics

(Kisner C, Colby L 2007)

- The Vertebral Disc
  - Functions as shock absorber
  - Axial Elongation places the vertebrae in their optimal position, minimizing destructive forces to the disc
  - Weight-bearing increases compressive forces on disc
  - Compression/decompression necessary for disc health



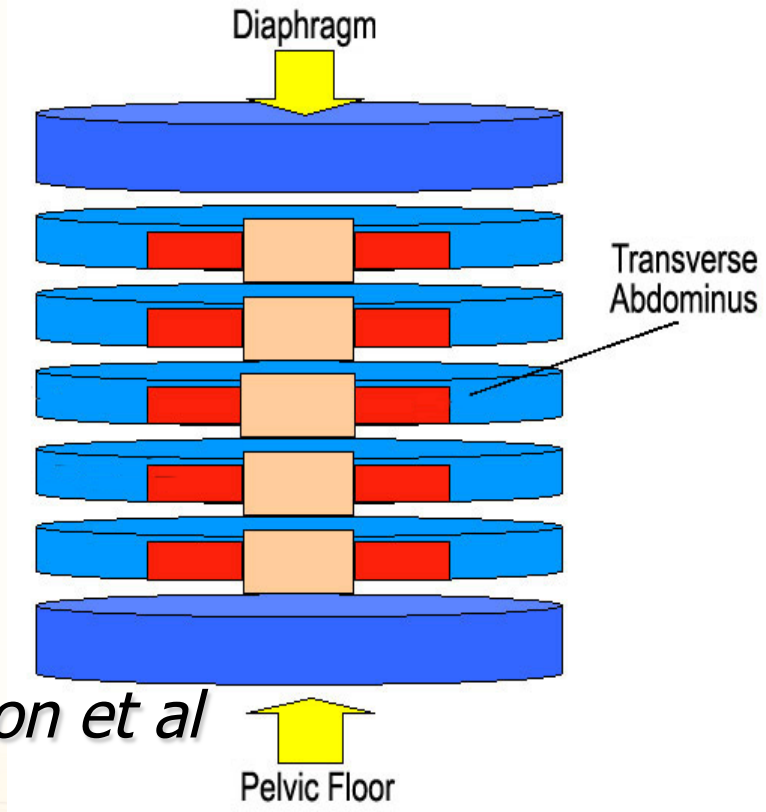
Axial Elongation/Core Control:

Bio-mechanics

(Bergmark A, 1989; Richardson et al 1990; Lee D, 2004)

Force Couples

- Diaphragm
- Transversus Abdominus
- Obliques and RA
- Pelvic Floor
- Multifidus



Often referred to as:

- The Inner Unit-*Diane Lee*
- Local Stabilising System *Richardson et al*
- The Hydraulic Amplifier
- The Cylinder of Support
- (This is not quite the same as the “Pilates Powerhouse”)

Mobility of the Spine

- Polestar Principles of Movement:

