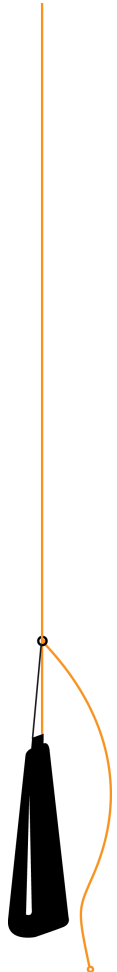




Sensorimotor - activity

The „local“ muscle system for prevention and performance development.

Erwin Reiterer



History

- Australian research group -
Hodges [1990]

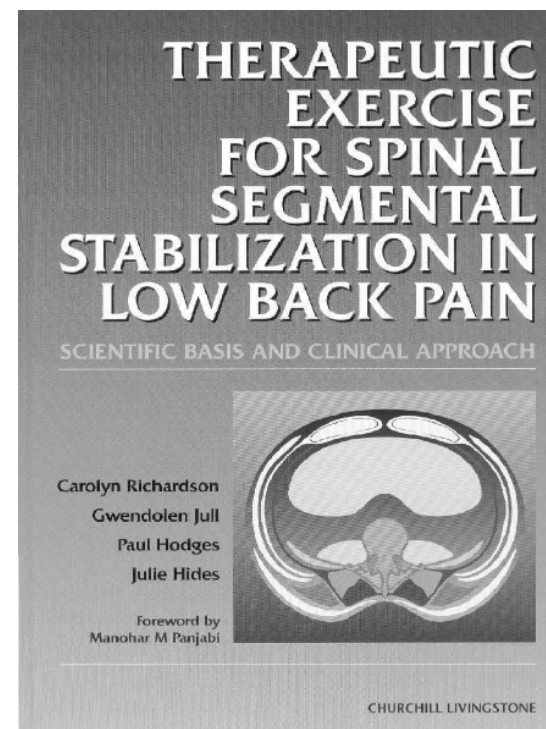
S-E-T concept

- Vidar Vindal, *Gitle Kirkesola*,
Silvia Kollos

[PT from Norway, Austria and Germany]



Hannspeter (Hape) Meier

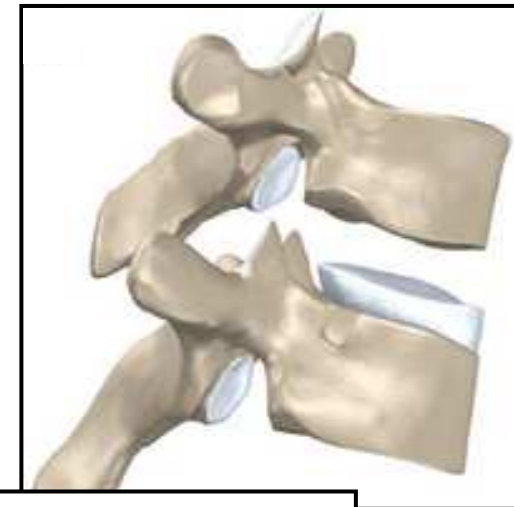


Anatomic basics

Muscle classification

- „global“ and
- „local“ stabilizers

..... to control segments and joints



segment system



Global muscles [lumbar area]

- back muscles [m. erector spinae]
- abdominal muscles [different parts]

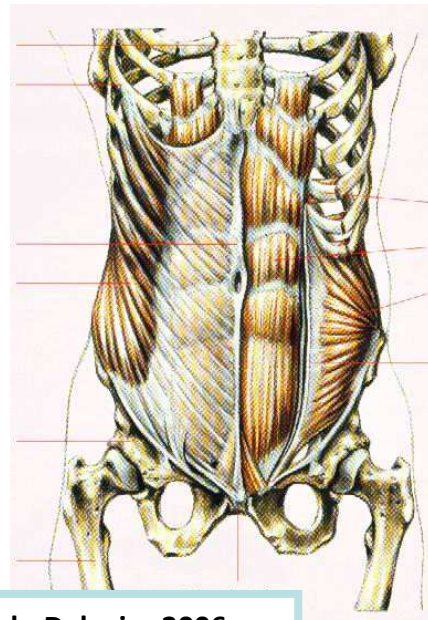


Abb. Delavier 2006

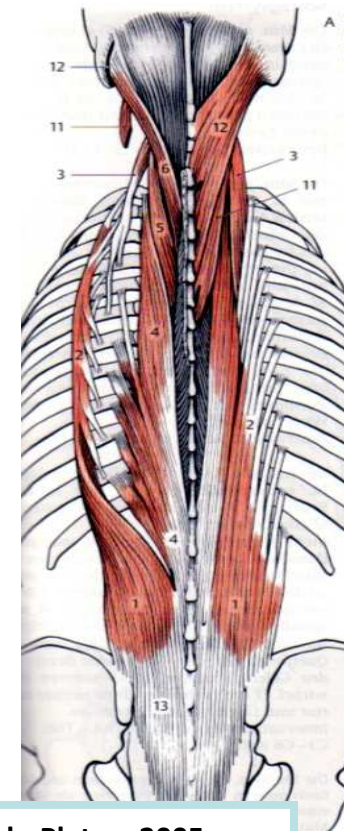
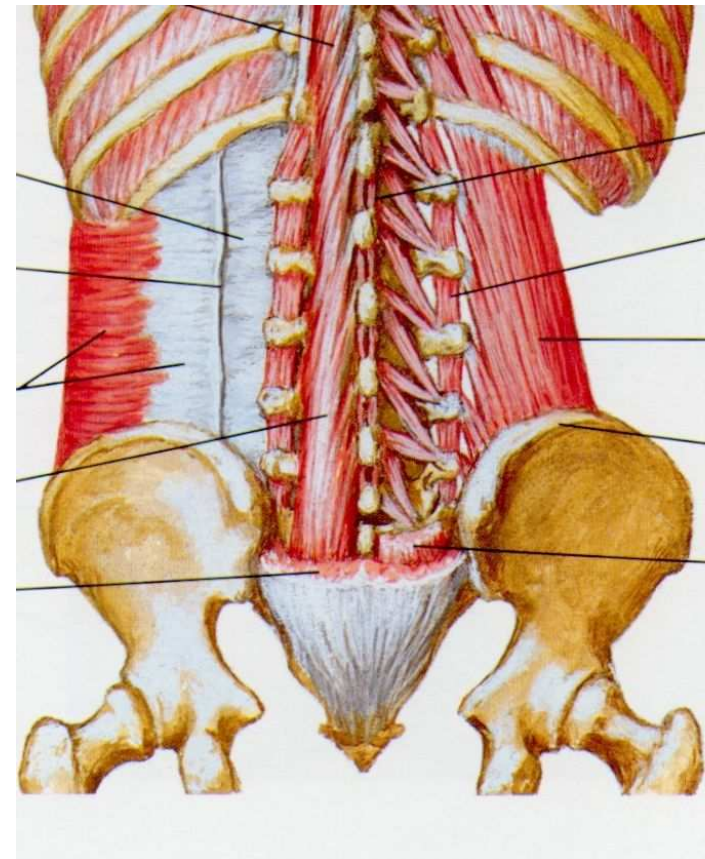


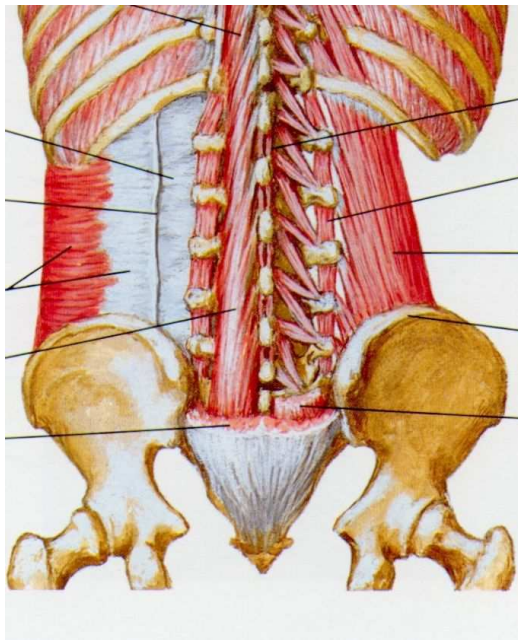
Abb. Platzer 2005

Local stabilizers [lumbar area]

- mm. multifidi
- mm. rotatores longi et brevi



Local stabilizers [lumbar area]



Properties and abilities

- tonic contraction
- optimal compression of joint surfaces
- „feed-forward“ →



Feed – forward – mechanism

Cresswell 1999, Hodges 1997 and 1999

“Transversus abdominis contracts in all quick movements of the trunk, upper extremities, and lower extremities, before the muscles producing the motion are activated.”



