

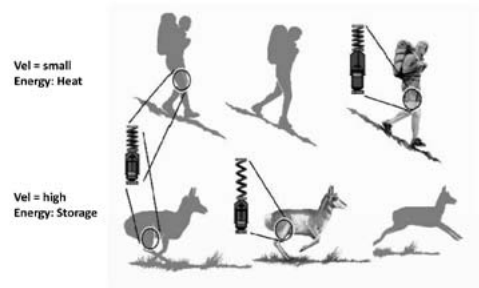
学術講演会報告

# Nerve Muscle Tendon -Physiological Unit for a Functional Training?

Albert Gollhofer<sup>1)</sup>



## □ Nerve-Muscle-Tendon



From: Lindstedt et al. 2001

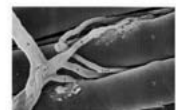
## Nerve - Muscle - Tendon: Physiological Unit for a functional training

Albert Gollhofer, Uni Freiburg



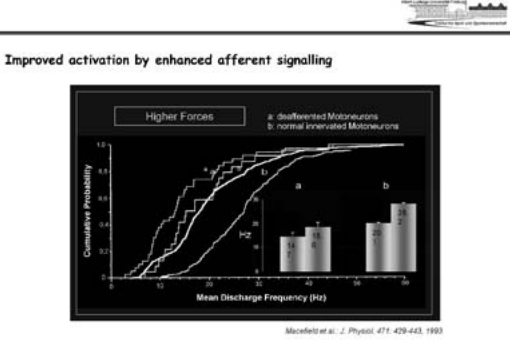
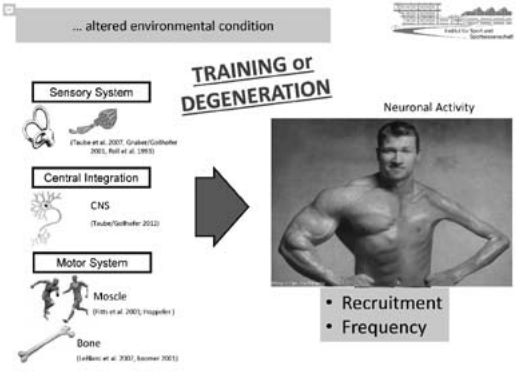
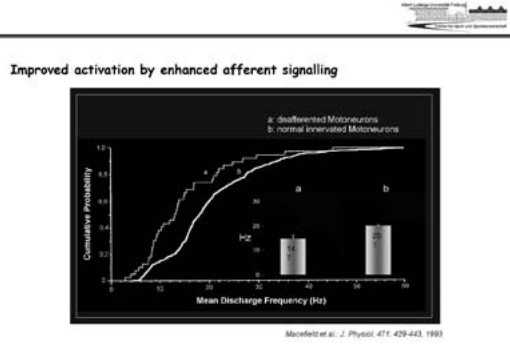
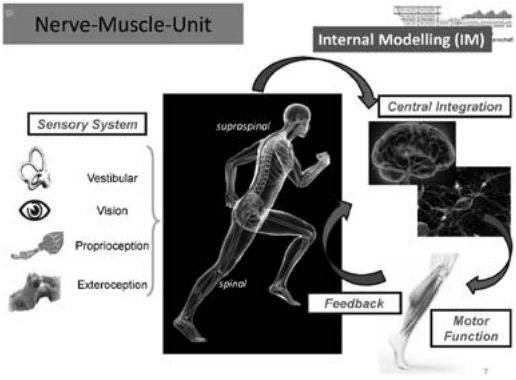
### Content:

- Nerve - Muscle Interaction
  - Physiology
  - Training: Adaptational Aspects
- Muscle - Tendon Interaction
  - Physiology
  - Training: Adaptational Aspects
- Conclusion



<sup>1)</sup> University of Freiburg

# Nerve Muscle Tendon -Physiological Unit for a Functional Training?



## Nerve – Muscle:

### Enhancement of neural drive to the muscle?

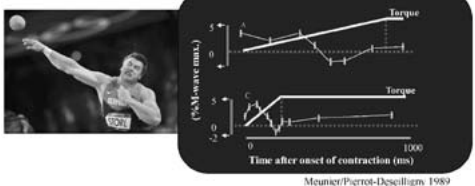
1. Enhancement of spinal afferent contributions
2. Reductions of antagonist activation (reciprocal inhibition)
3. Enhancement of supraspinal activation