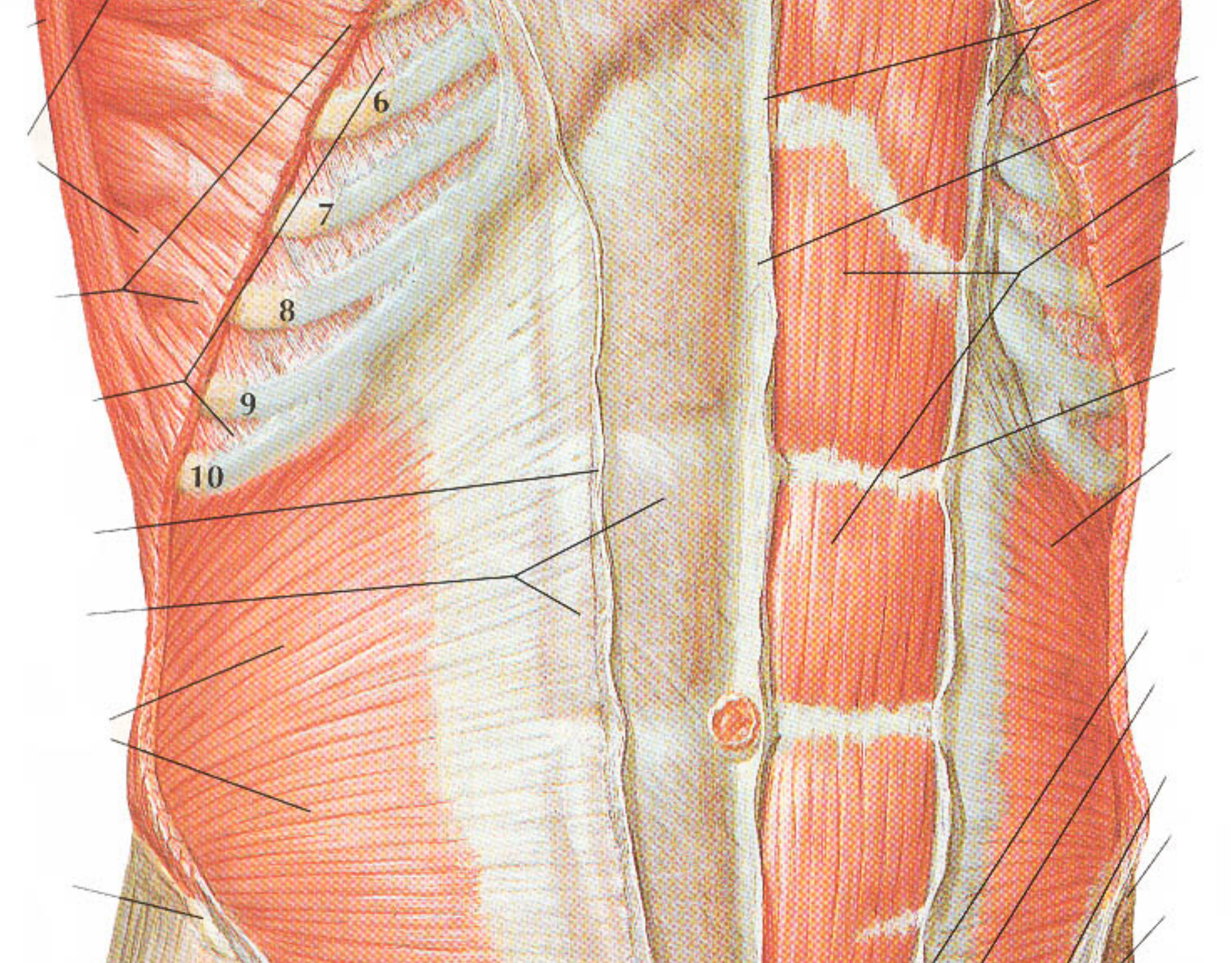
"Distribution of Movement Equals Distribution of Force"

Current Trends for Spine Care

- Stability
- Core Stability
- Motor Control
- Return to Functional Activity
- Psychosocial Influence