Feed – forward - mechanism

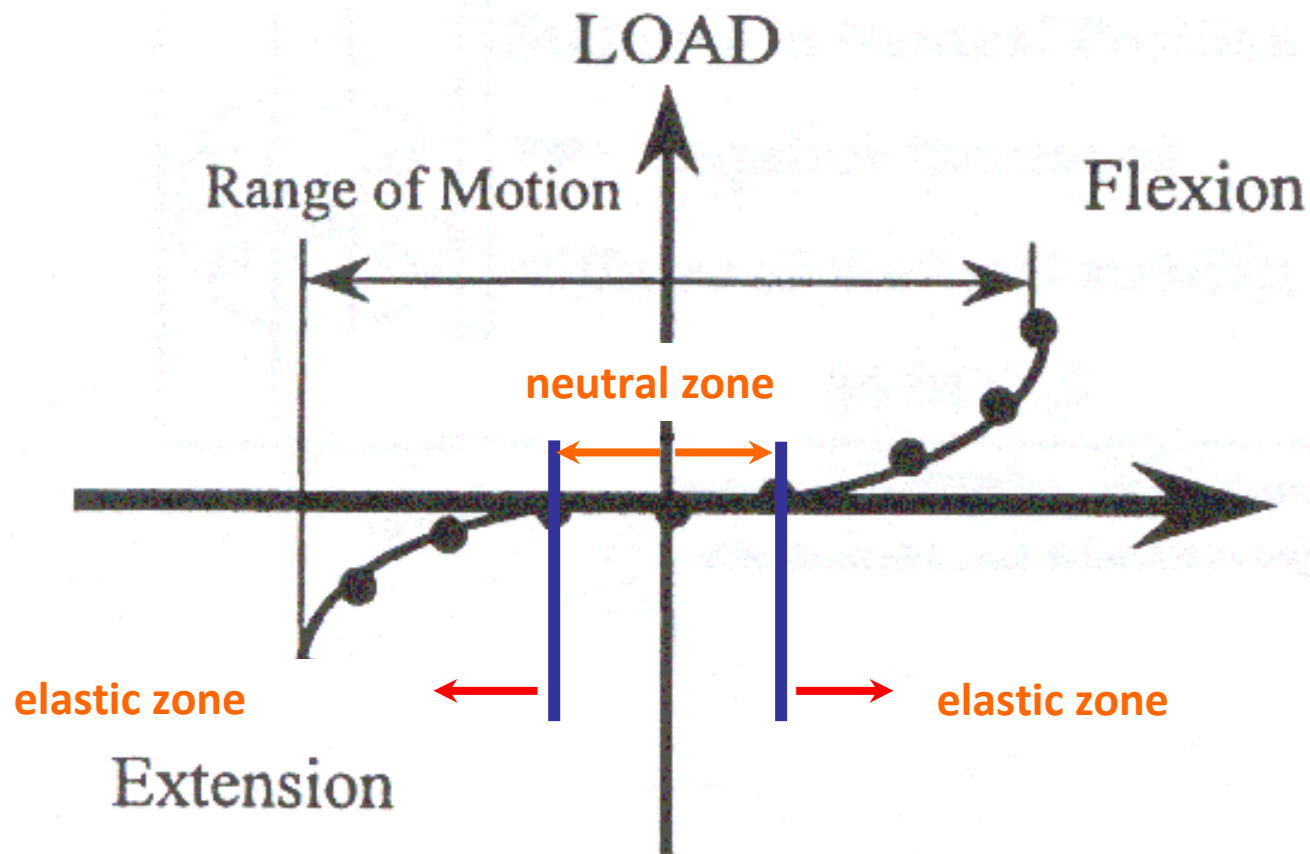
Moseley GL, Hodges PW, Gandevia SC :

“Deep and superficial fibers of the lumbar multifidus muscle are differently active during voluntary arm movements.”

Spine 2002;2:E29-E36



Model of stabilizing systems [lumbar area]



Panjabi 1992

For 75%, the m. multifidus is the most important muscle for stabilization of the segment L4 - 5, during movement in the “neutral zone!”

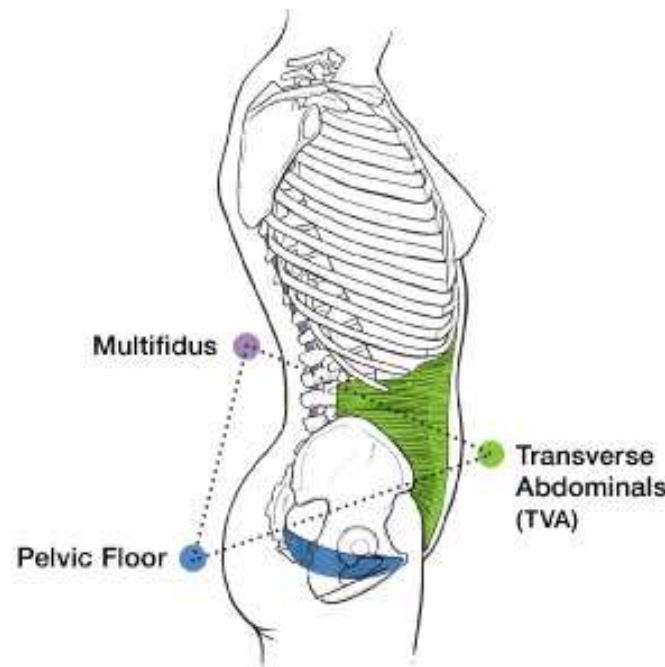
Wilke 1995



The collective of lumbar stabilization

Local stabilizers „first order“ [lumbar area]

- diaphragm
- m. transversus abdominis
- mm. multifidi
- pelvic floor



Local stabilizers „second order“

- m. quadratus lumborum [medial portions]
- m. psoas major [posterior portions]
- m. latissimus dorsi
- m. obliquus internus u. externus abdominis



Abb. Prometheus, Schünke u.a., 2005

Global muscles

- back muscles [m. erector spinae]
- abdominal muscles [m. rectus abdominis]

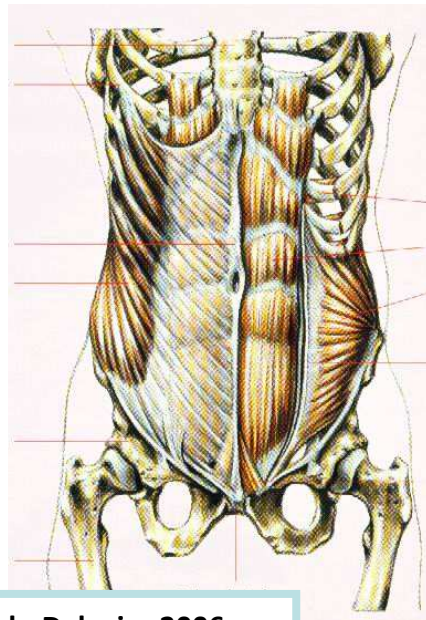


Abb. Delavier 2006

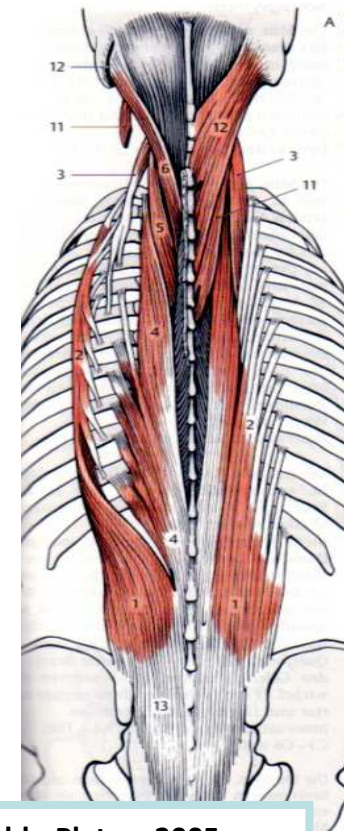
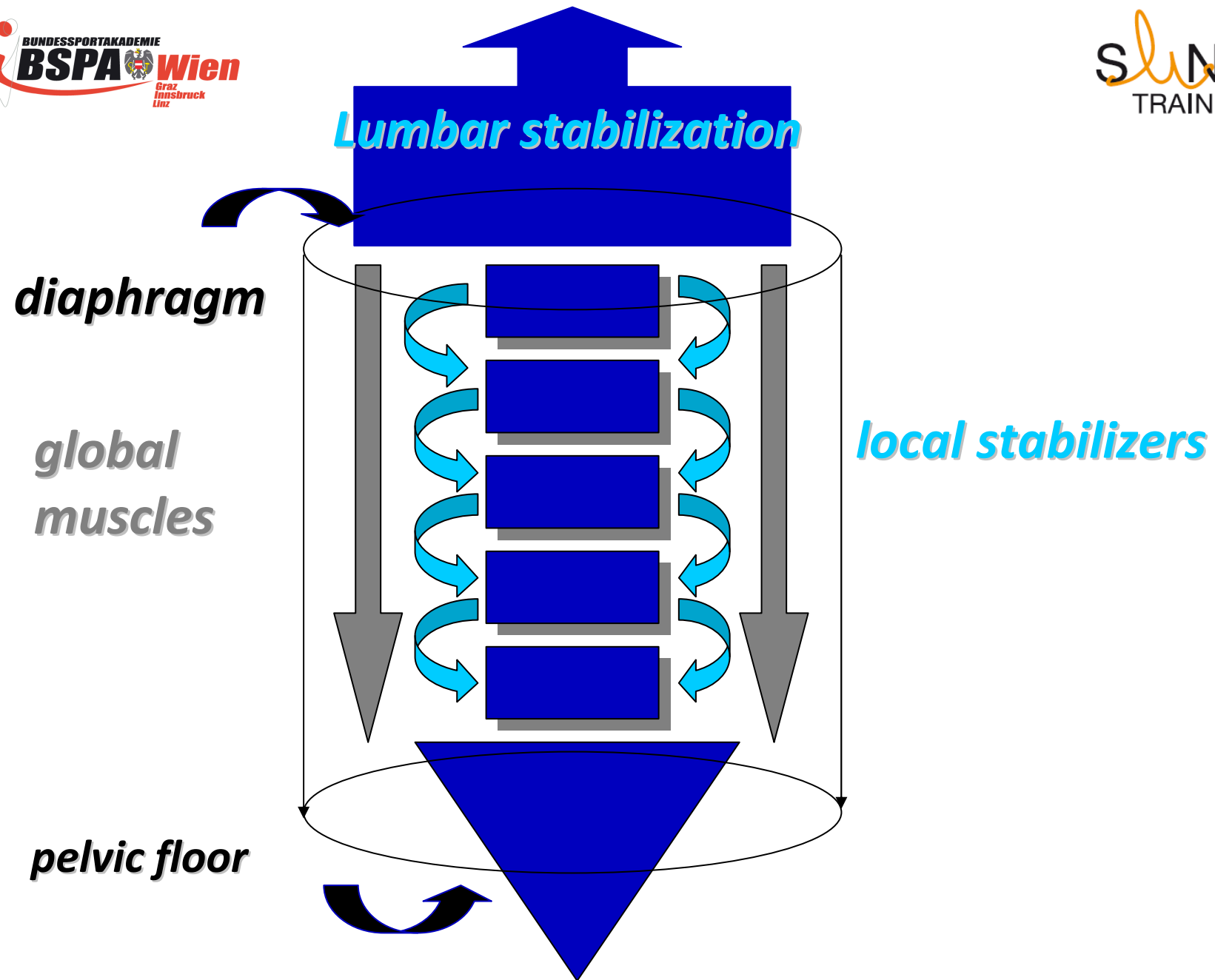


