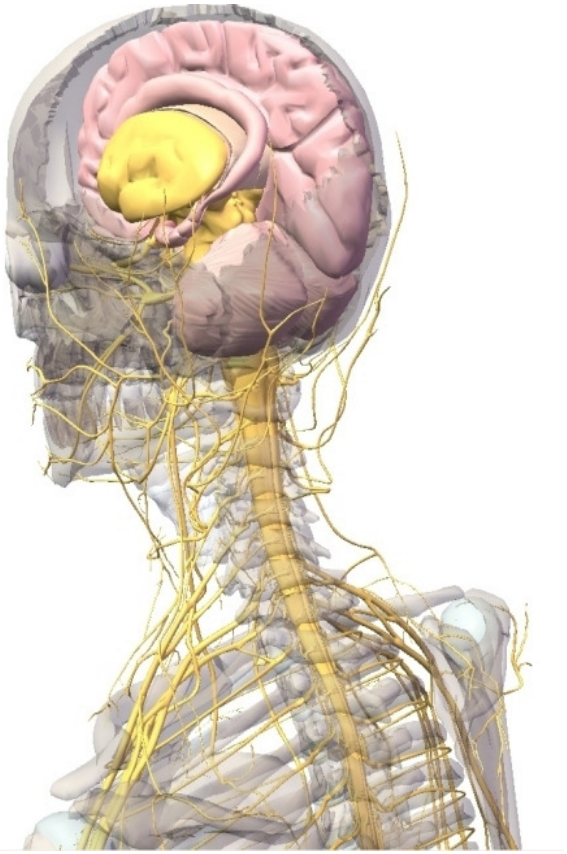
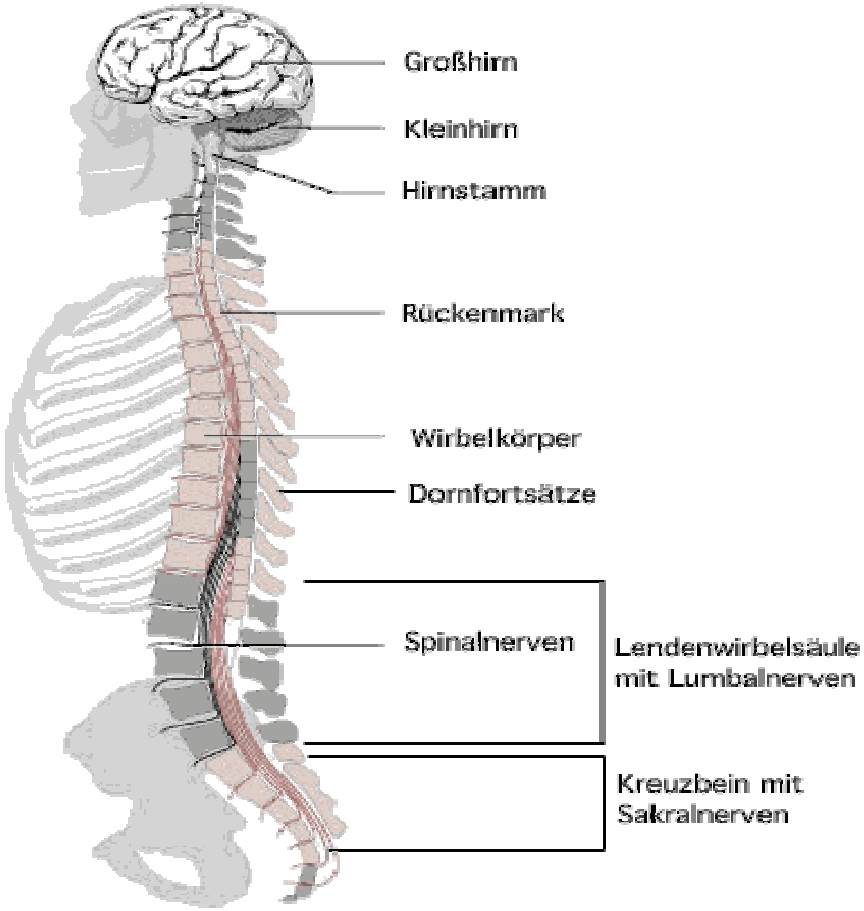
Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen

DR. BENEDIKT LAUBER, MAGGLINGEN, 24.10.2017

- Überblick Nervensystem
- Dehnungs-Verkürzungs-Zyklus (DVZ)
- Neuronale Kontrolle des DVZ
- Trainierbarkeit DVZ
- Ballistische Kontraktionen
- Ermüdung und Regeneration im DVZ

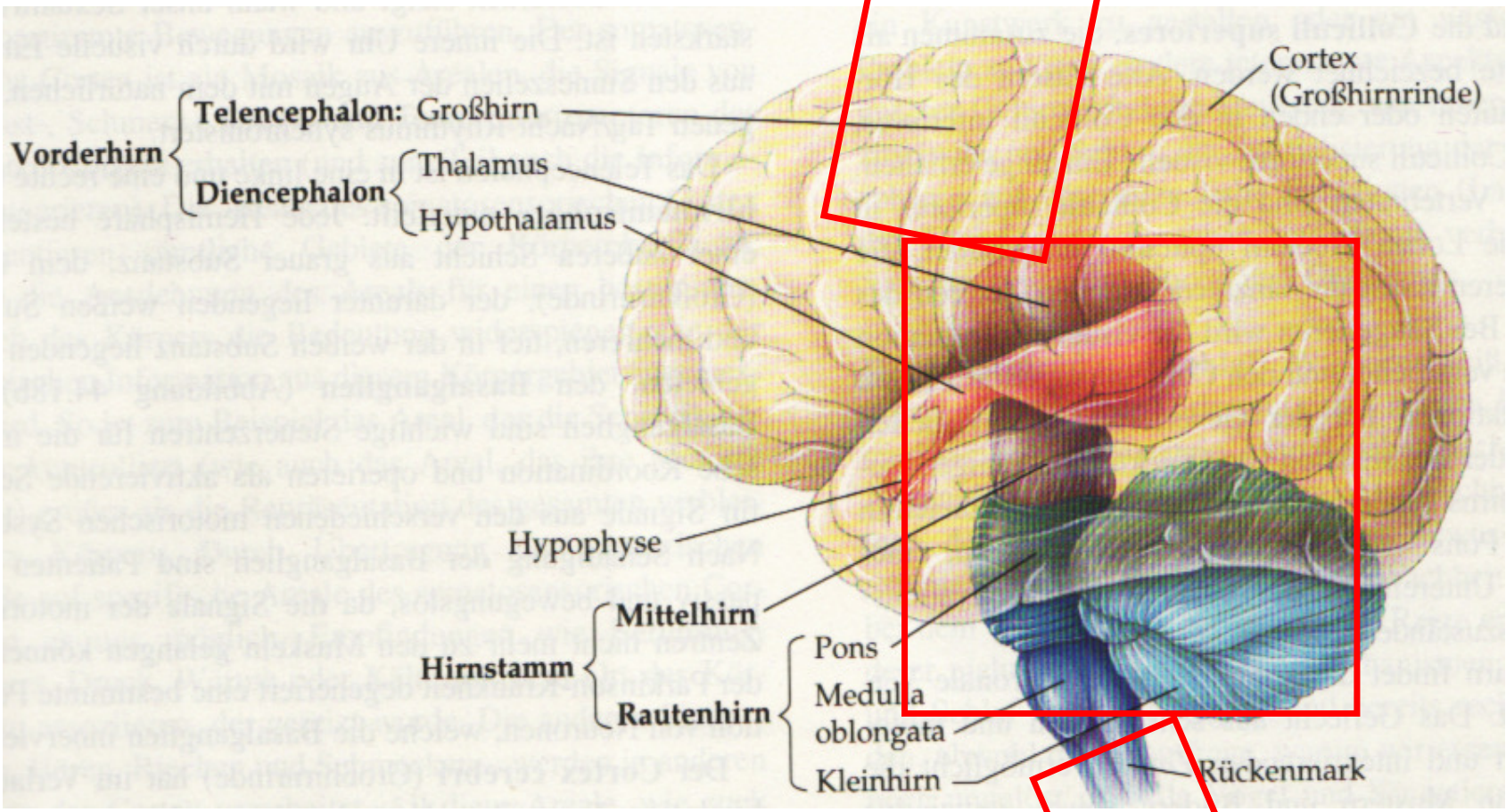
Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *ZNS*