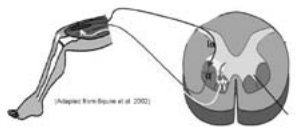
### Importance for Power

#### Rate of Force Development

#### Supplementary facilitation during contraction (%Mmax)

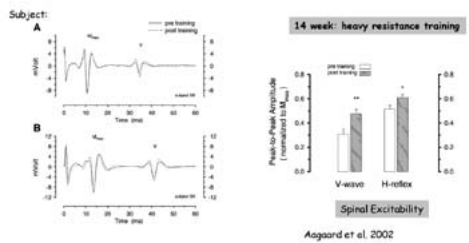


### 1. Question: How can spinal mechanisms contribute to an enhanced neural drive?



**Purpose:**  
Improved activation by enhanced afferent activation

### Spinal excitability after Strength Training



**In Summary:**  
Spinal excitability after Strength Training

**Assumed Mechanism:**  
- Reduced Presynaptic Inhibition of Ia-afferents

Lagerquist et al. 2006  
Aagaard et al. 2002  
Gollhofer et al. 2003

**Acute Effects:**

- HL - High-Load
- LL - Low-Load
- BFR-C - Bloodflow restriction contin.
- BFR-I - Bloodflow restriction intermitt.

**Elbow flexion exercises:**

Week	1RM (%)	Load (kg)	Time (min)	Rest (min)	Repetition reserve (%)	Intensity	Volume
HL	70	17.5 ± 1.2	4:00	1:00	100	100	100
LL	30	7.0 ± 1.0	4:00	1:00	100	100	100
BFR-C	30	7.0 ± 1.0	4:00	1:00	100	100	100
BFR-I	30	7.0 ± 1.0	4:00	1:00	100	100	100

**FIGURE 1** MEP amplitude relative to Mmax following resistance training... (Caption text continues with statistical details)

Brandner et al. 2015

**2. Question: Suppression of neural drive to antagonistic muscles**

Increased central facilitation of antagonist reciprocal inhibition at the onset of denatification following explosive strength training

David S. Keating, Brian Lamberton-Davis, and Dan S. Nolte

**Explosive type of strength training of Tibialis inhibits the Soleus**

**Avoid activation of antagonistic muscle**

**Nerve – Muscle:**

**Enhancement of neural drive to the muscle?**

1. Enhancement of spinal afferent contributions
2. Reductions of antagonist activation (reciprocal inhibition)
3. Enhancement of supraspinal activation

**In Summary:**  
Reduced neural drive to antagonistic muscles: DRI

**Mechanism:**  
Changes in Presynaptic Inhibition (PSI)

Journal of Neuroscience Methods 2008

**Muscle-Tendon Unit**

Composition:  
Evolution  
Functional importance

Bramble & Lieberman 2004

**3. Question: Enhanced supraspinal drive to the muscles**

**Purpose:**  
Determine cortico-spinal excitability before and after strength training

**MEP - Motor evoked Potential**

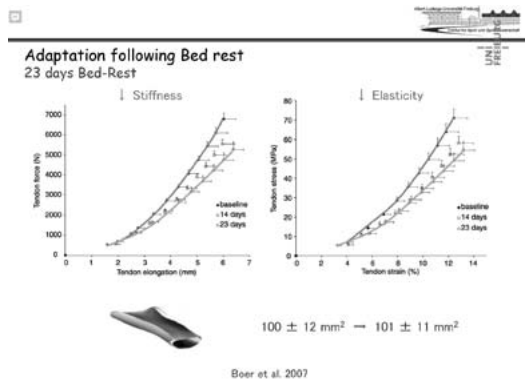
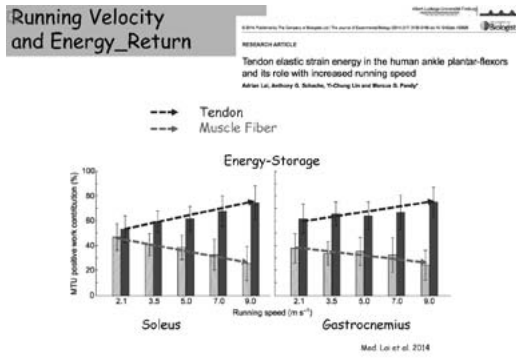
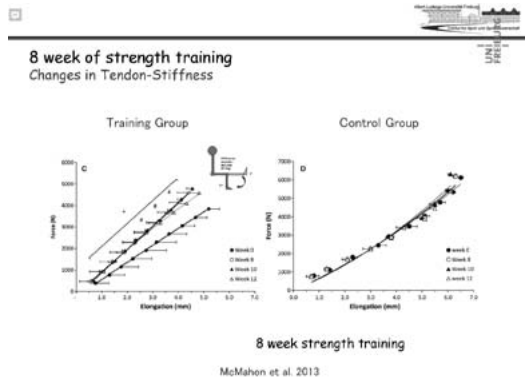
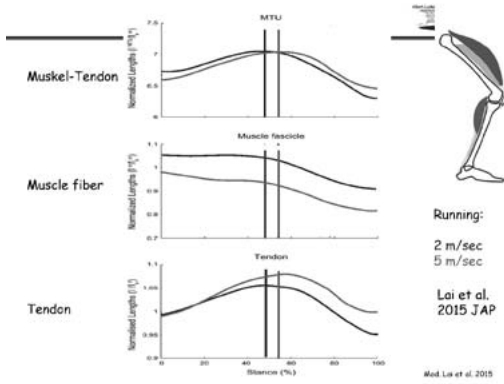
**RESEARCH ARTICLE**  
Differences in gibbon locomotion: springs or strings?