Abb. Platzer 2005



This stabilizing system depends on the performance of the sensorimotoric system!



Meissner's corpuscles



Merkel cell



Pacini's corpuscles



Ruffini's corpuscles

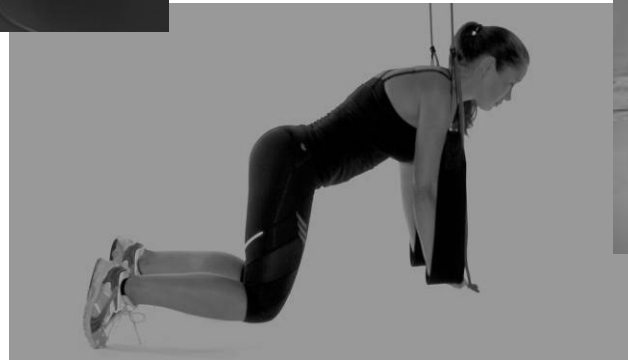
Sensors

- 1] muscles
- 2] tendons
- 3] joints
- 4] sensors for movement and acceleration
- 5] sensors for pain and injuries
- 6] sensors of the skin

Sensorimotoric training



Abb. Hape Meier 2007



Labile und **unstable** training devices



Unstable training devices

- high sensorimotoric activity based on
- fast, aggressive und unstable stimuli



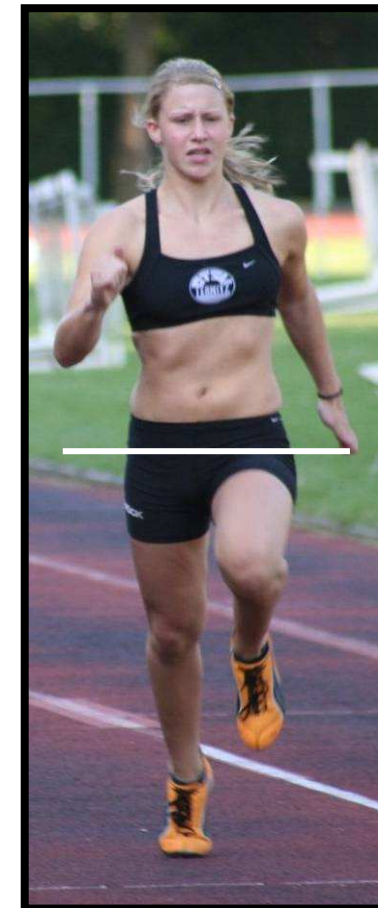
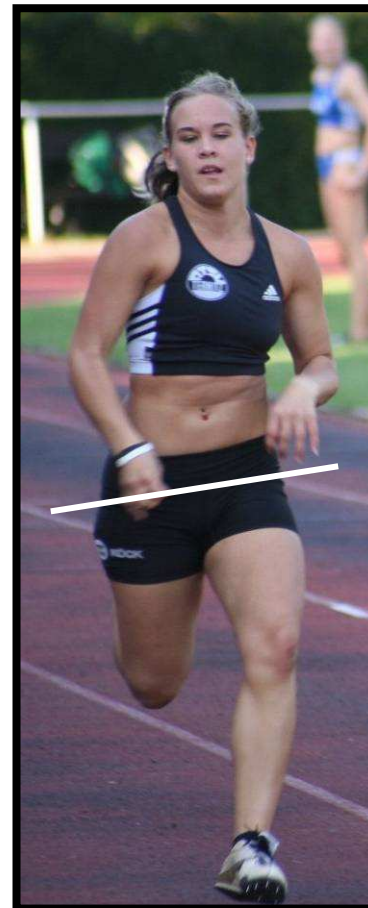
Unstable training devices



Sensorimotoric training

Injury prevention and performance development:

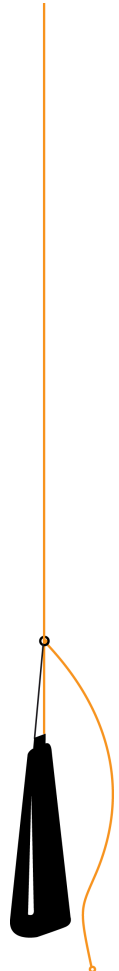
- Hypertrophy and synchronous activity of the local stabilizers
- coordinated interaction



Chronic injuries or pain in the locomotor system means



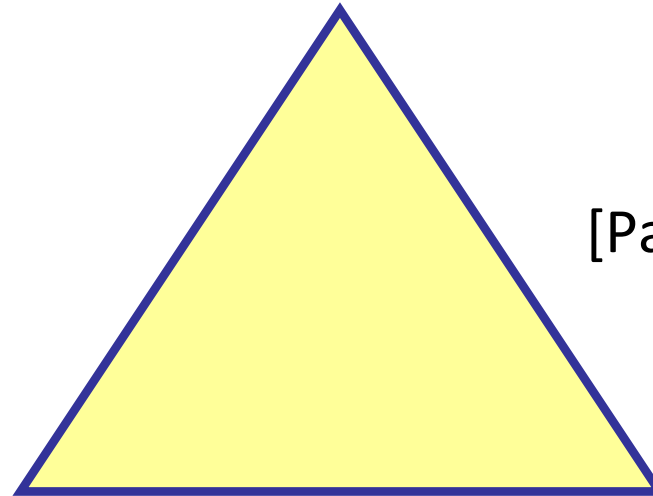
- reduced information from the sensori-motoric system and
 - reduced local stabilization
-
- reduced strength
 - shear forces



Functional instability

[motor control deficit]

passive control
system



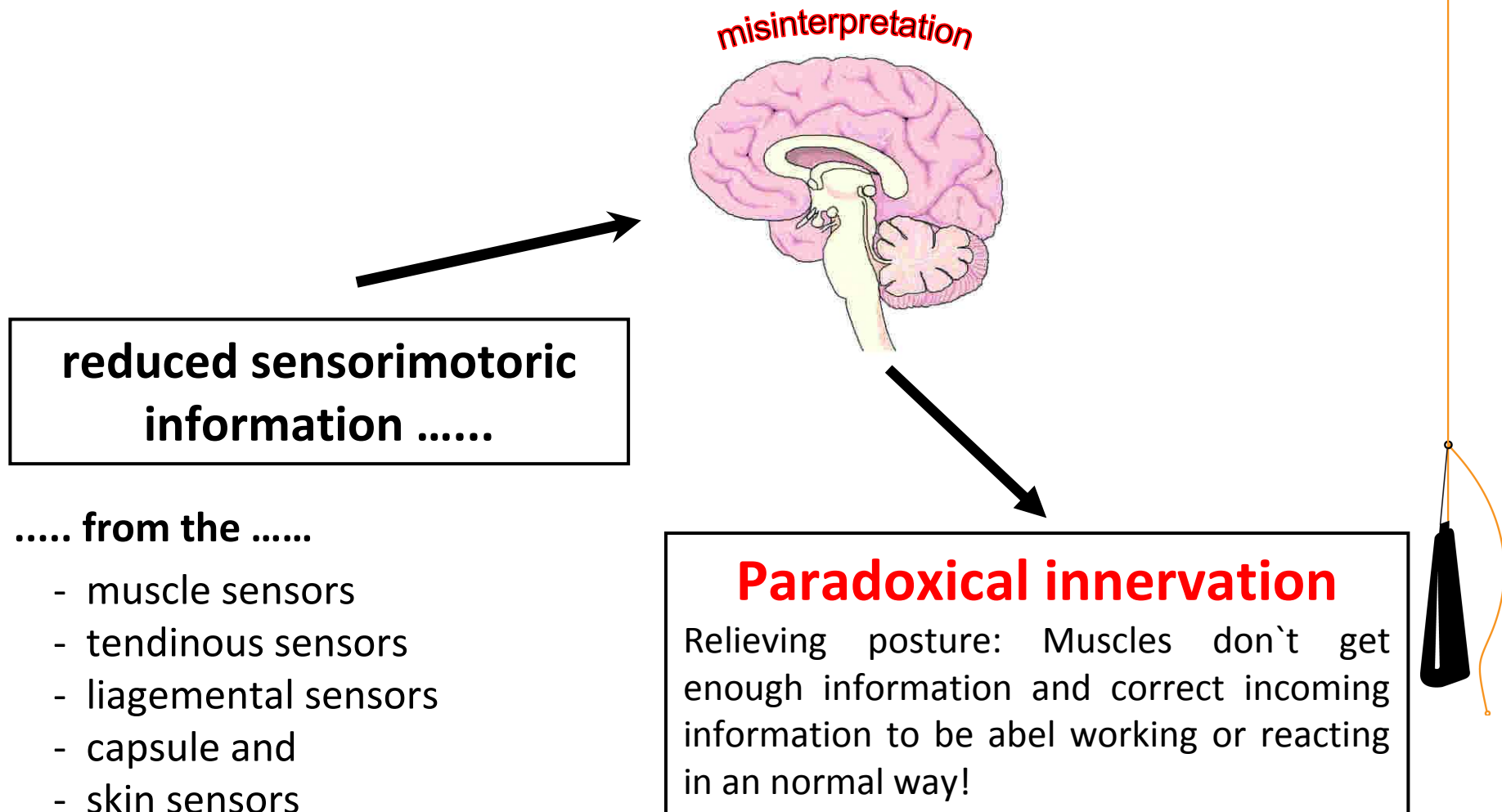
[Panjabi 1991]