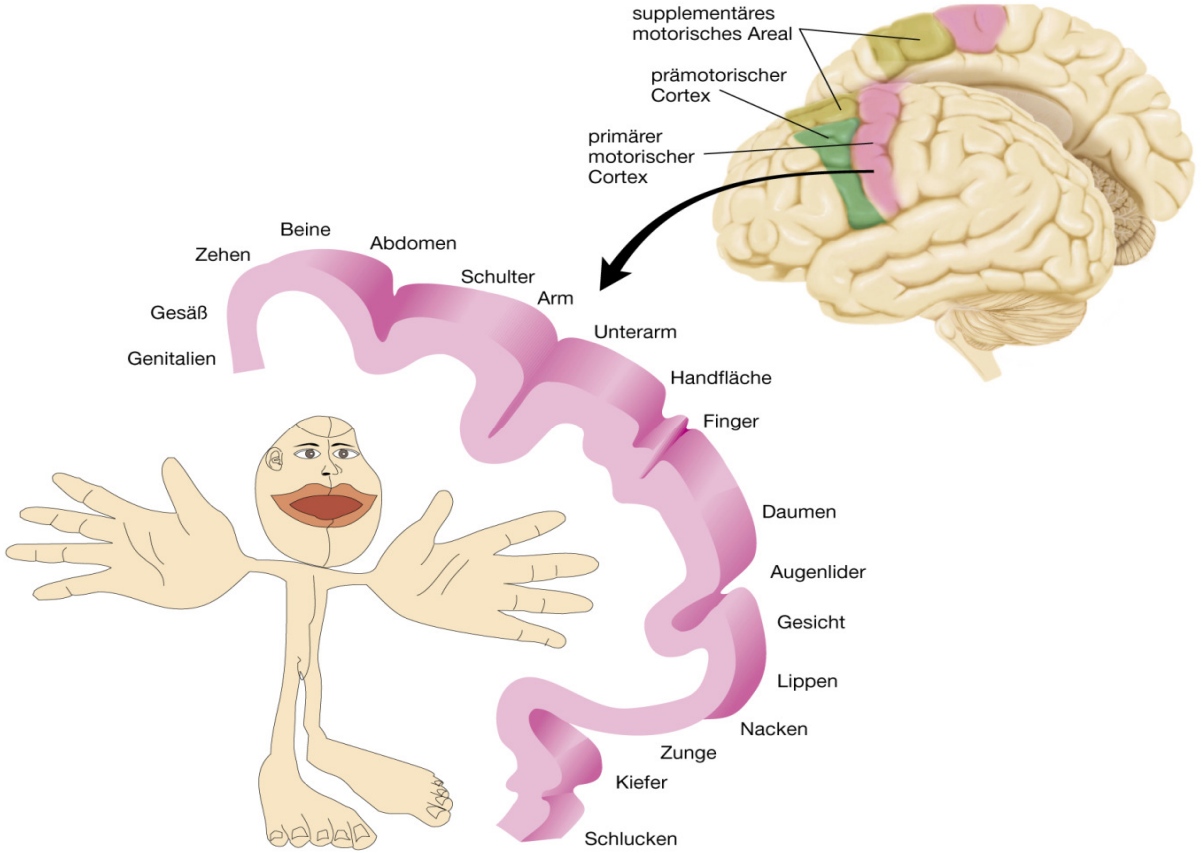


www.medizin-netz.de

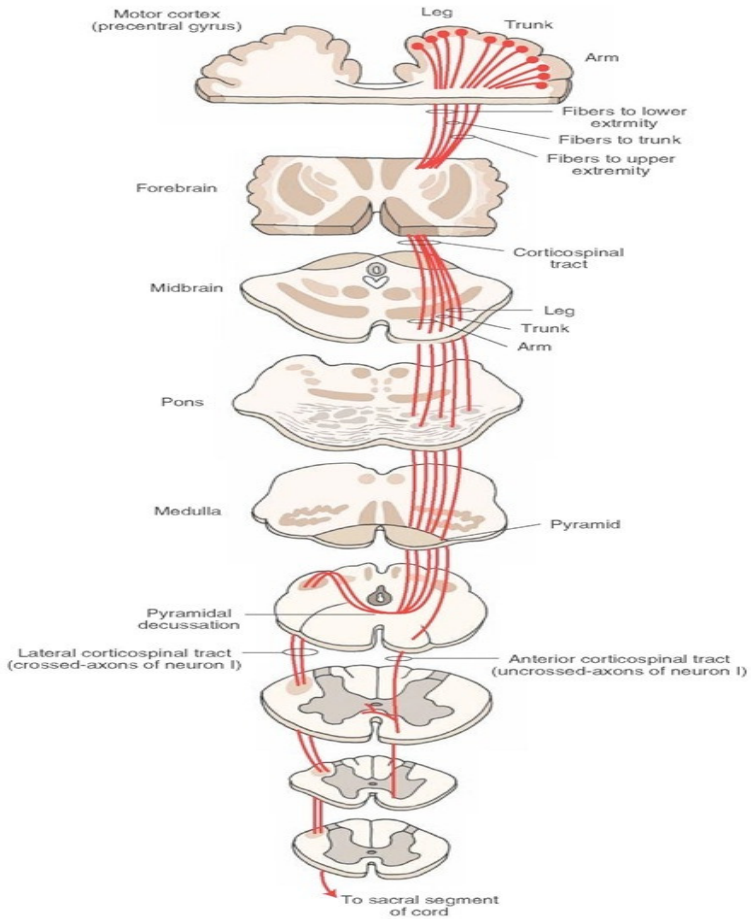
Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *ZNS*



Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *ZNS*

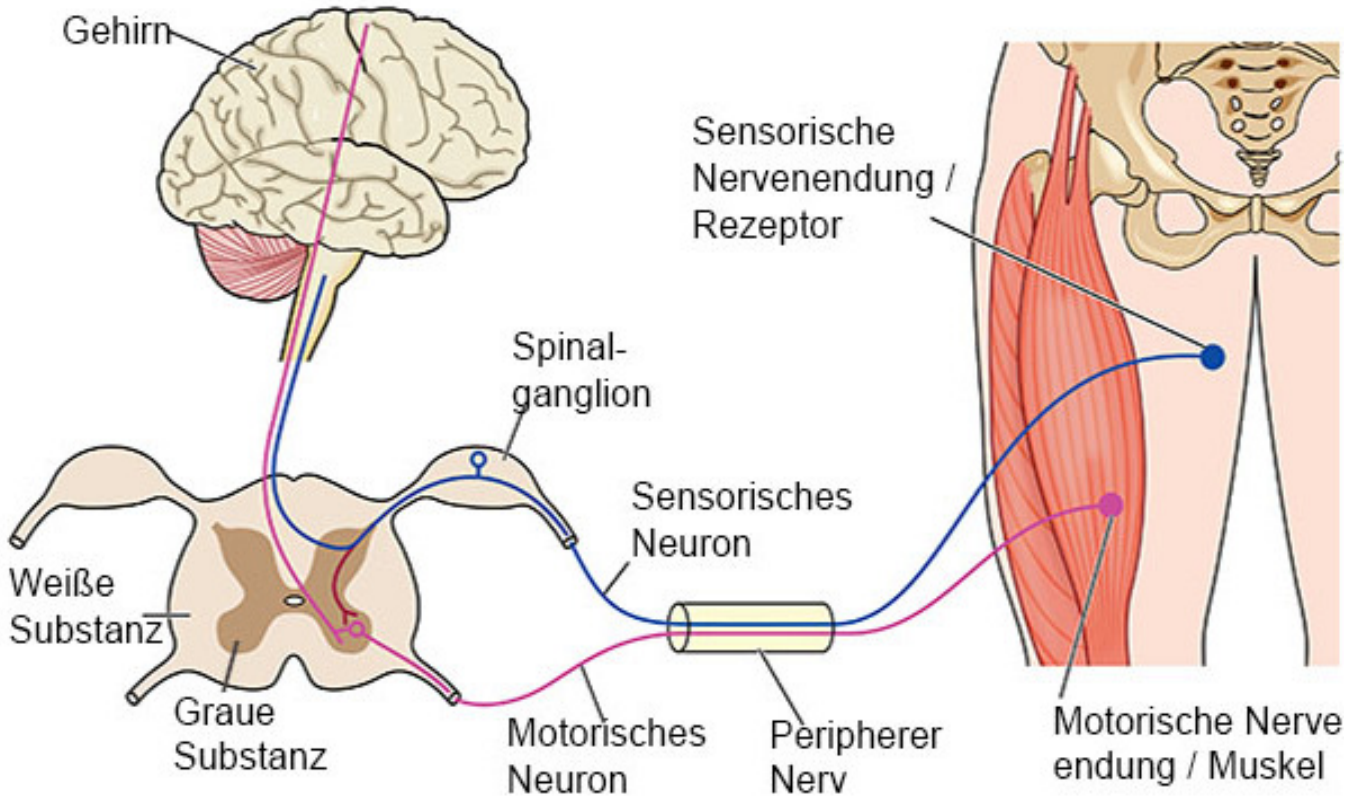


Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *ZNS*

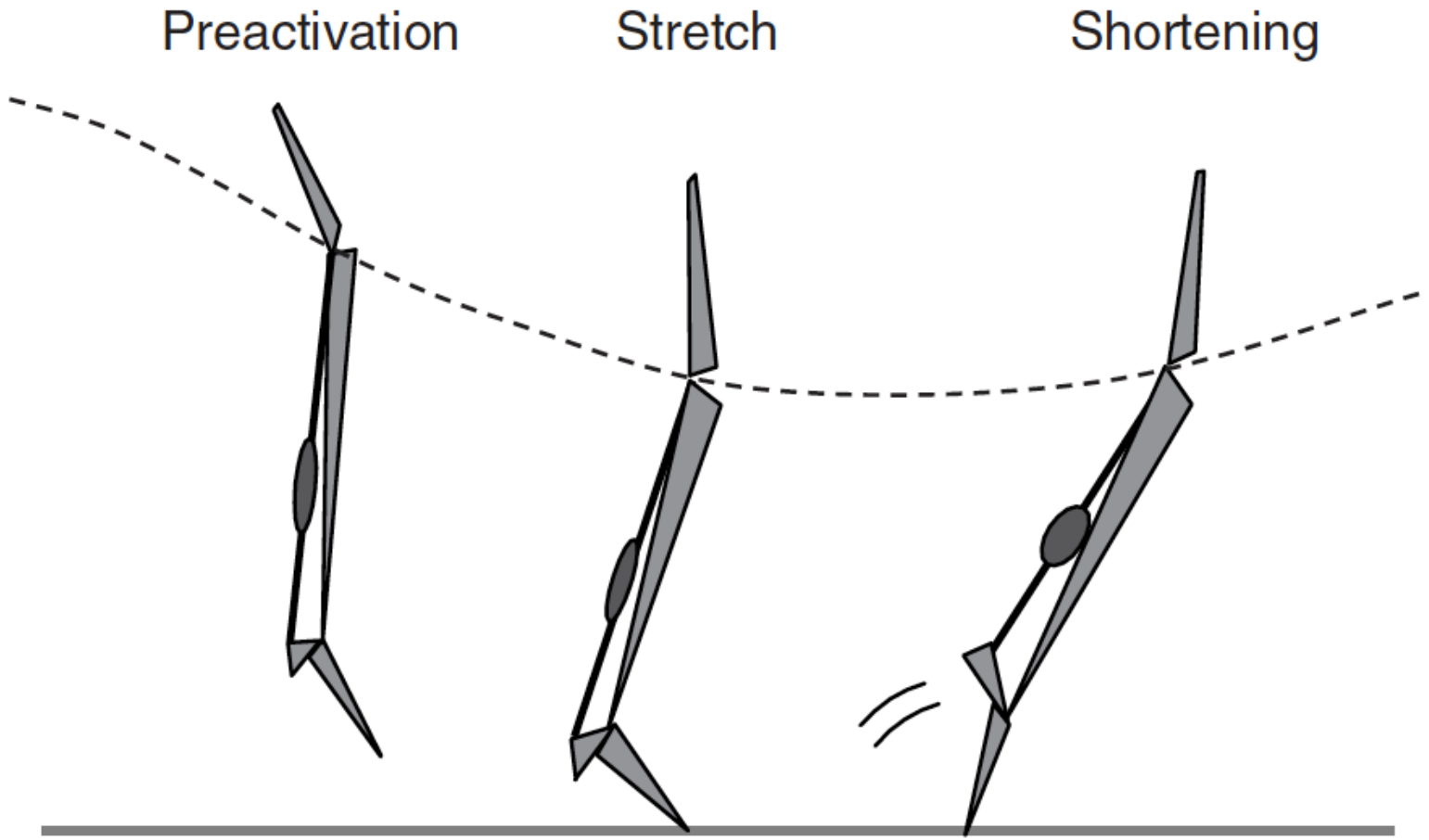


www.what-when-how.com

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *ZNS*

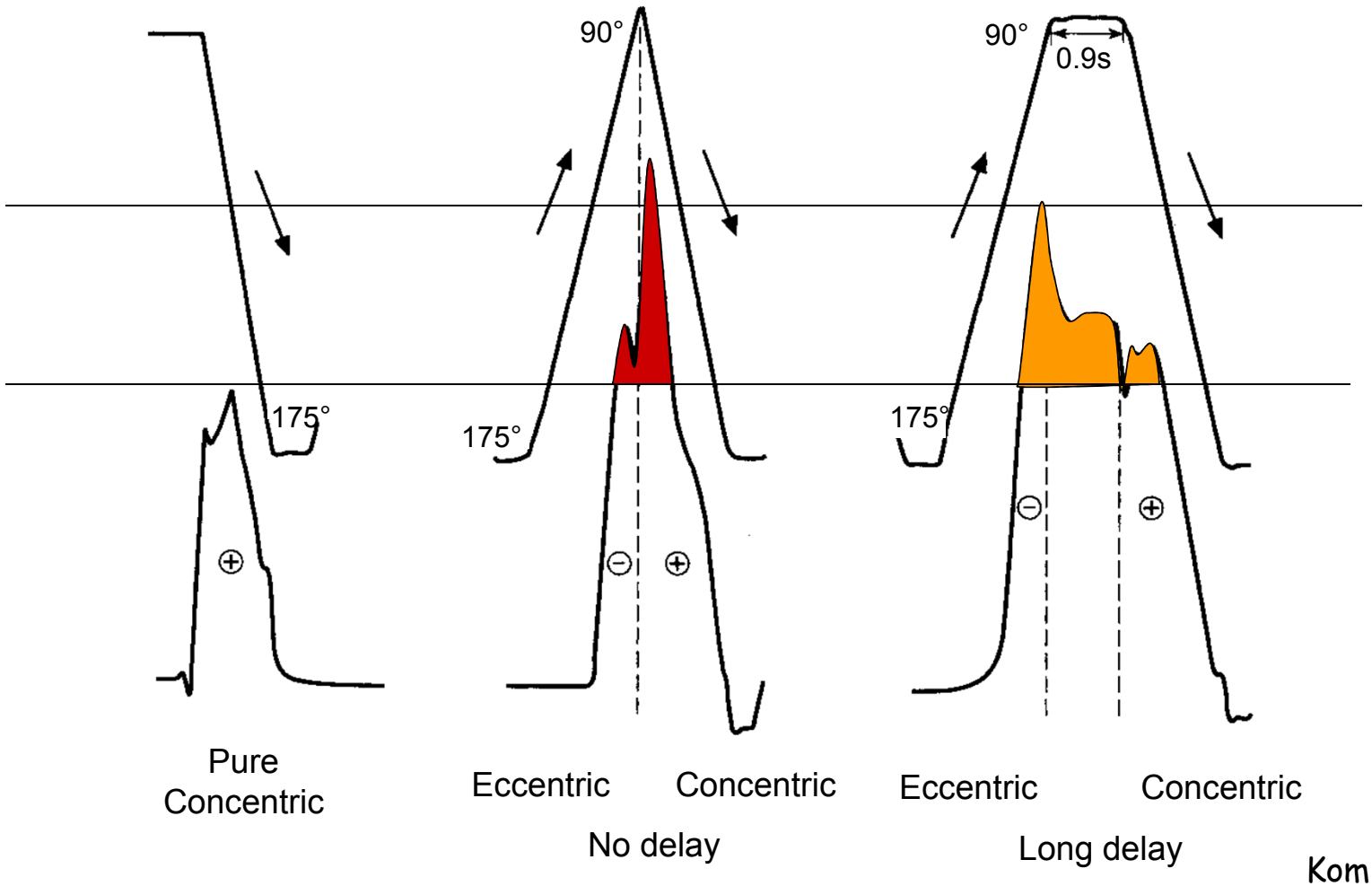


Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *DVZ*



Nicoll 2006

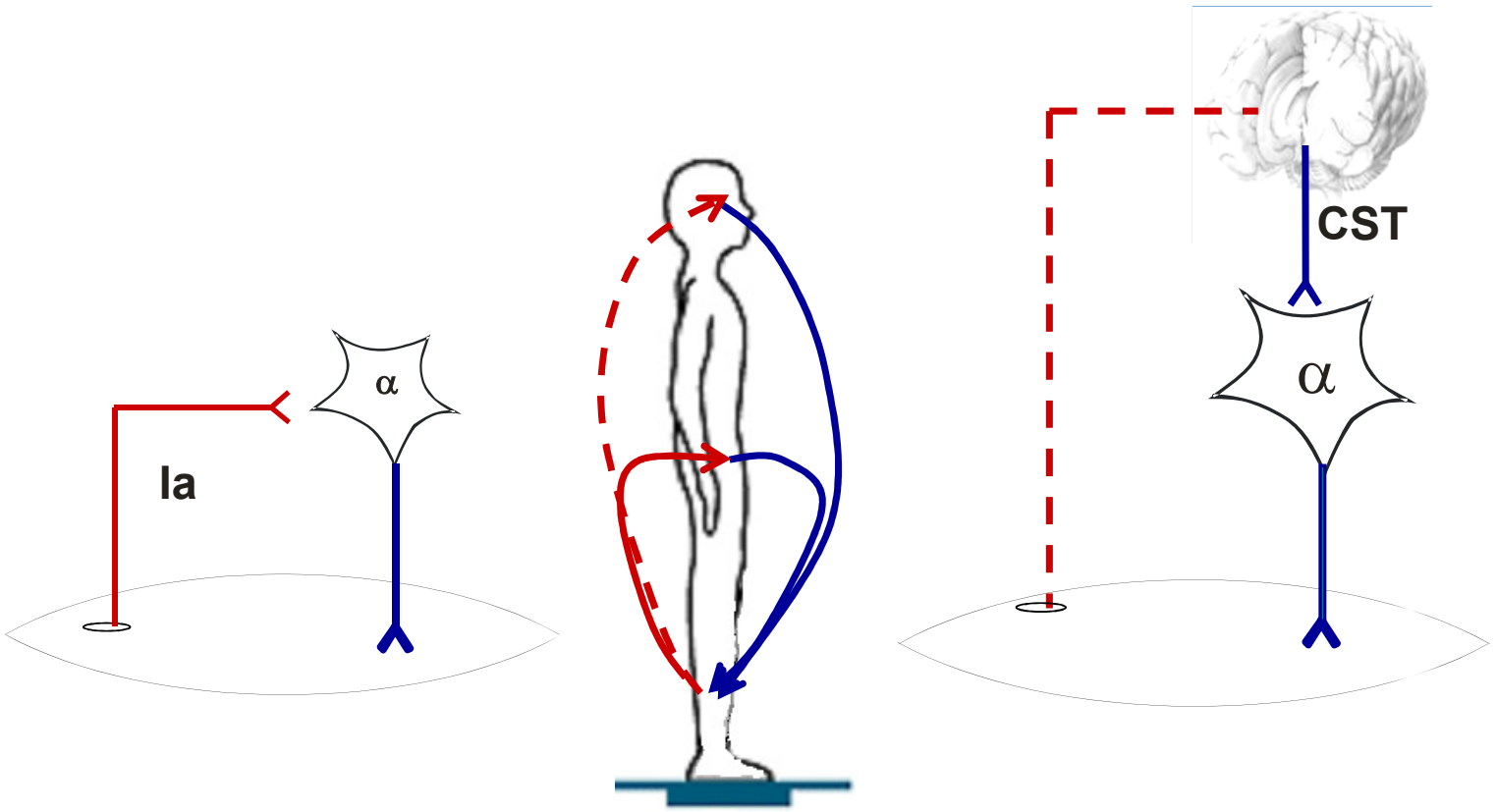
Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *DVZ*



Komi 2003

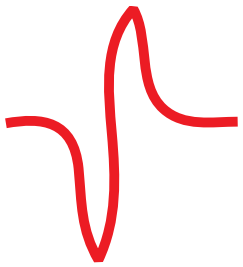
Spinal excitability

Corticospinal excitability

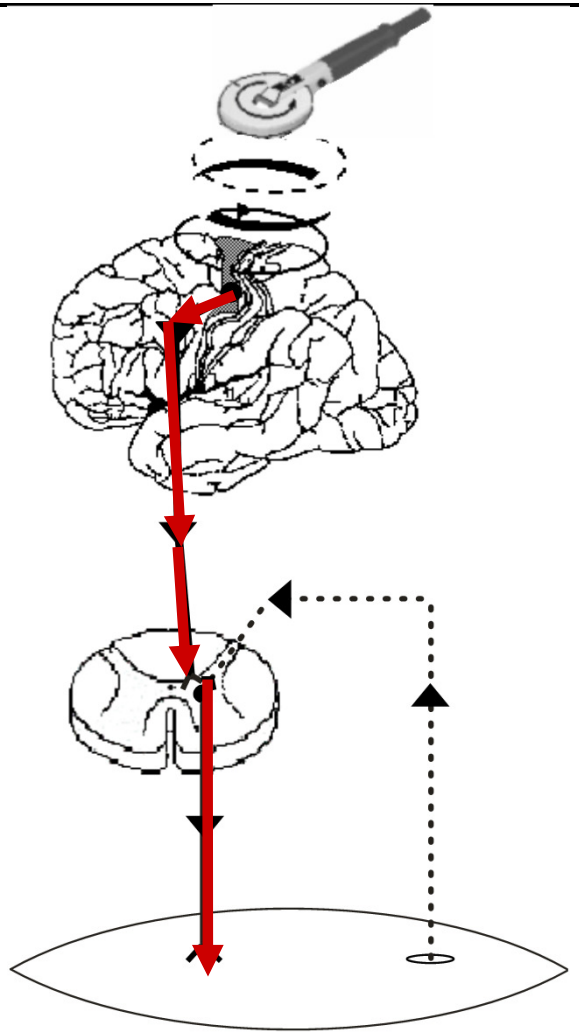


Transcranial Magnetic Stimulation (TMS)

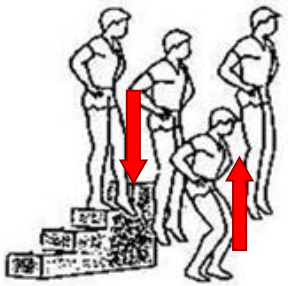
To assess changes in the corticospinal excitability



„Motor evoked potential“ (MEP)



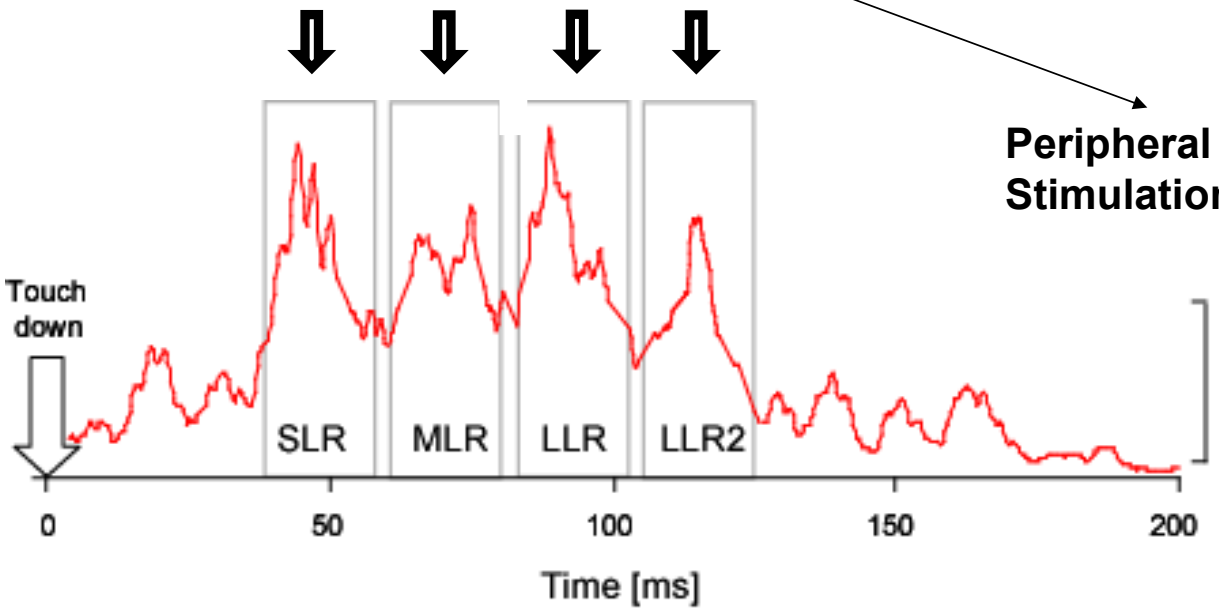
Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *DVZ*