Stability of the Spine

- Principle of Control: “You must have mobility before you can have control of mobility”
- “Appropriate amount of stiffness for the anticipated load”
- “As much as necessary as little as possible”
- Rules of efficiency in movement (unconsciously competent)
- The Yoga Bandas
    - Co-contraction of a joint complex
    - Experiential lab
        - **MOVING YOUR BANDAS/MOVING YOUR SPINE**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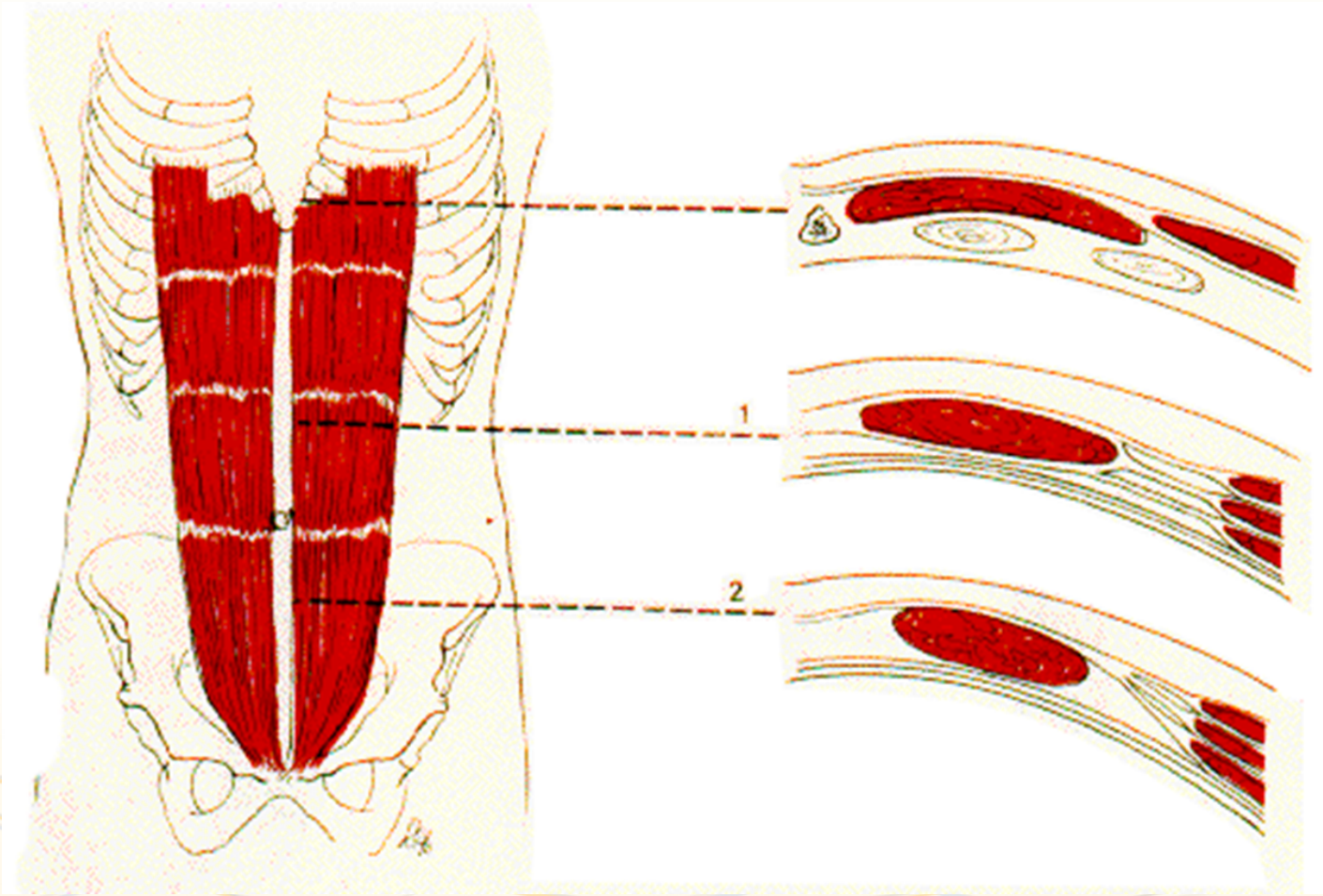
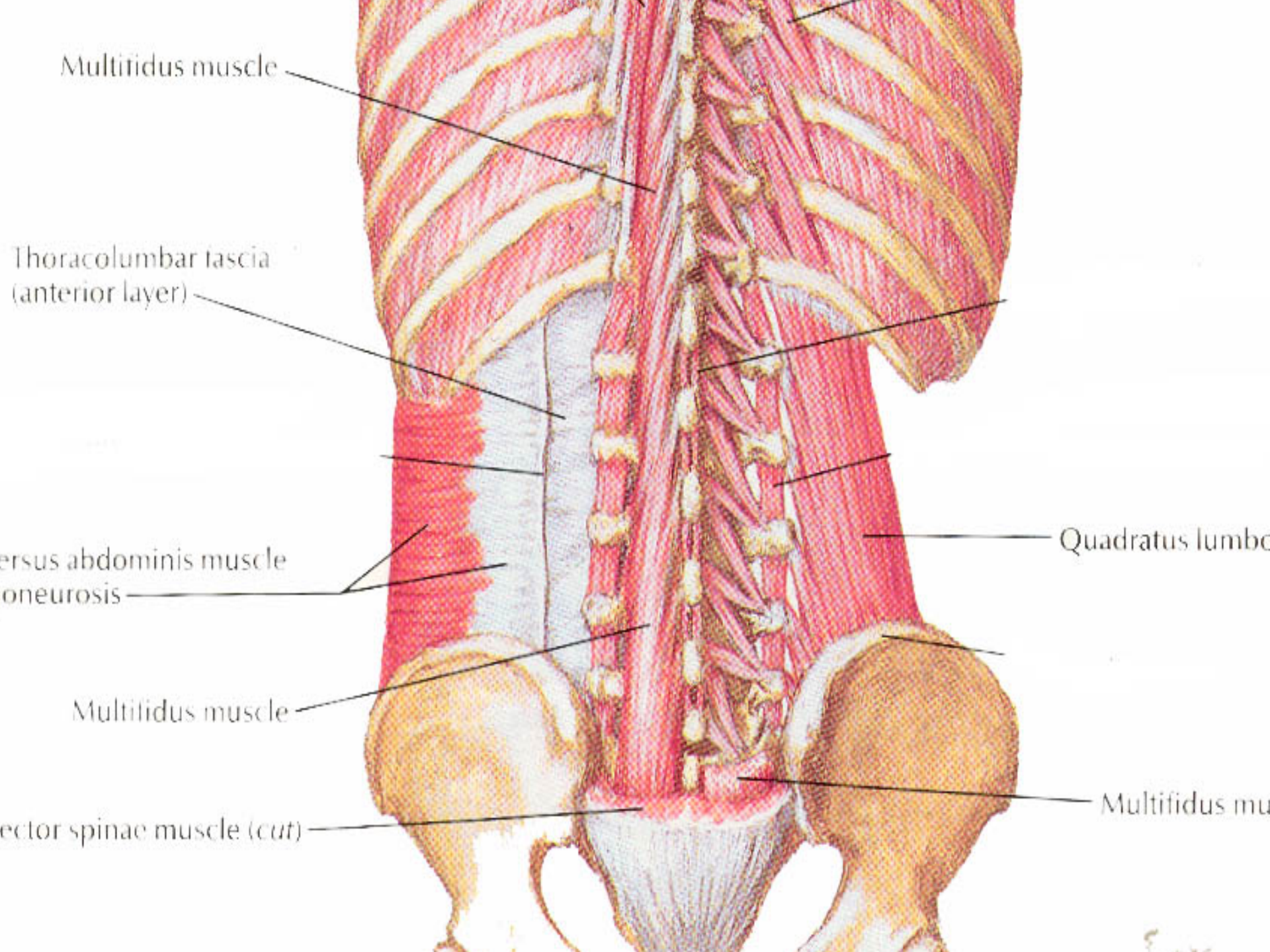
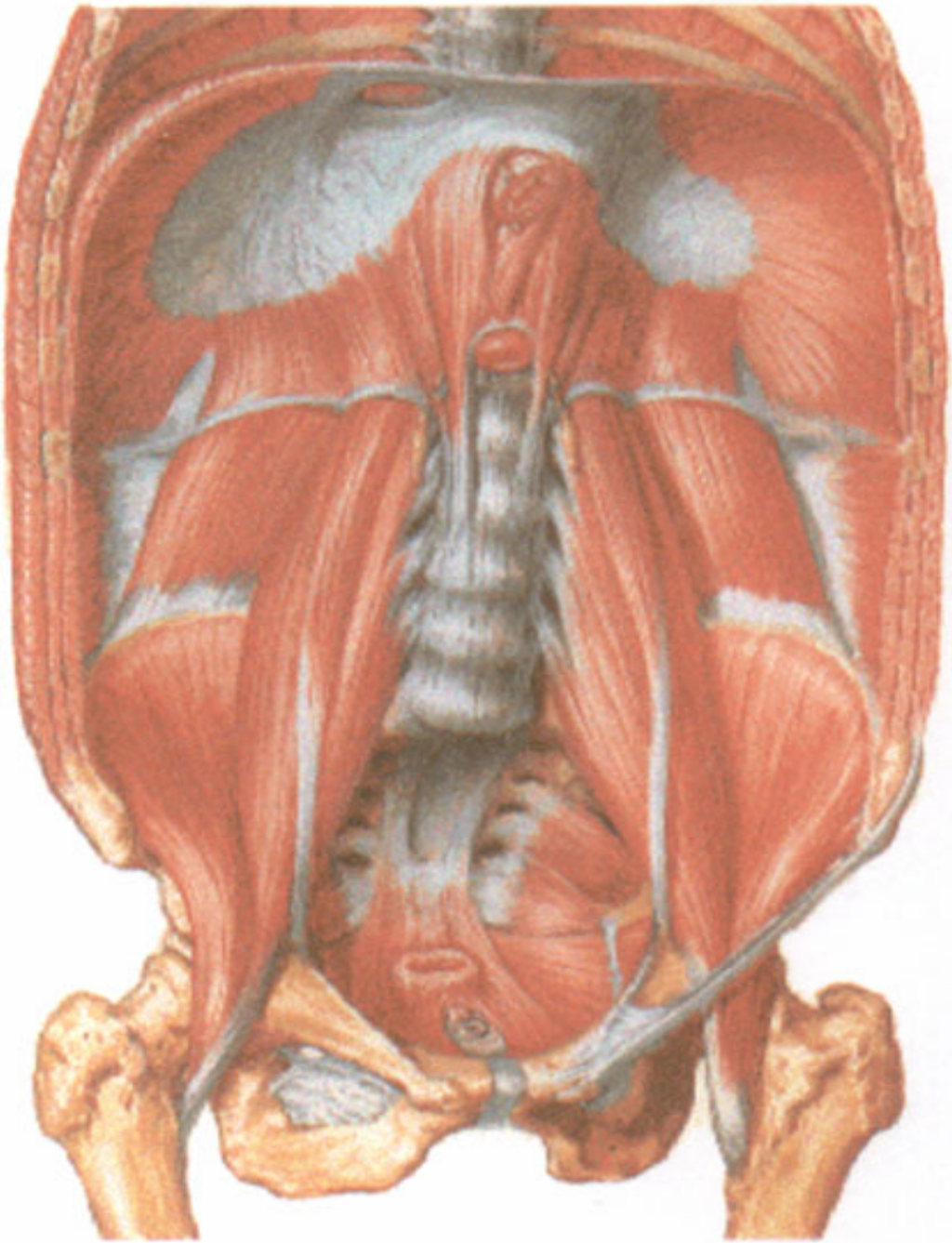
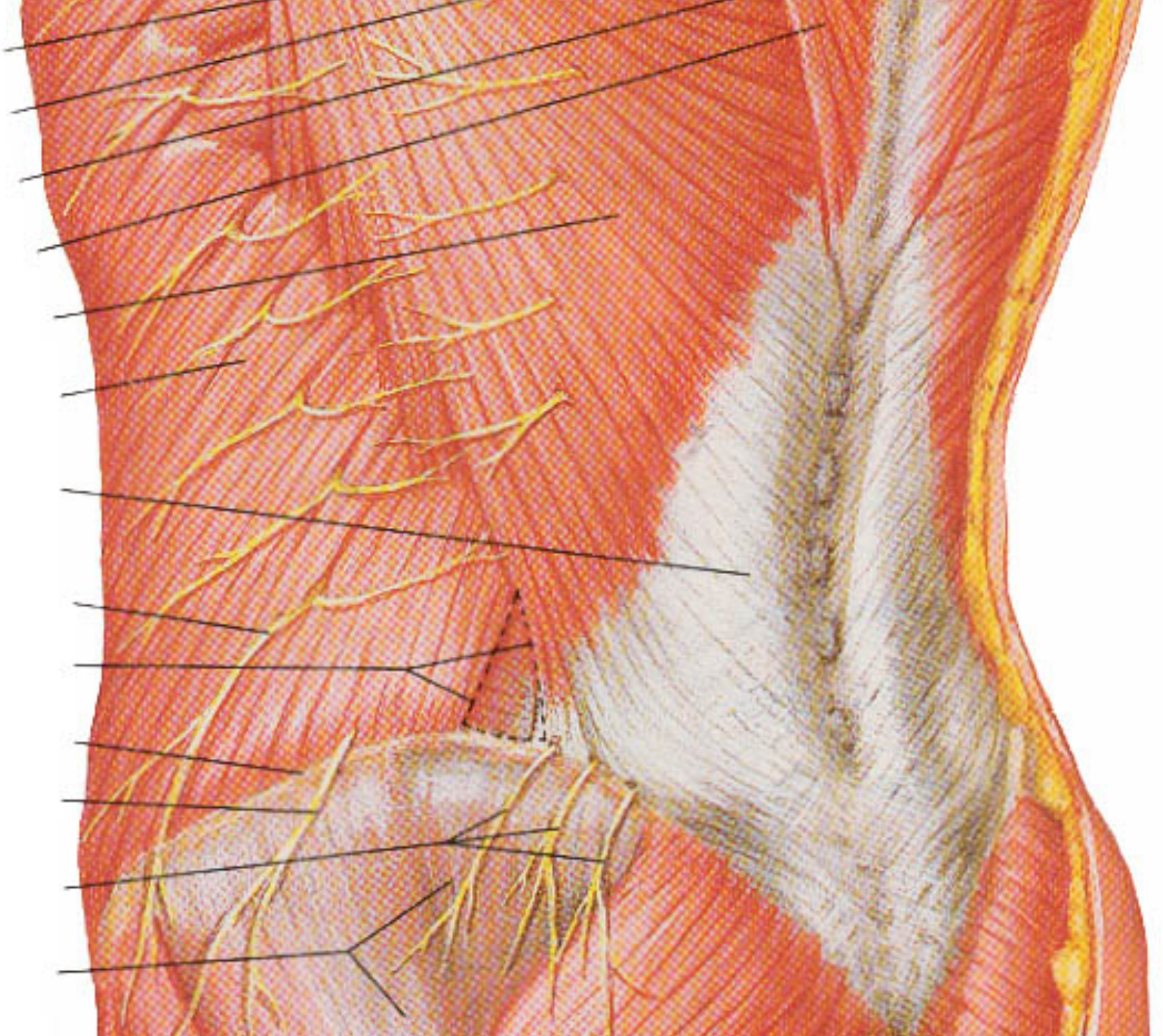
Abdominal Cross-section