active control
system

nervous control
system



Emergency programm/ paradoxic innervation



Emergency programm/ paradoxic innervation

The „global“ muscle system

- mainly takes the stabilizing control
- tries to limit painful movement
- **hypertension**
- coordinated interaction is disordered
- structural muscle shortening



Summary

Without sensorimotoric activity no motoric!

Pain reduces the flow of information from the sensors

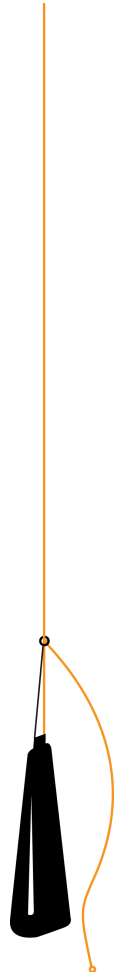
„Feed – forward“ mechanism does not work at peak level!

..... paradoxical innervation/relieving posture



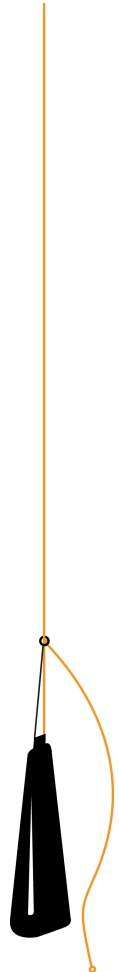
Methodological approach

- Chiropractic manipulation?
- Back- and abdominal muscle training?



Methodological approach

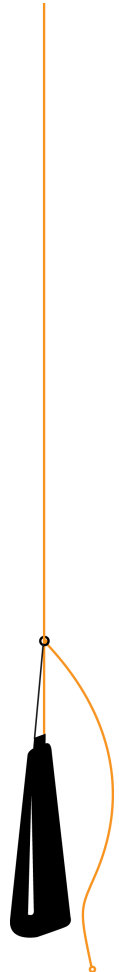
„Reactivation of neuromuscular response!“



Methodological approach

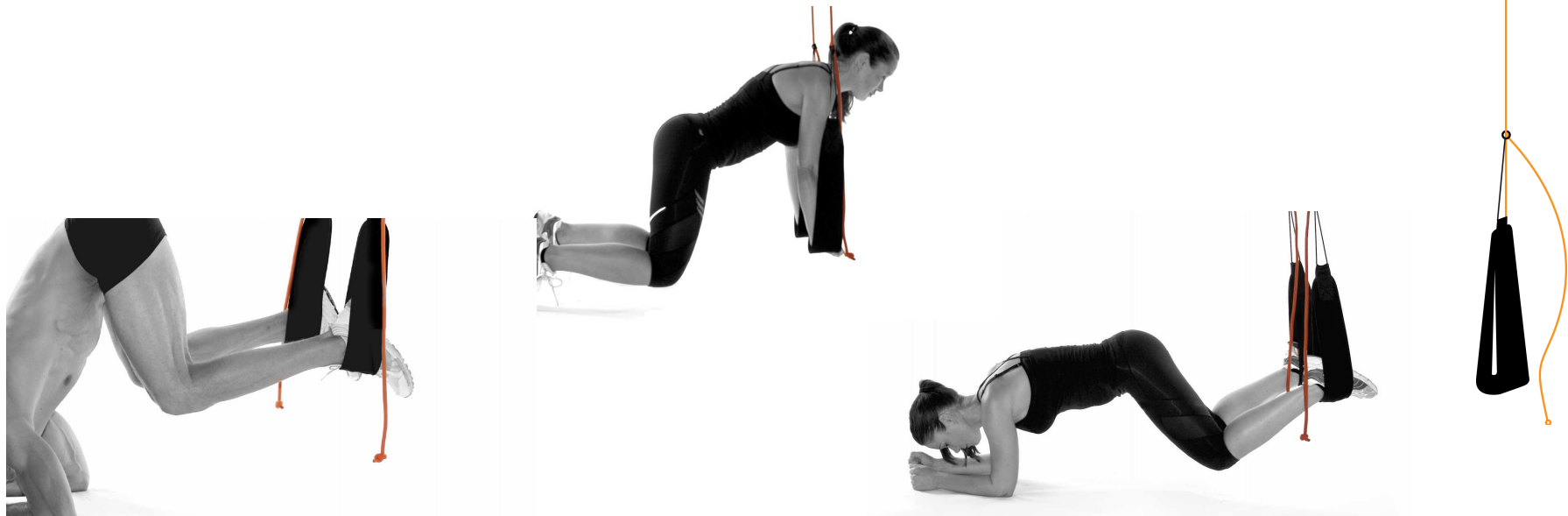
The REHAPE[®] concept

- reduce pain
- reduce tension
- Increase metabolism in the global muscle system
- sensorimotoric training



REHAPE® Sling Trainer

- I. First, activate the „local“ stabilizers.
- II. Second, the „global“ muscle system.



Remember: methodological approach

- high sensorimotoric activity based on
- fast, aggressive und unstable stimuli with and on unstable training devices and ...
- pain free
- open and closed kinetic chains



Open and closed kinetic chains

Closed kinetic chain:

The distal end of the body segment is fixed, the proximal segment of the body moves.

For example: push up, squats

Open kinetic chain:

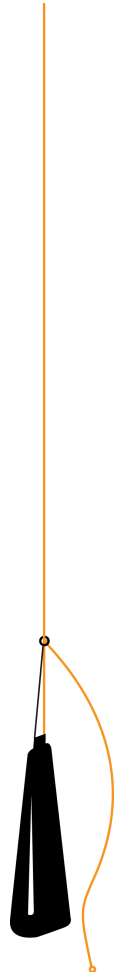
The proximal part of the body is fixed and the distal end of the body segment moves.

For example: bench press, leg extension



Sensorimotoric training after injuries [pain]:

- „Reactivation of neuromuscular response!“
- Hypertrophy and
synchronous activity of the local stabilizers
- coordinated interaction