Prosser<sup>1</sup>\* and Anthony J. Channon<sup>1</sup>

<sup>1</sup> Vrije Universiteit Brussel, 1050 Brussels, Belgium and <sup>2</sup> Institute for Agricultural and Fisheries Research, 2300 Wye, Kent, UK

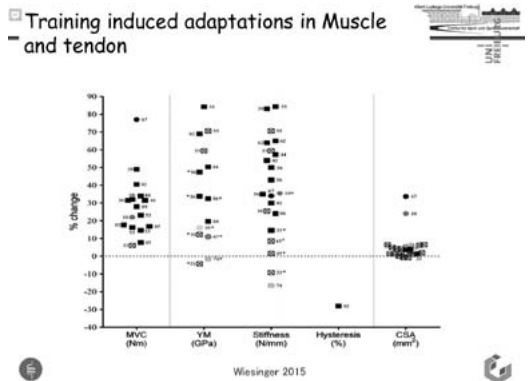
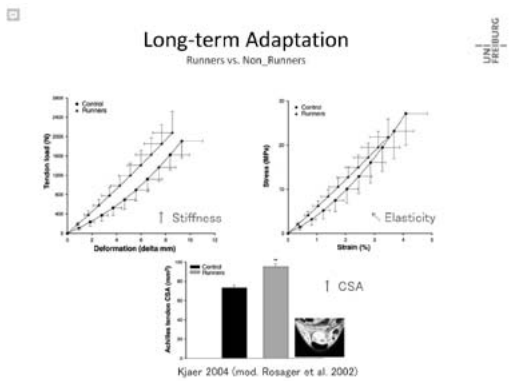
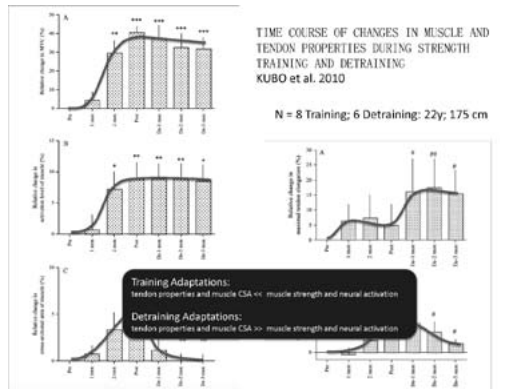
MTUL, TL, ETL, Triceps surae, MTUL, ETL, Quadriceps femoris

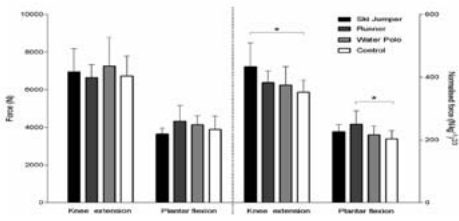




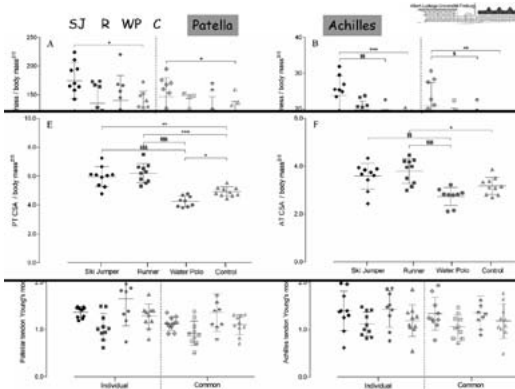
**Application in Sports**

What can be trained ??  
How is it trained ??

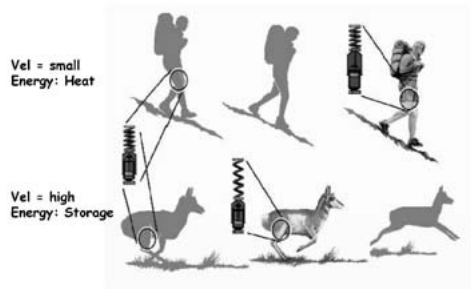




Wiesinger et al. 2016



**Nerve-Muscle-Tendon**



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