Multifidus muscle
Thoracolumbar fascia
(anterior layer)
ersus abdominis muscle
oneurosis
Quadratus lumbo
Multifidus muscle
Multifidus mu
ector spinae muscle (*cut*)



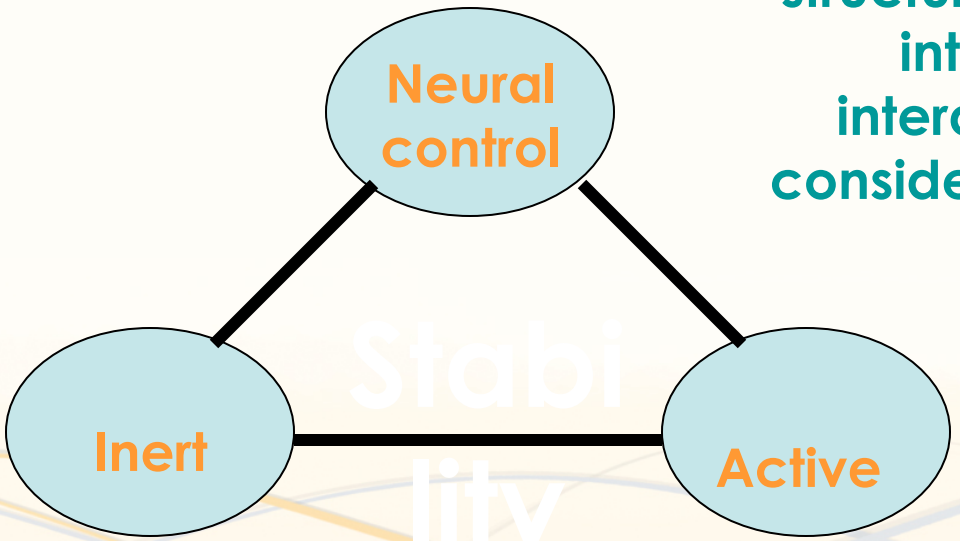


Core Stability

- Panjabi: Stability
  - » Panjabi M, 1992
- Richardson's group: Segmental stabilization, TA activation
  - » Richardson et al: Therapeutic Exs. For Spinal Segmental Stabilization in LBP 1999
- McGill: Integrated abdominal wall, no separation from deep and global stabilization muscles, integration between all of the abdominal muscles. Guide Wires
  - » McGill,S: Low Back Disorders 2nd edition 2007

Summary of Physical Factors

- Inert Structures
- Active Structures
- Neural Control



Panjabi M 1992

Physical factors that are thought to influence CLBP and RLBP are more than likely a combination of the three structural categories and their interaction or lack of interaction, which can be considered a major influencer.

Trunk Stabilization Interventions

- Low threshold training is more effective than high threshold training Gibbons S et al. 2001
- Improved stability of the spine with training of intra-abdominal pressure (IAP) using the diaphragm, abdominal mm. and pelvic floor, the "hydraulic amplifier". Norris C., 1995
- Integration of deep stability muscles system into functional movements and high ADL's. O'Sullivan P., 1995, 1997a, 1997b, 1998
- Local and global retraining ideally should be trained concurrently Comerford M., 2001
- Specific stabilization exs. (multifidus, TA) may be more effective in reducing RLBP than normal management and normal activity alone Hides J, et al. 2001
- Pilates Reformer is an appropriate and useful tool for spine stabilization. Comerford M and Mottram S, 2001

Motor Control

- Agreement:
  - Appropriate amount of stiffness for anticipated load
  - Motor control of trunk is a critical component to stability
- Disagreement
  - Abdominal Bracing vs. Abdominal Hollowing

Hollowing Vs. Bracing

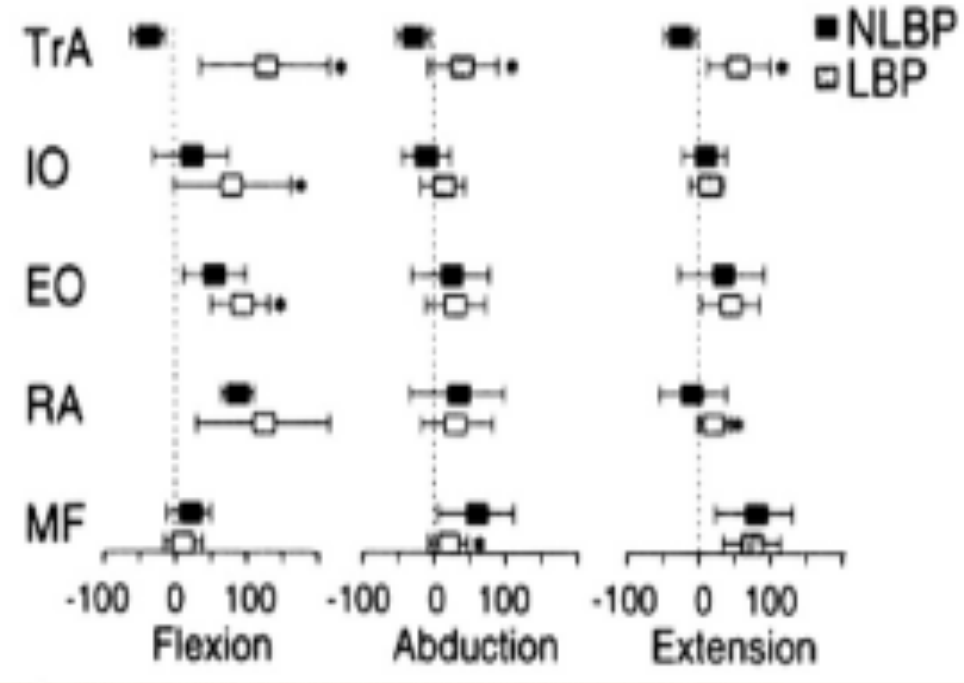
Richardson's Group

- TA Isolation
- Drawing the abdominal wall in to increase the IAP
- Rehabilitation program of isolated re-education of TA was developed