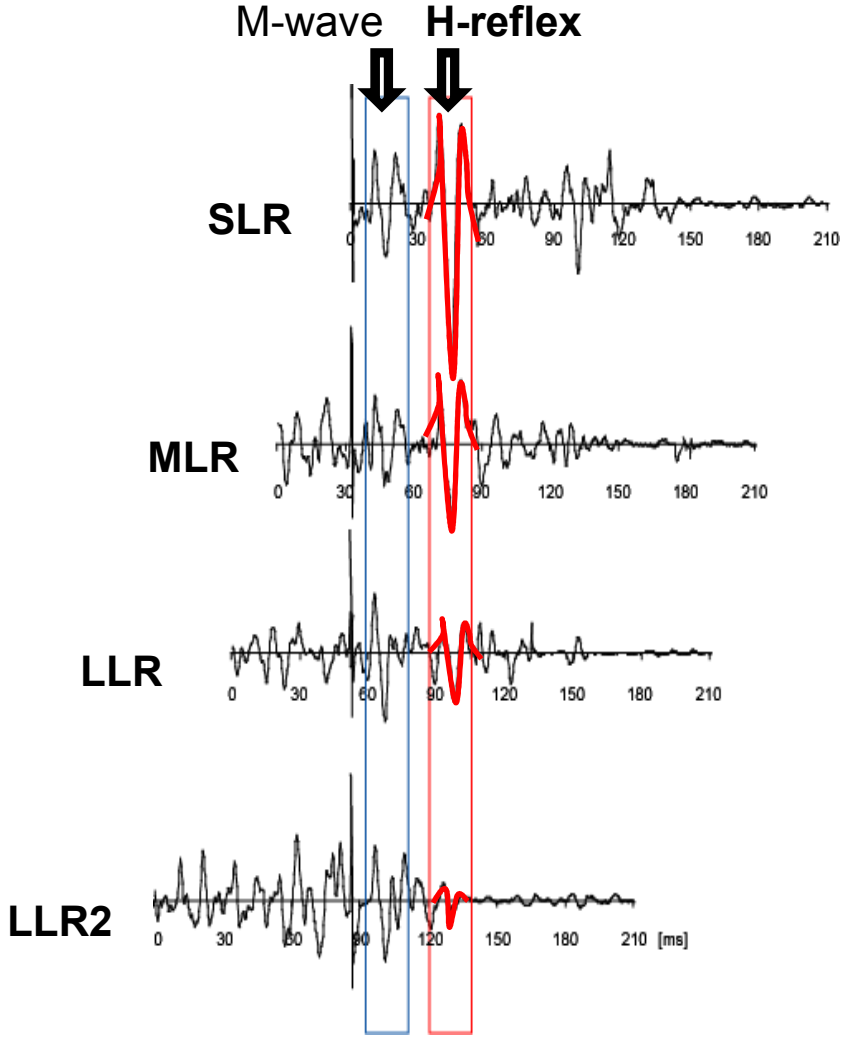


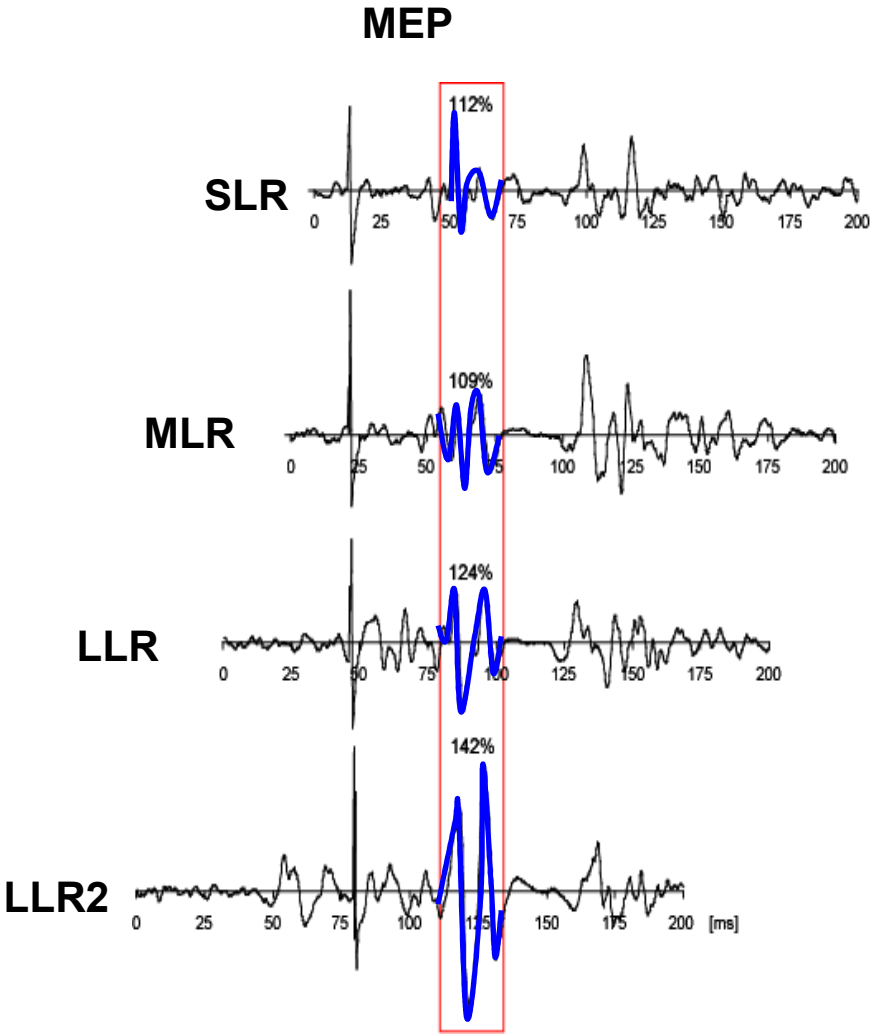
Stimulation

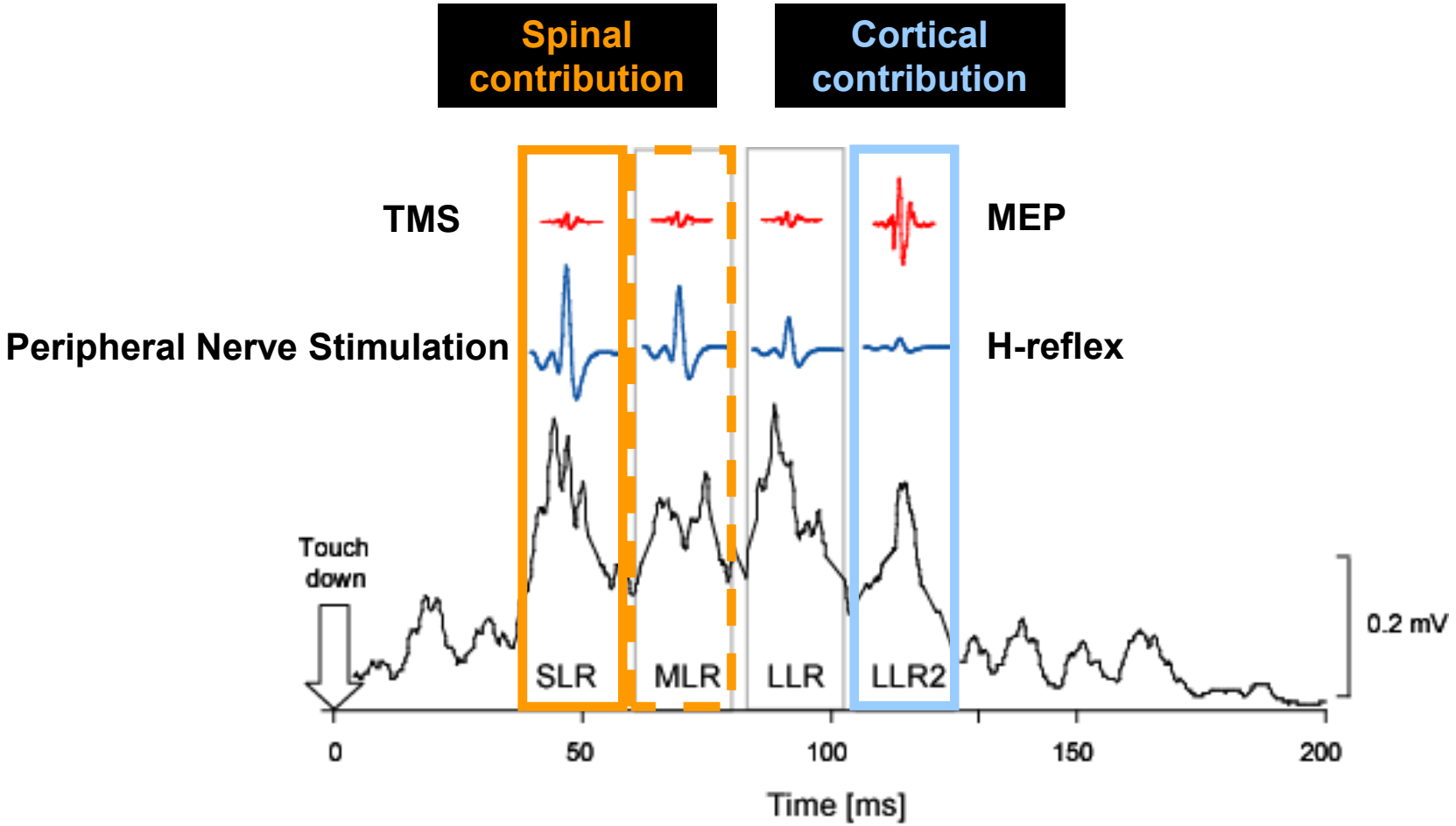
TMS

Peripheral Nerve Stimulation



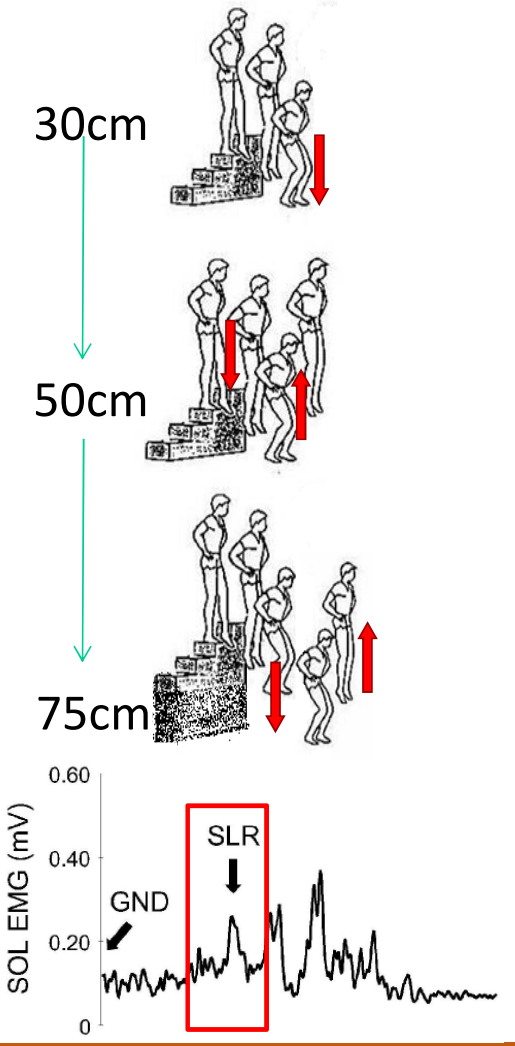

M-wave
H-reflex
SLR
MLR
LLR
LLR2
0
30
60
90
120
150
180
210
[ms]