SLINGTRAINING

Speaking about the shoulder

Erwin Reiterer



Anatomic basis

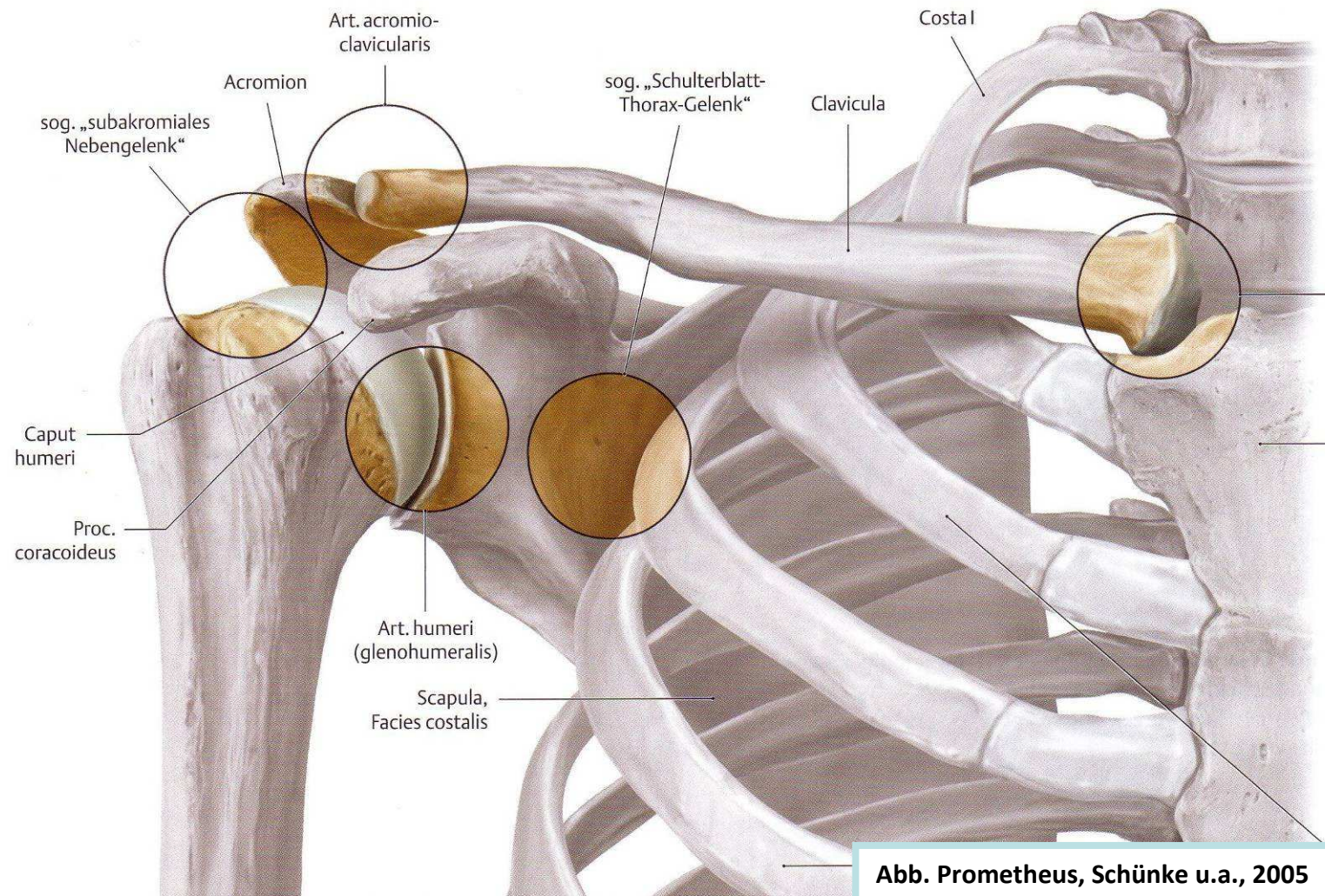


Abb. Prometheus, Schünke u.a., 2005

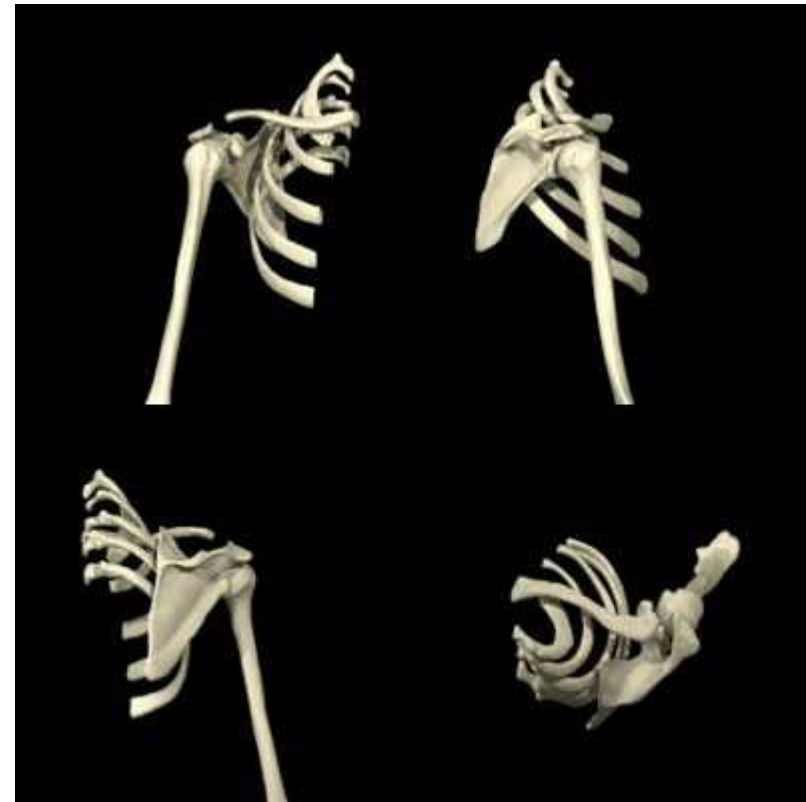
Anatomic basis

- art. glenohumerale
- art. subacromiale
- art. acromioclaviculare
- art. sternoclaviculare
- art. scapulothoracale



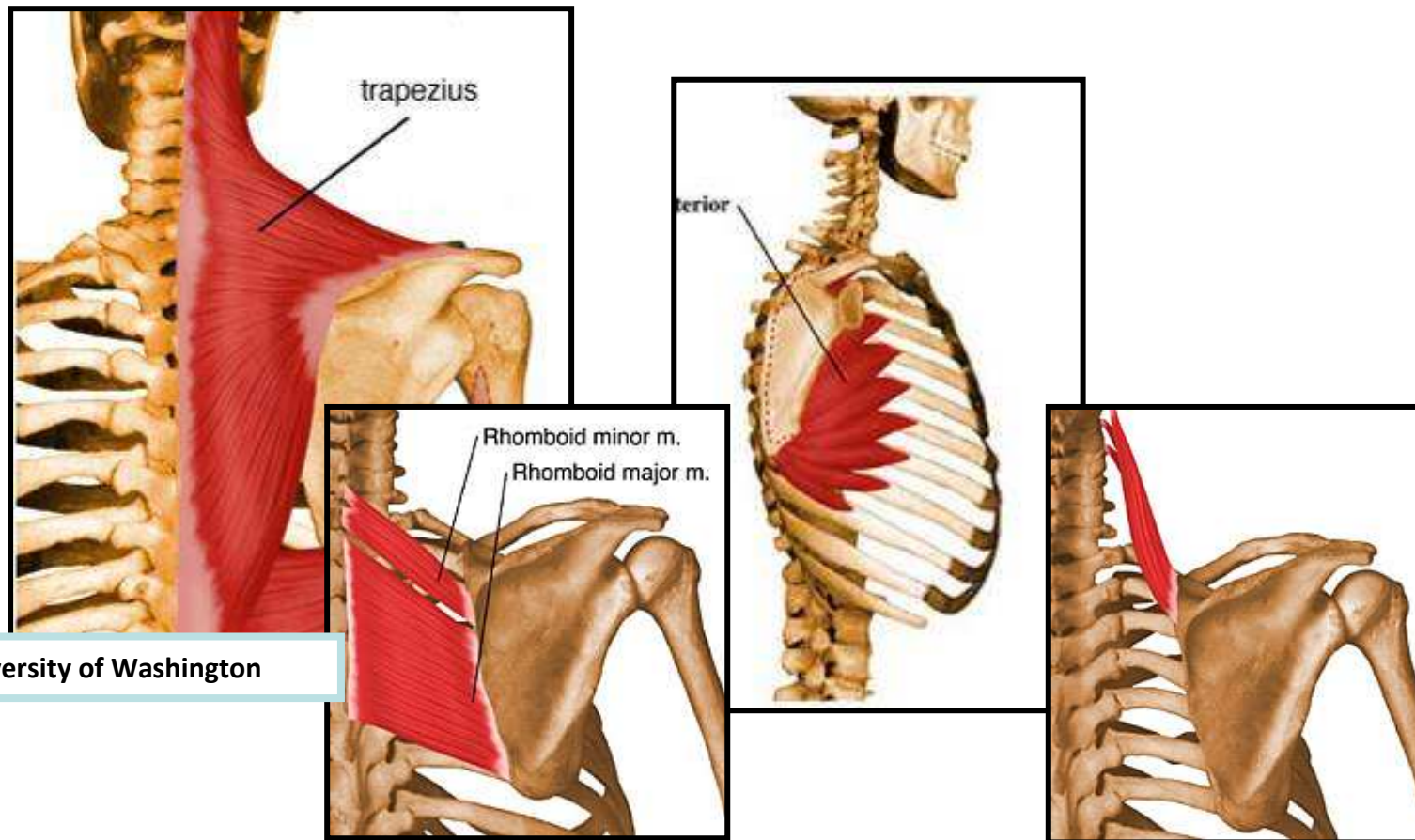
Anatomic basis

Scapula – thoracal – rhythm



Anatomic basis

Scapula thoracal – rhythm



University of Washington

Anatomic basis

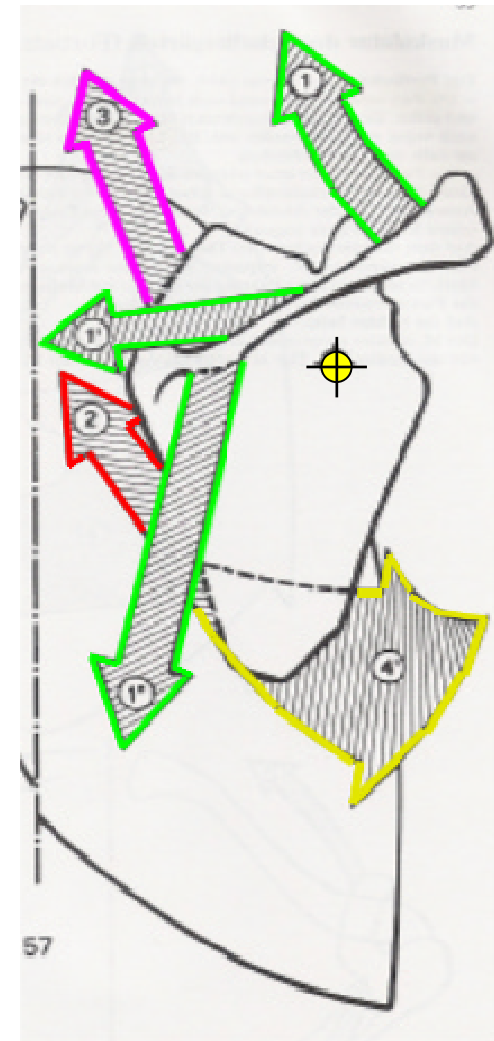
Scapula thoracal – rhythm

- m. trapezius
 - pars descendens
 - pars transversa
 - pars ascendens
- mm. rhomboidei
- m. levator scapulae
- m. serratus anterior