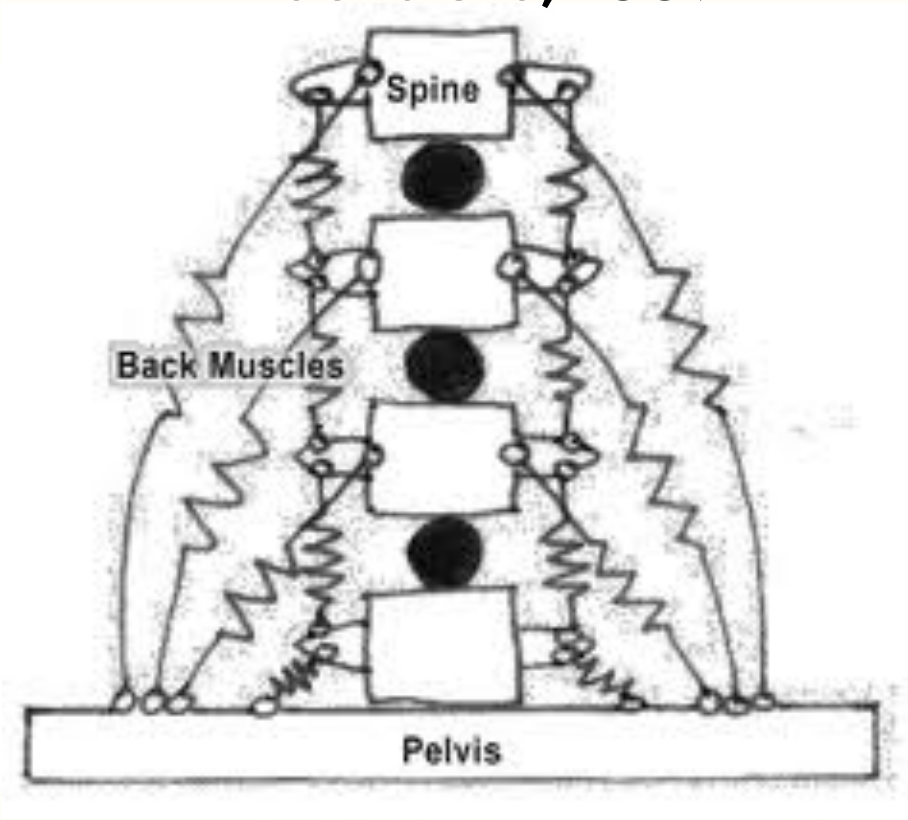
Stuart McGill

- Co-activation of TA with all abdominal muscles
- No change in the position of the abdominal wall
- Activation of all three layers creates a more affective IAP than hollowing. McGill 2002

Hodges & Richardson, Spine 1996:2640-2650



McGill, Low Back Disorders,2007



Maybe just Maybe?

Transversus Abdominus does not create the greatest core stability independently.

A guide-wire model of lumbar stability is not the most practical strategy for daily tasks that require movement of the spine.

BLASPHEMY

New Rules for Spine movement

- When the spine moves through planes of movement:
  - Velocity and load should maintain an inverse ratio.
    - The greater the load, the less velocity (i.e. lifting)
    - The higher the velocity, the less load (i.e. dancing, golf)
  - As the load increases, segmental movement decreases to prevent
    - Sheer force, i.e. power lifting
    - Tissue failure (tissue failure tolerance decreases with fatigue)
  - The appropriate amount of stiffness for the anticipated load.

Supported Truth about the Spine and its Movement

- The spine is made to move in all planes of movement
- Behavior proceeds form: “We are what we practice” Eric Franklin
- Wolfe’s Law: our bodies will adapt to stresses applied to it.
- Pathologies are a result of deformation of tissues secondary to restrictions and compensations. (Commerford et al.)

Restrictions can be Structural

- Tight ligaments
- Physiologically shortened muscles (myofascial restrictions)
- Degenerated cartilage
- Mal-alignment of joints
- Neural adhesions
- Skin adhesions

Restrictions can be Strategic

- Poor alignment
- Habitual posture
- Activity specific posture: swimmers, dancers, lifters, runners etc.
- Compensation to an injury
- Fear of pain
- False perception of ability:
    - Internal expectations
    - External expectations

Structure VS. Strategy

- Structural work is not needed all the time
- Strategic work is always needed

GOOD NEWS!

A Pilates teacher's job is secure

Functional Movements: Myth or Science

- Is flexion really a taboo?
- “Swan kills my low back”
- Rotation is the culprit of disc herniation and should be avoided
- Side bending will fracture my vertebrae

Depends on the Individual

- Scenarios:
  - Deconditioned sagittal beast
  - Lumbar Stenosis
  - Disc disease and damage
  - Rotational Sport Athlete
  - Laborer needs to do repetitive heavy lifting
  - Cirque de Solei Performer

ICF MODEL

- Physiological
- Structural
- Activities
- **Participation**
- Personal

What do we choose to participate in?