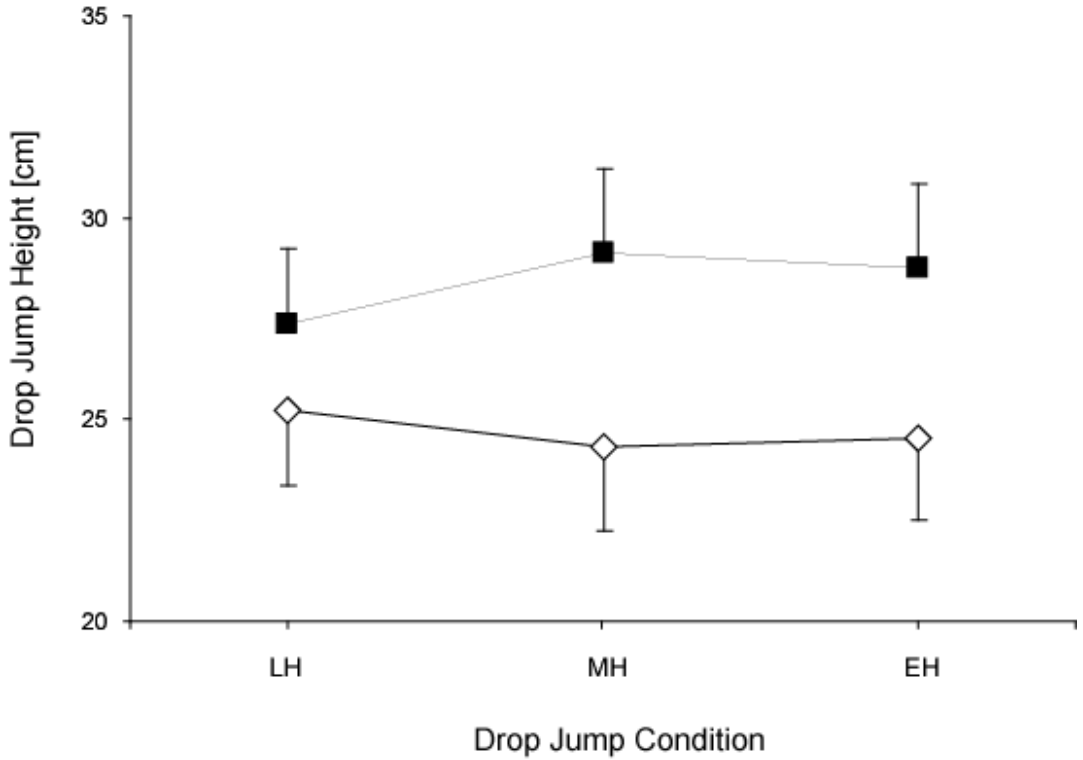

MEP
SLR
112%
MLR
109%
LLR
124%
LLR2
142%
0 25 50 75 100 125 150 175 200 [ms]



Taube et al. 2008

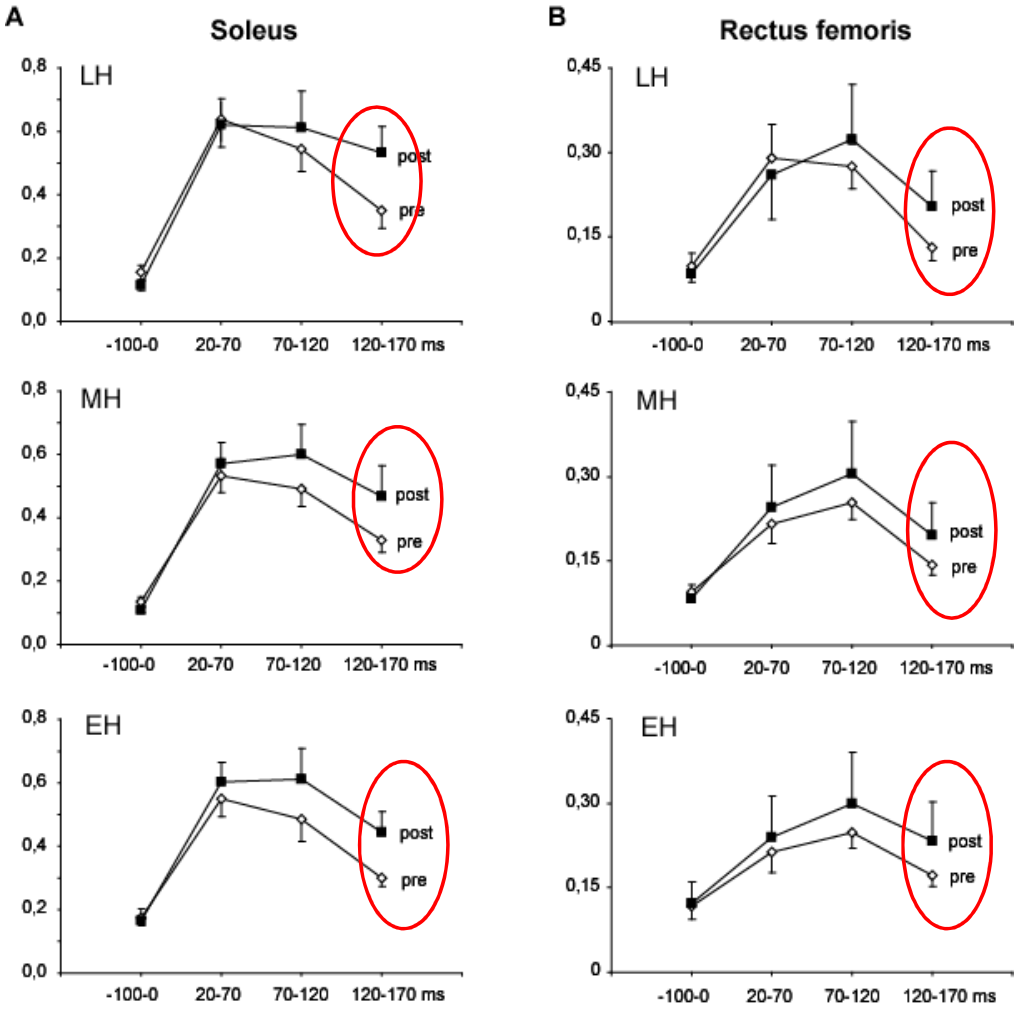
- Jump height
- “Spinal excitability” (H/M-ratios)
- Duration of ground contact
- Hip, knee and ankle angles
- Muscular activity (surface EMG)