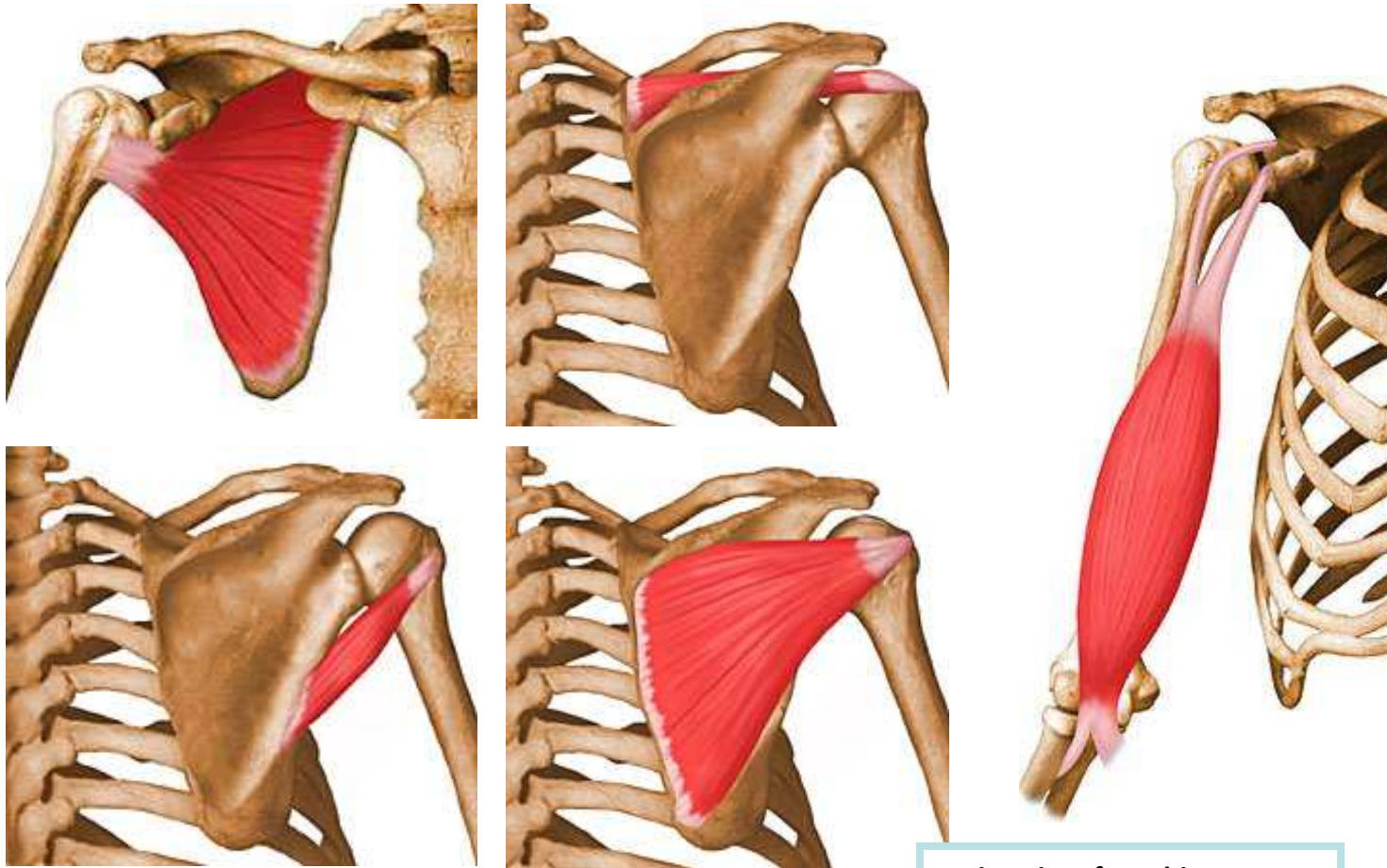


Coordinated interaction in the moment of scapula – thoracal moves

- concentric and
- excentric activity



Local stabilizers: rotator cuff



University of Washington



Scapula/arm moves and the stabilization depends on the performance of the sensorimotoric system!



Meissner's corpuscles



Merkel cell



Pacini's corpuscles



Ruffini's corpuscles

Sensors

- 1] muscles
- 2] tendons
- 3] joints
- 4] sensors for movement and acceleration
- 5] sensors for pain and injuries
- 6] sensors of the skin

Methodological approach for stabilizing the shoulder

- I. „Feed-forward“
- II. „centering“
- III. „control distance“



Abb. Prometheus, Schünke u.a., 2005



I goal: „Feed-forward“

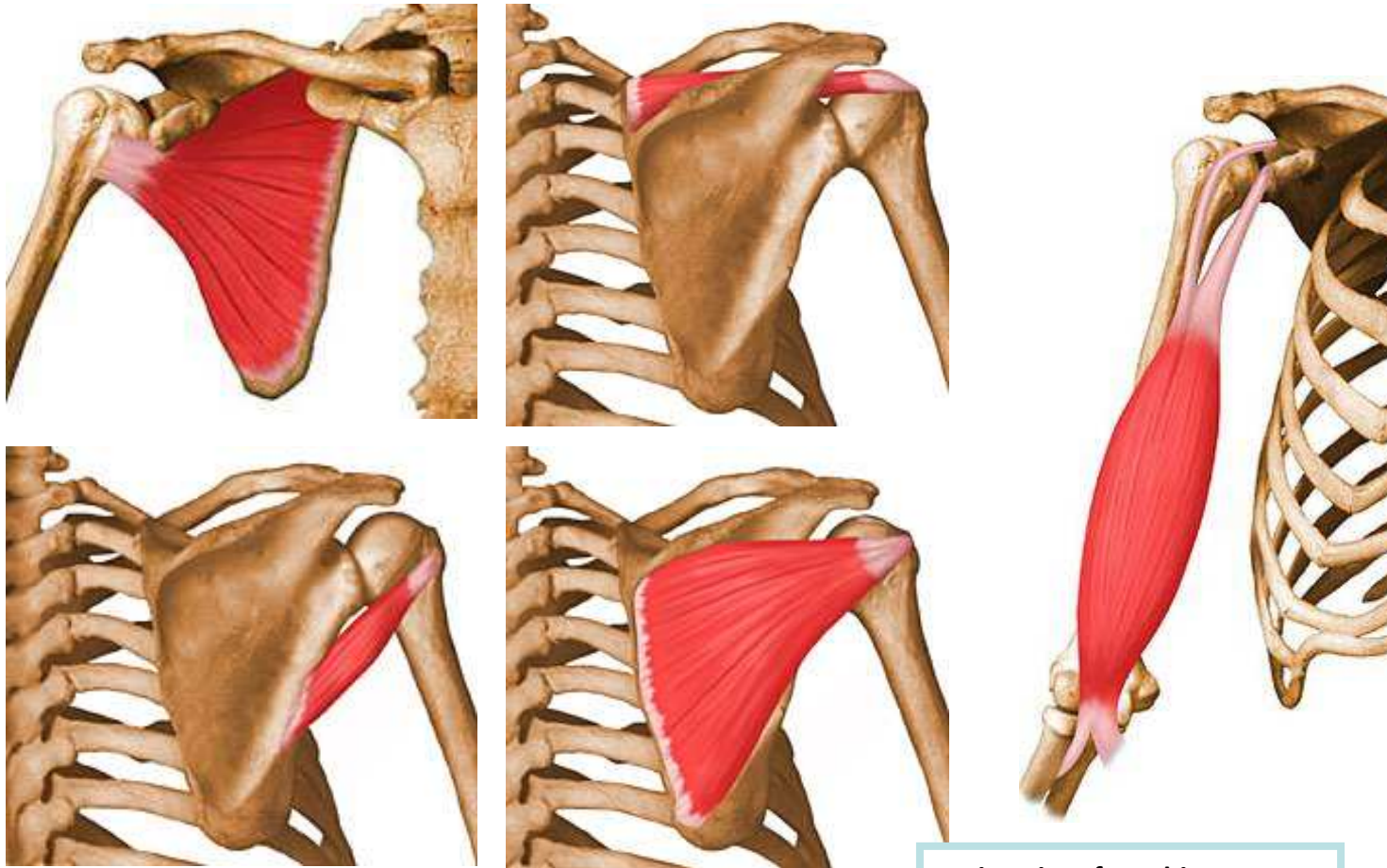
The “feed-forward-activity” depends on the performance of the sensorimotoric system!



Training with and on unstable devices!