What do you choose to participate in?

Powerlifting **Breakdancing**

Pilates is ideal to create optimal load and stress to reeducate new postural strategies

- Varying base of support
- Full spectrum of closed chain to open change
- Varying degrees of assistance: fully passive to fully resistive
- Varying lengths of levers
- Varying challenge of proprioception
- Ability to progress from foreign to familiar environment
- Create Positive Movement Experiences
- POWERFUL

Continue with strategic intervention while receiving structural intervention.

Always apply Joe's guiding principles

- Whole body health
- Whole body commitment
- Breath

Restoring the Healthy Spine

1. Establish clients unique limits and what exacerbates the symptoms
2. Establish what activities clients chooses to participate in if their back did not hurt.
3. Biomechanical Counseling
   - Disassociation/Stabilization- teaching how to move without perturbing the lesion, sit to stand, squats, transfers, lifting **(most programs end here)**

Restoring the Healthy Spine

4. Introduce movement with non destructive force.
   - Successful movement experiences without pain
   - NO PAIN
5. Restore Function
   - Graded load and training
   - Varied speed of movement
   - Endurance
   - Create hope of returning to participate
6. Set Internal Limits

Psycho-Social Factors

- Fear of movement (fear avoidance) Waddel 1993,
- Perceived ability (Self Efficacy) Bandura 1986, Lackner J. et al. 1996
- McGill: LBD's appear to be associated with both loading and psychosocial factors… which seem to be multifactorial

Change the Paradigm

Movement=Pain

to

Movement=Happiness

“Provide a Successful Movement Experience Without Pain”

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Impacting the World through Intelligent Movement

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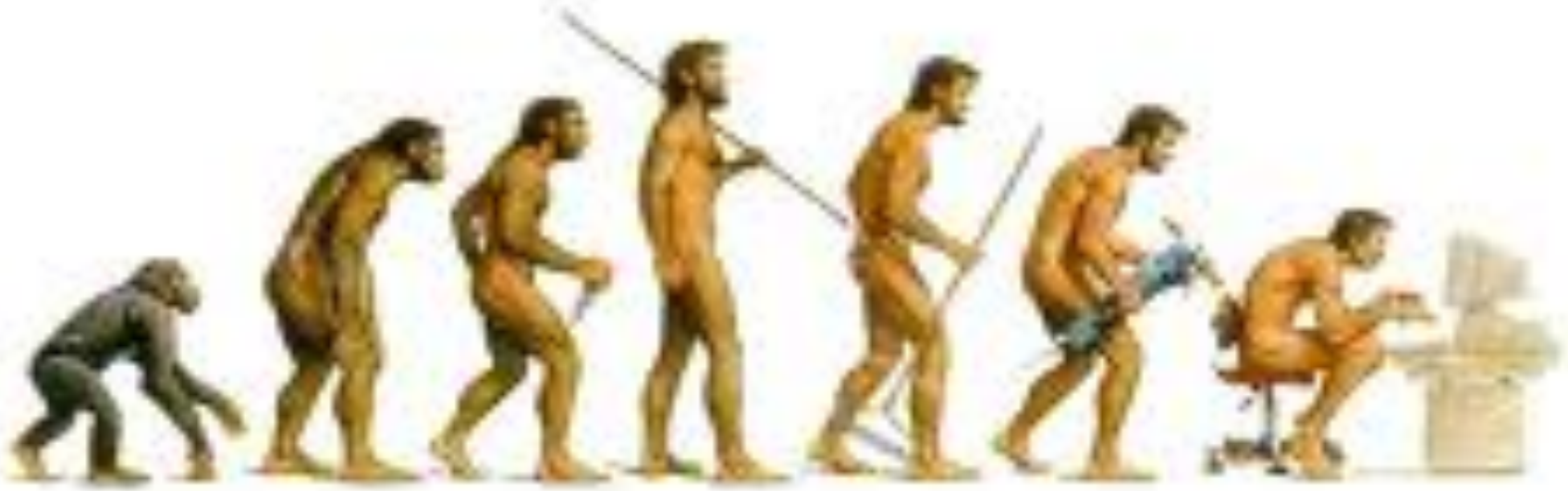
POLESTAR

Evolution



(or is it?)

Goals of movement for clients with spine pathologies

- .Segmental mobility
  - Respect the nature and biomechanics of the spine
  - Avoid end of ranges in all planes of motion
    - Fryette's law
    - Axial Elongation is the answer
  - Teach segmental control
    - Bone cueing (avoid muscle cueing)
    - Spatial cueing
    - Imagery
  - Realize that true change in tissues can take up to 6-12 months of regular practice
  - Always assume restriction is strategic first
  - If not, refer out for structural intervention