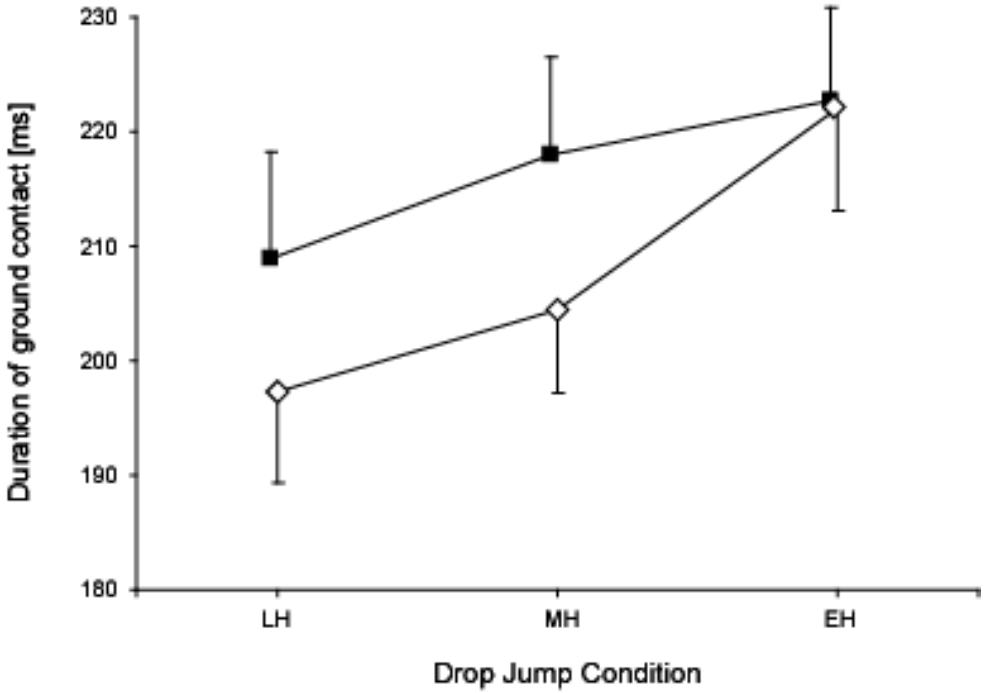


Taube et al. 2012

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *DVZ*

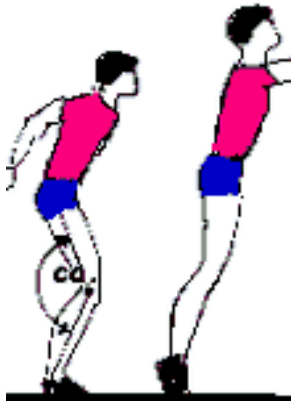


Taube et al. 2012



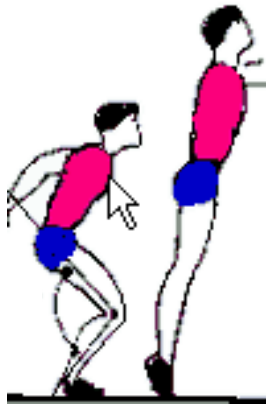
Taube et al. 2012

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *DVZ*



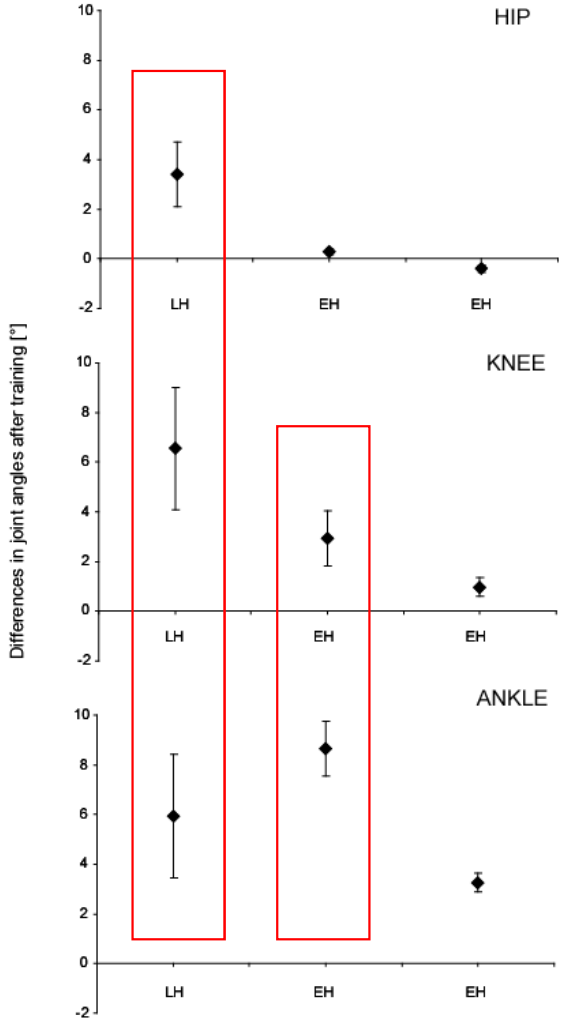
pre

LH_{pre}

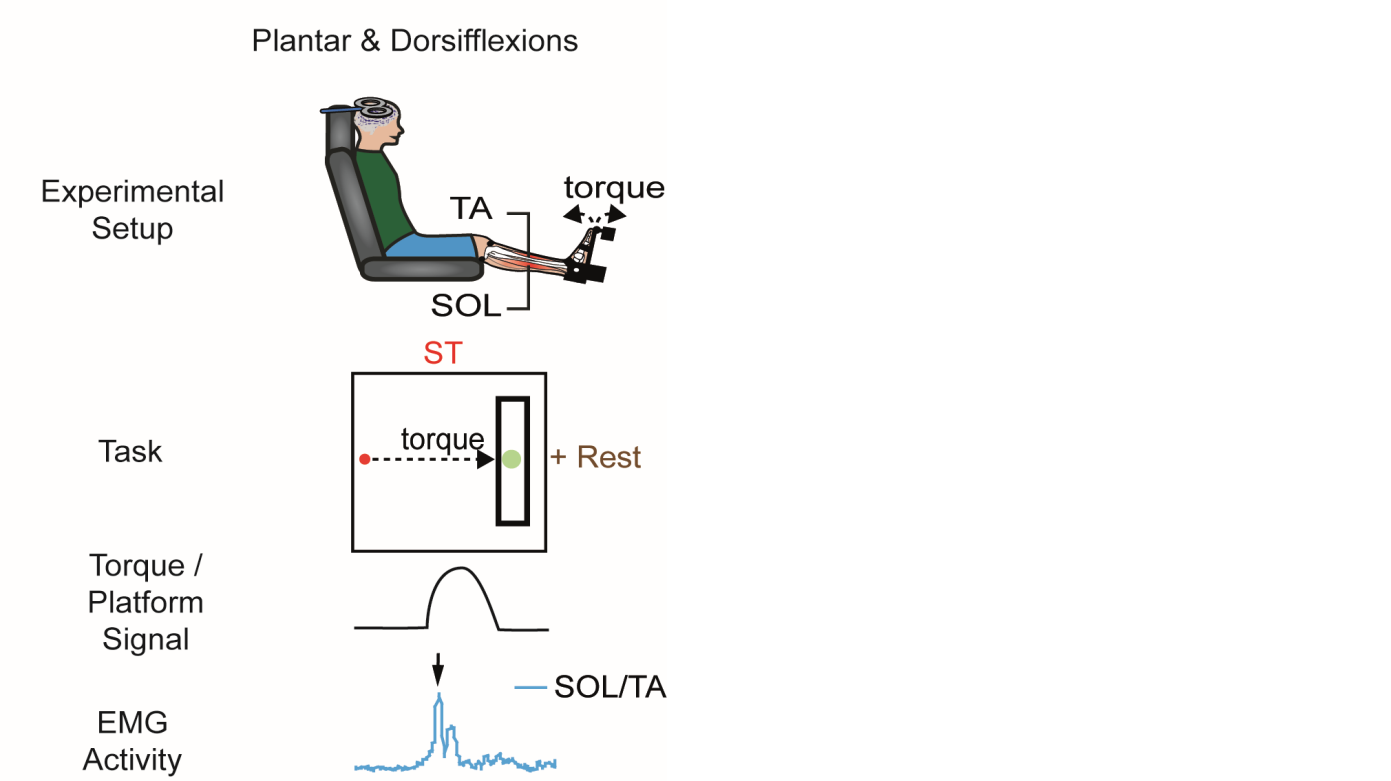


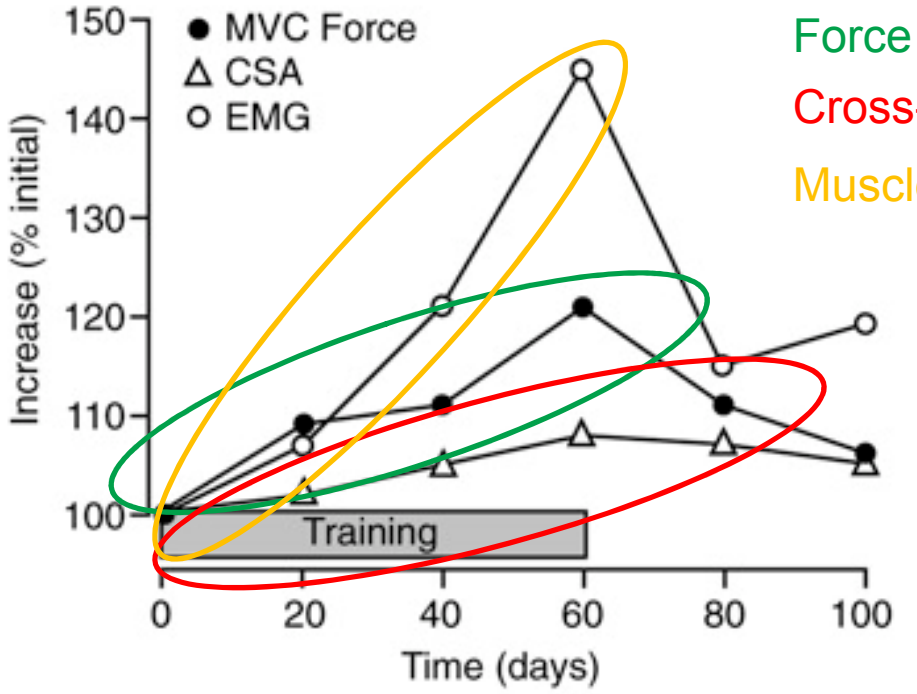
post

EH_{pre}



Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Explosivkraft*


Plantar & Dorsifflexions
Experimental Setup
TA
torque
SOL
ST
Task
torque
+ Rest
Torque / Platform Signal
SOL/TA
EMG Activity