II goal: „centering“ [rotator cuff]



University of Washington



III goal: „distance holder“

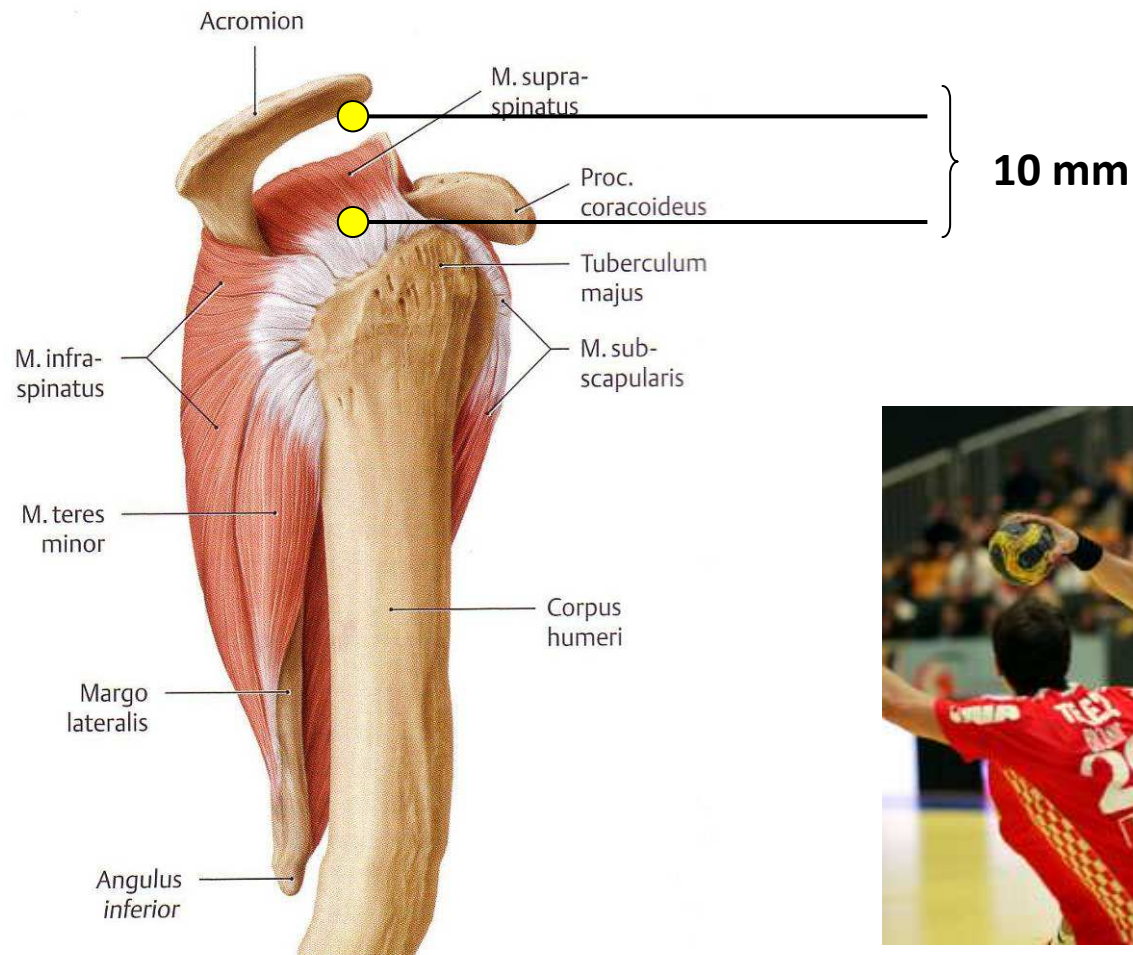
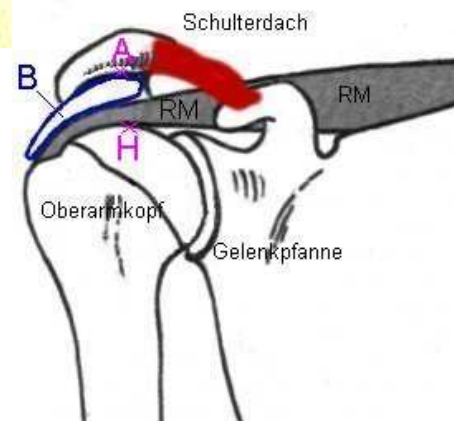
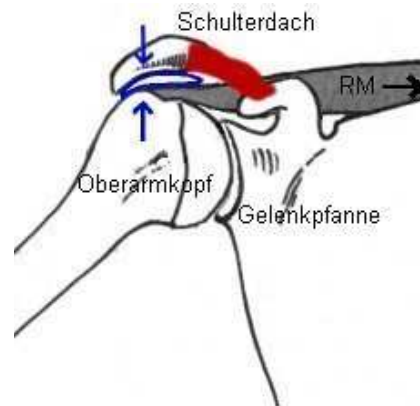
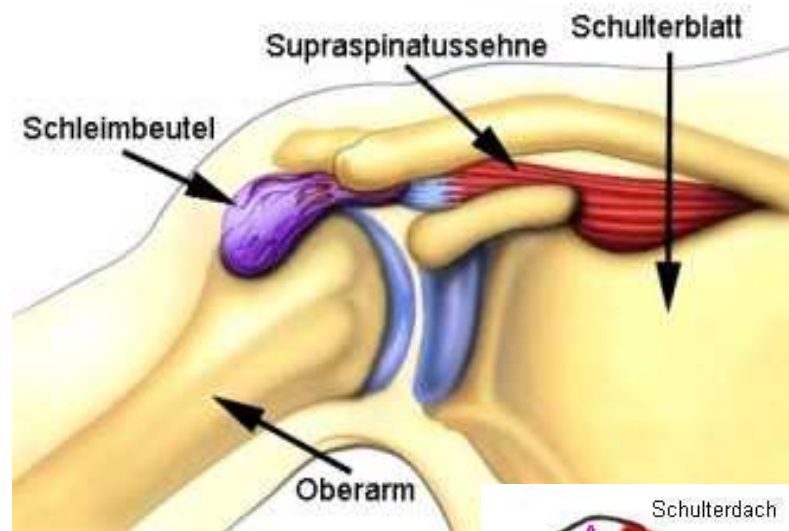


Abb. Prometheus, Schünke u.a., 2005



Impingement - injurie



Chronic injuries or pain in the locomotor system means

- „Feed – forward“ mechanism does not work at peak level! 



Functional instability

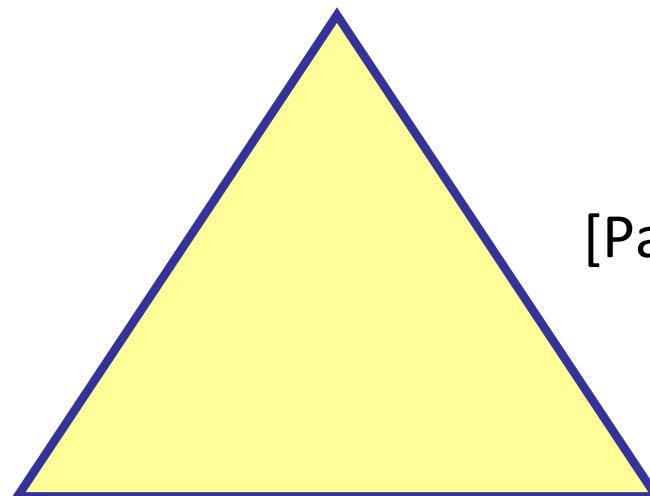
[motor control deficit]