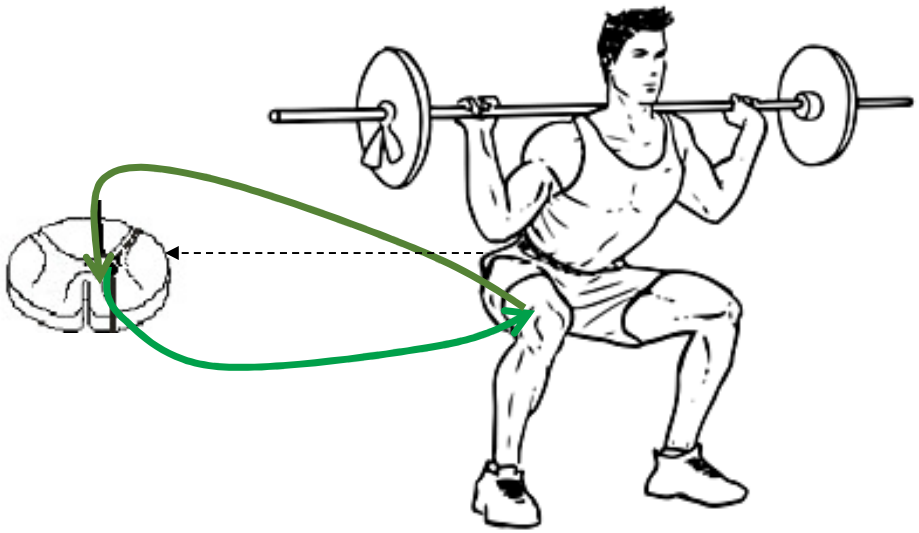
Force

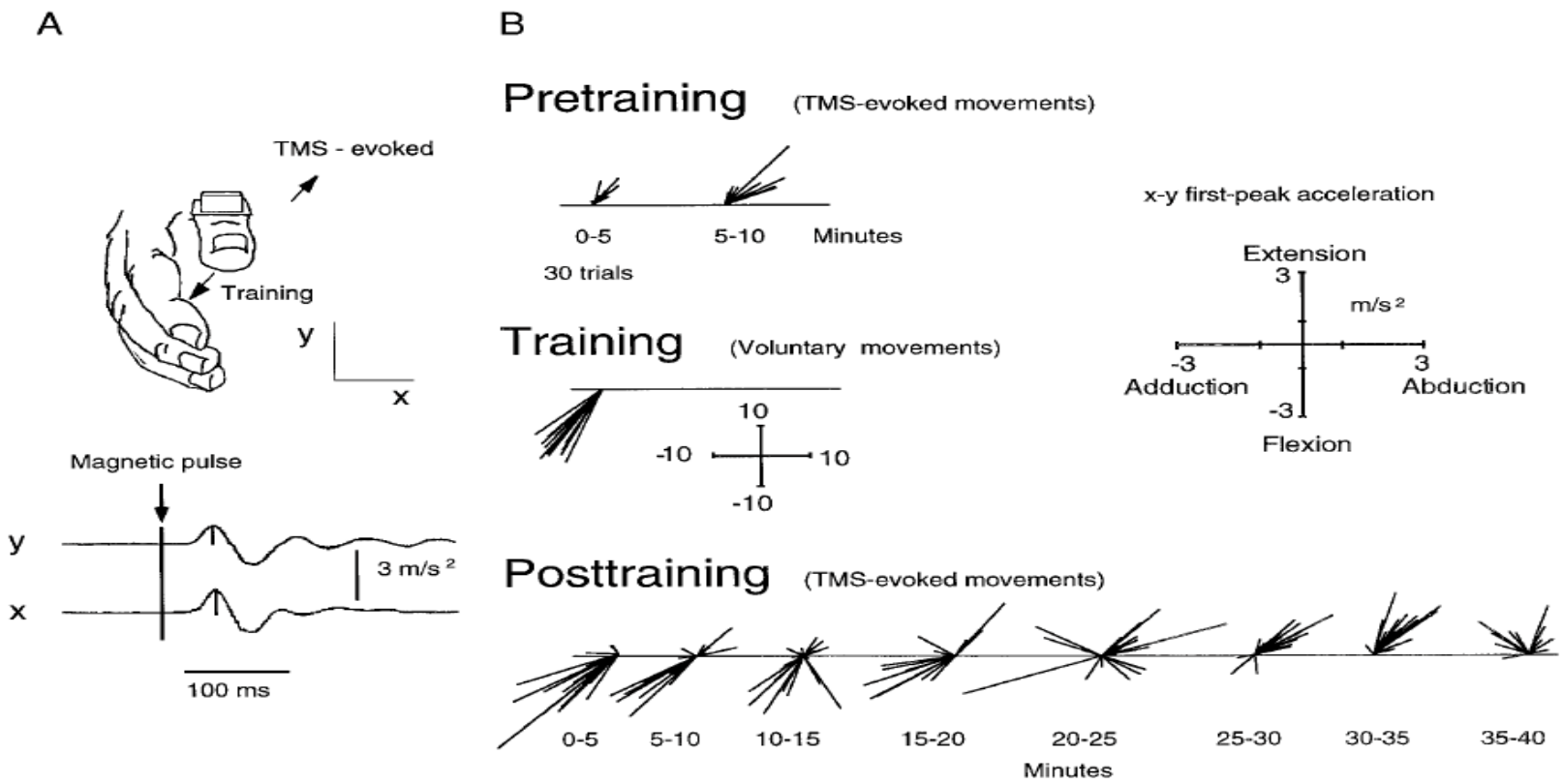
Cross-Sectional Area

Muscle Activity

Narici et al. 1989

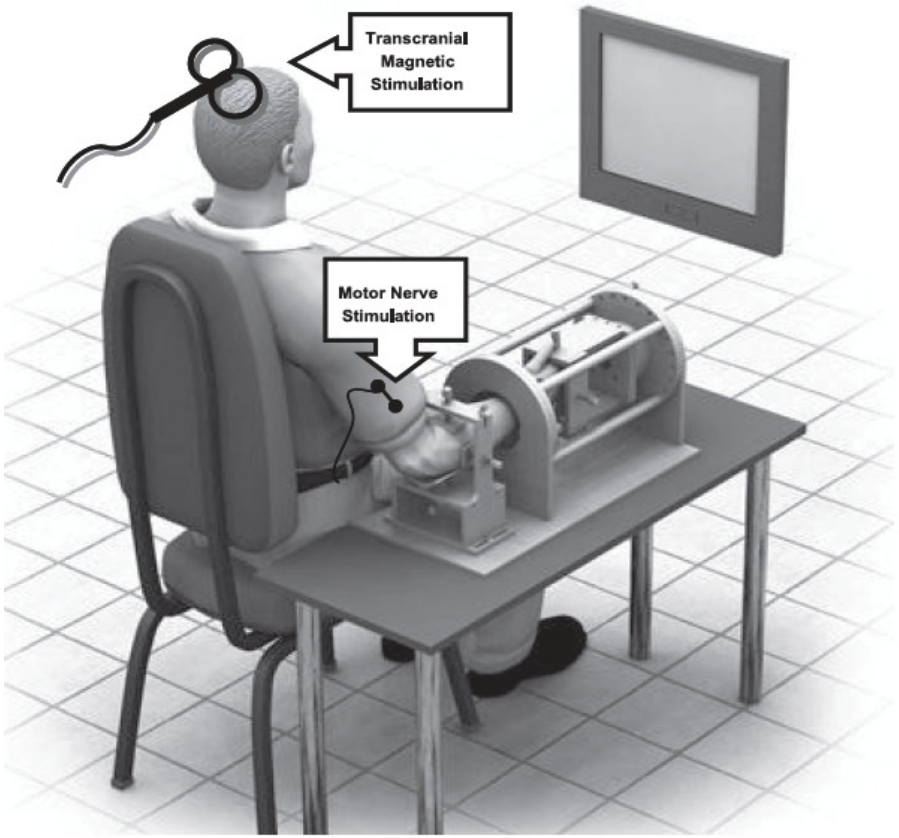
Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Einleitung*