passive control
system

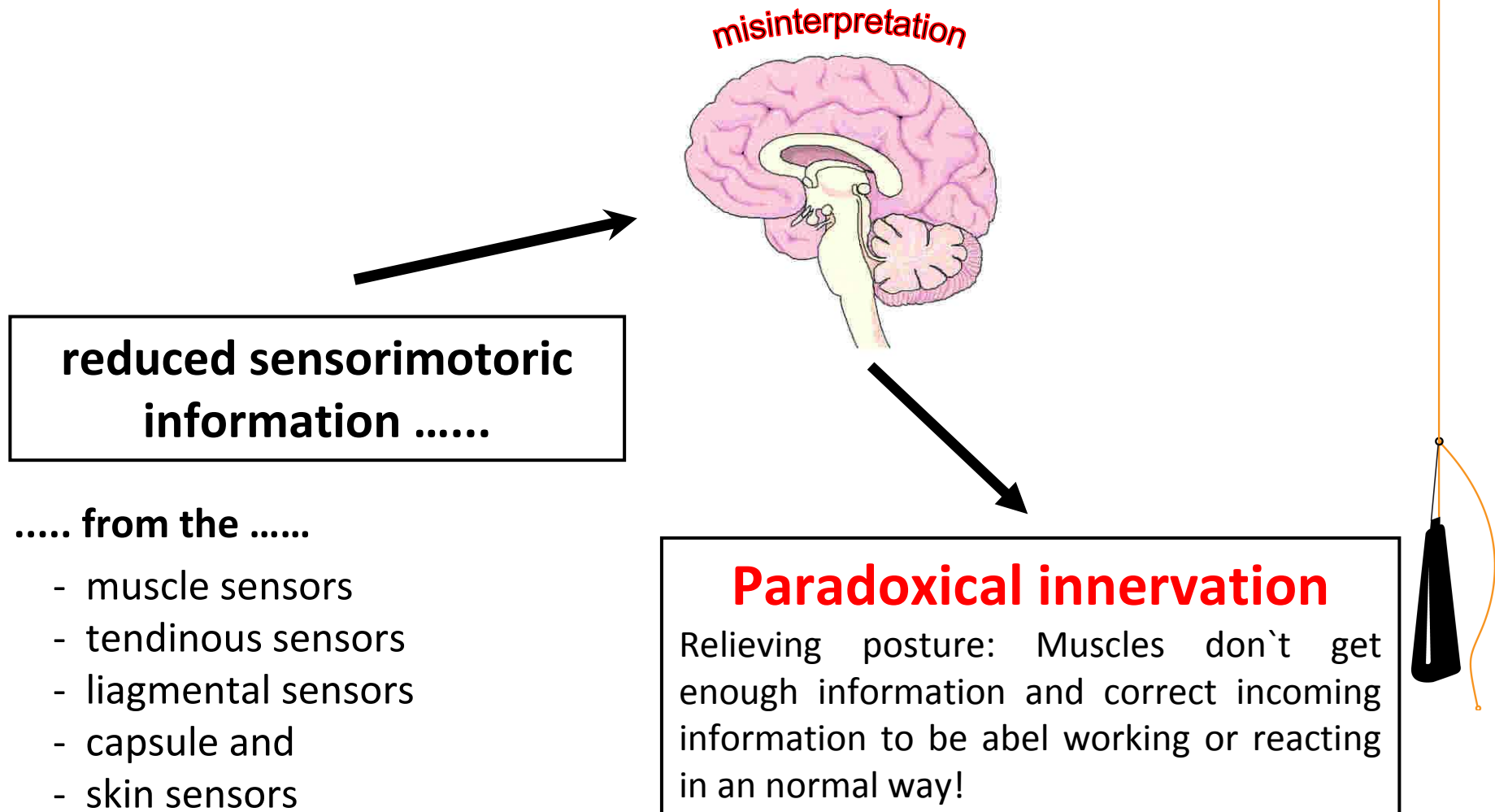
[Panjabi 1991]

active control
system

nervous control
system

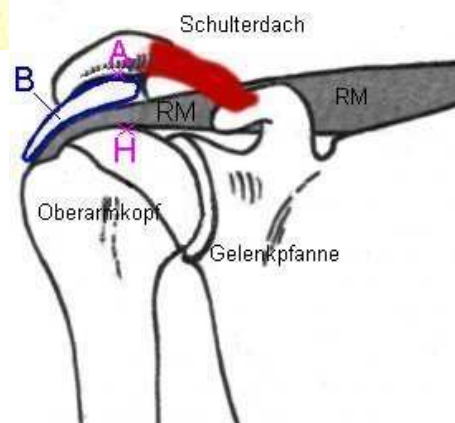
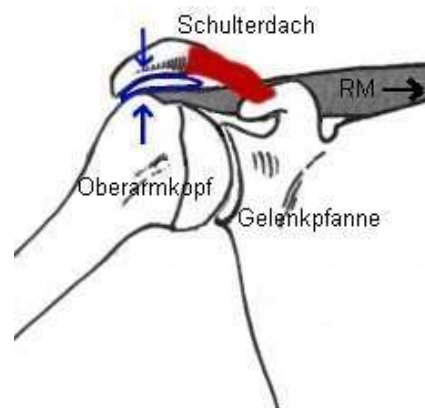
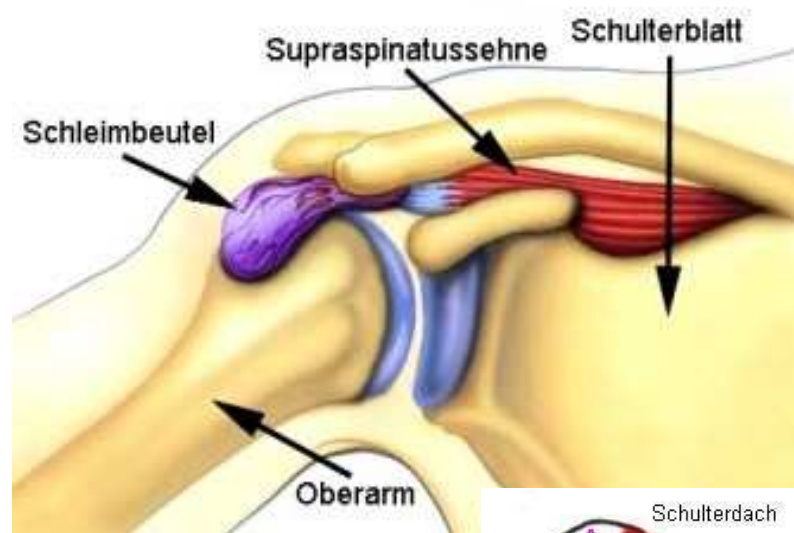


Emergency programm/ paradoxic Innervation



Scapula thoracal

[relieving posture] → Impingement - injury



Chronic injuries or pain in the locomotor system means

- scapula – thoracal muscles don't work together
- structural muscle shortening



University of Washington

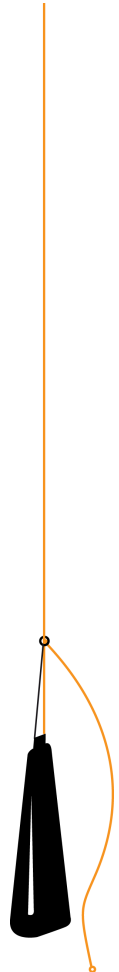
m. levator scapula



m. pectoralis minor

Chronic injuries or pain in the locomotor system means

- „Feed – forward“ mechanism does not work at peak level!
- scapula – thoracal muscles don't work together
- structural muscle shortening
- decentration – caput humerus



Gleno humeral

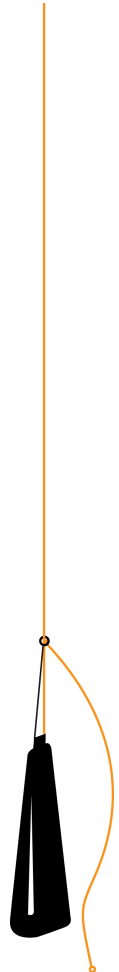
- **Ventral position** of the caput humerus
- **Shear forces**



Methodological approach

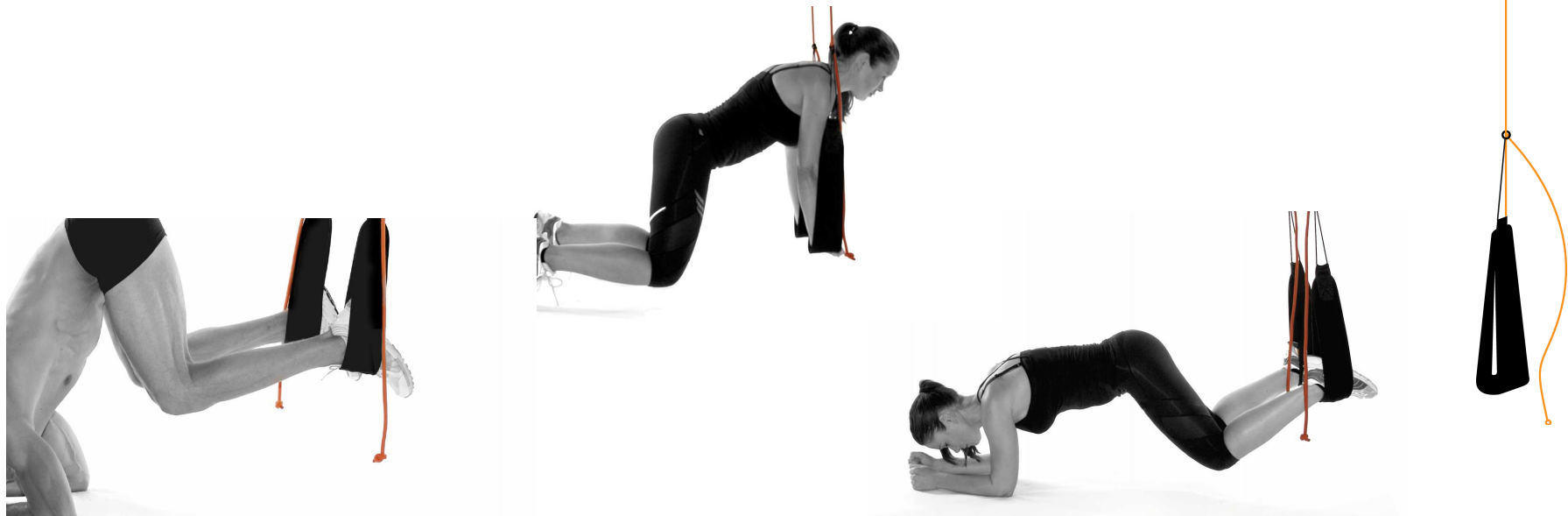
The REHAPE[®] concept

- reduce pain
- reduce tension
- increase metabolism in the global muscle system
- sensorimotoric training



REHAPE® Sling Trainer

- I. First, activate the „local“ stabilizers.
- II. Second, the „global“ muscle system.



Remember: methodological approach

- fast, aggressive und unstable stimuli with and on unstable training devices and ...
- pain free
- closed kinetic chains
- **muscles of the thoracic spine**



scapula – thoracic – muscles



gleno – humeral – muscles