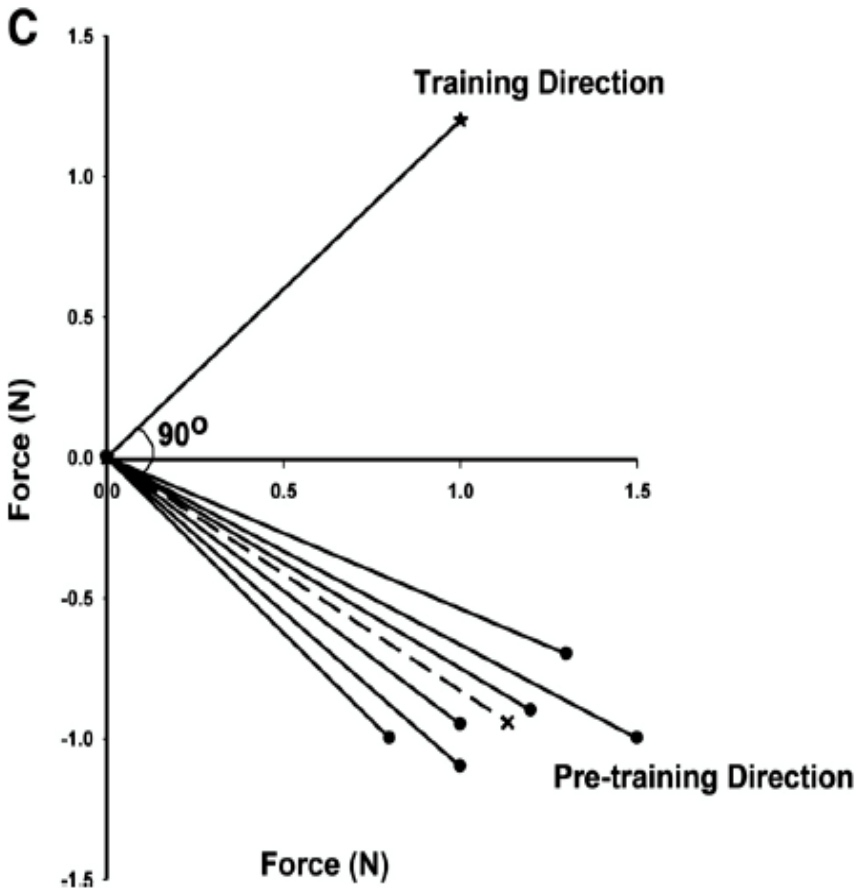




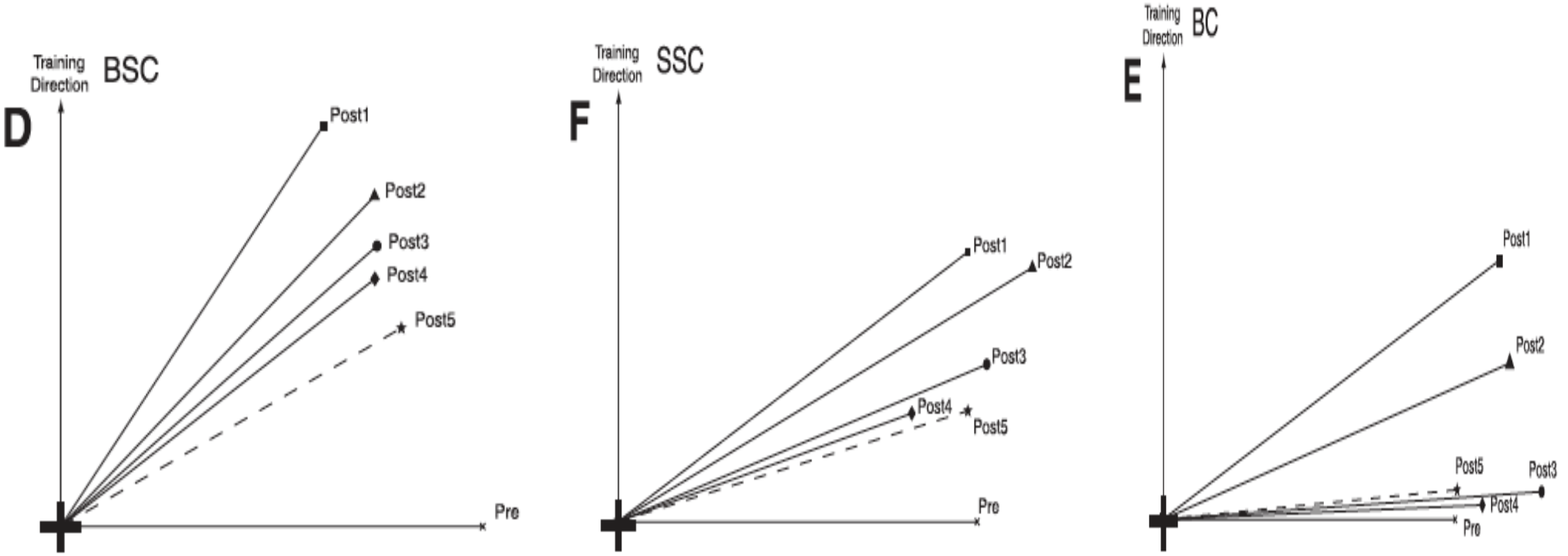
Classen et al. 1998

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Explosivkraft*



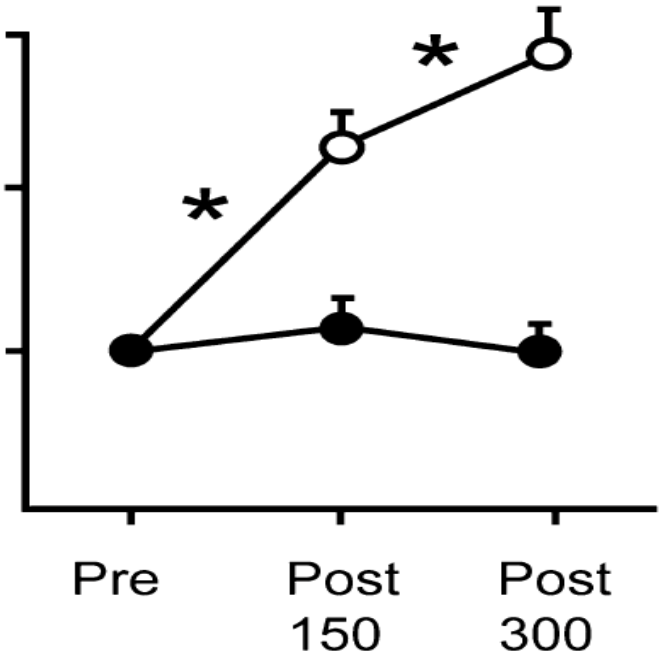


Selvanayagam et al. 2011

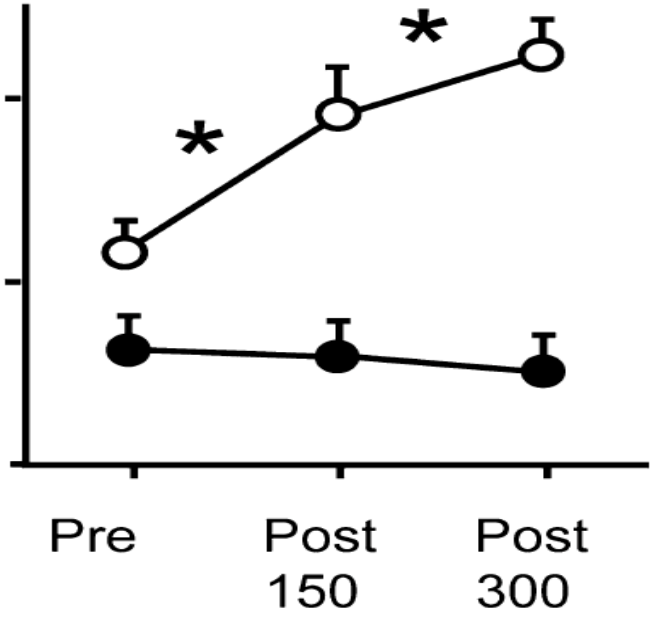


Selvanayagam et al. 2011

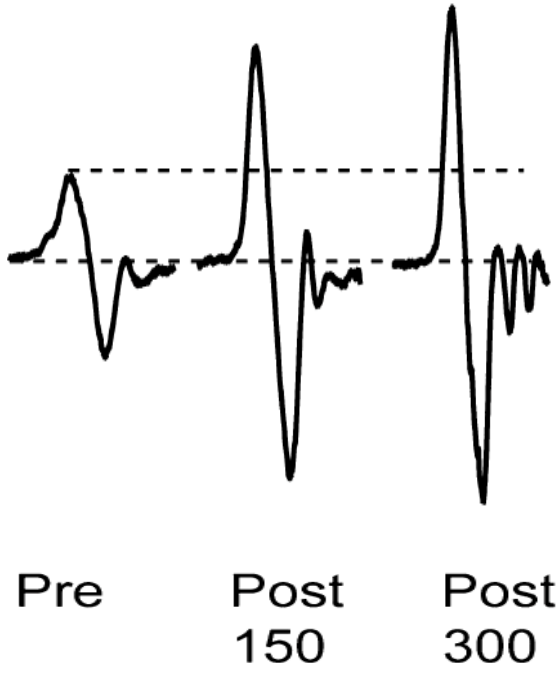
Beschleunigung



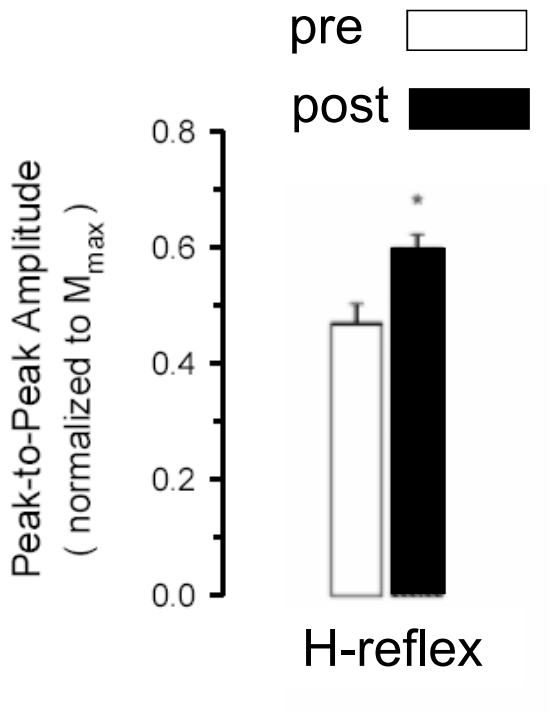
MEP



Beschleunigung

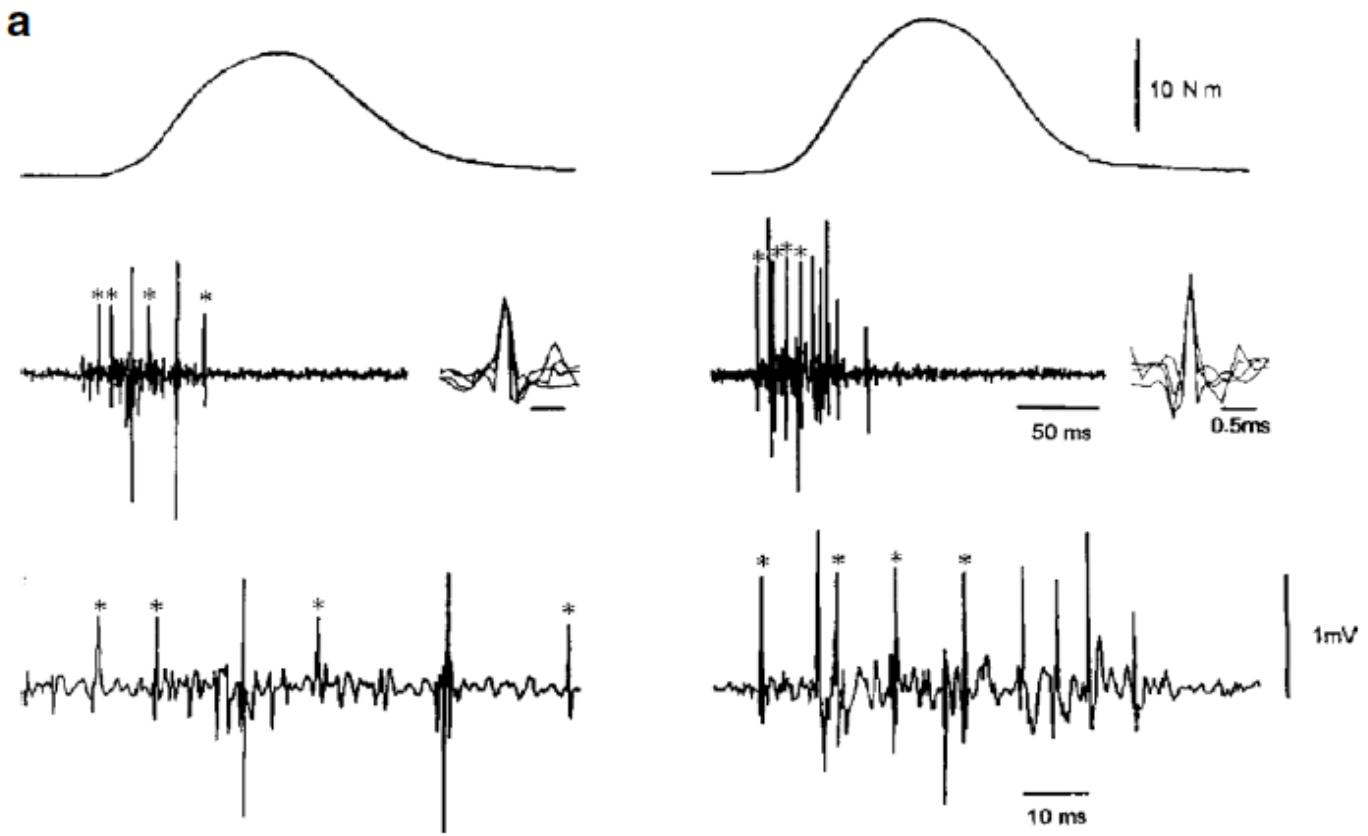


Lee et al. 2010

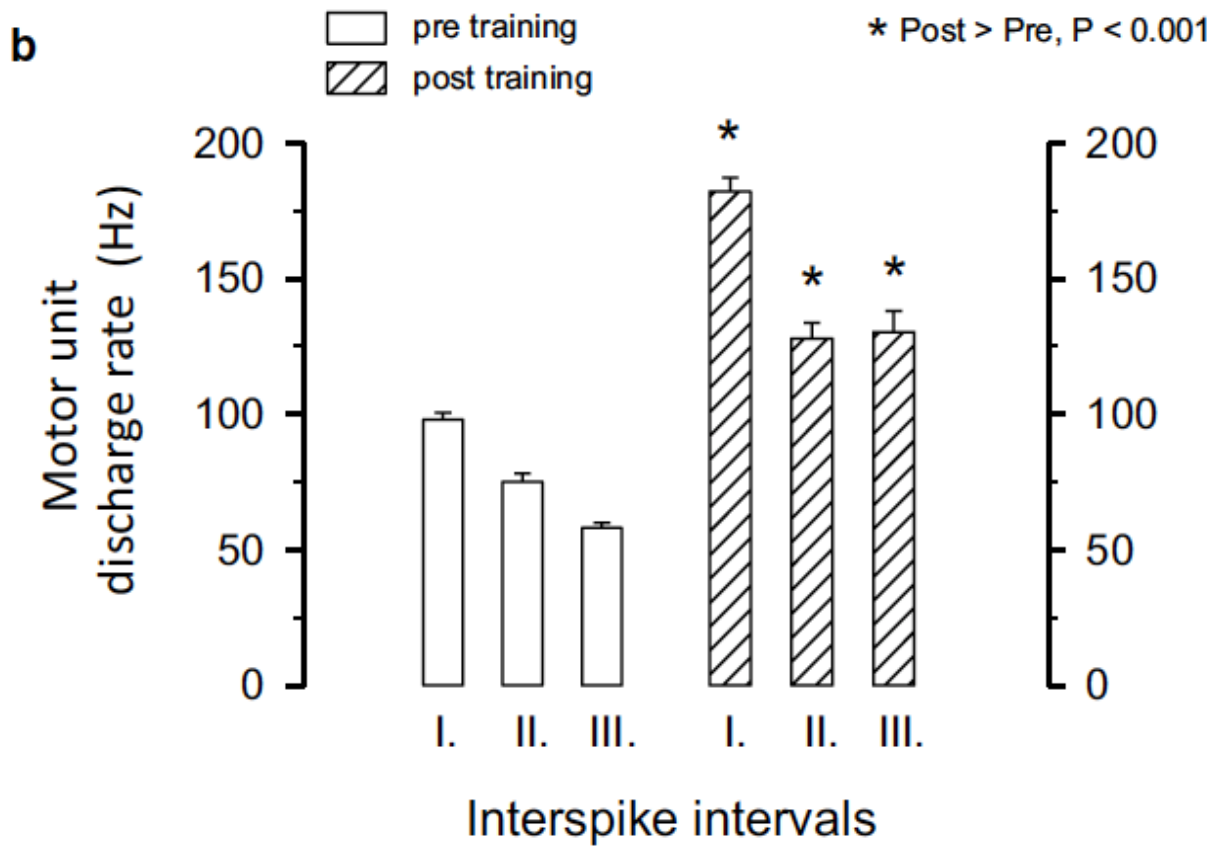


Aagaard et al. 2002

Lagerquist et al. 2006

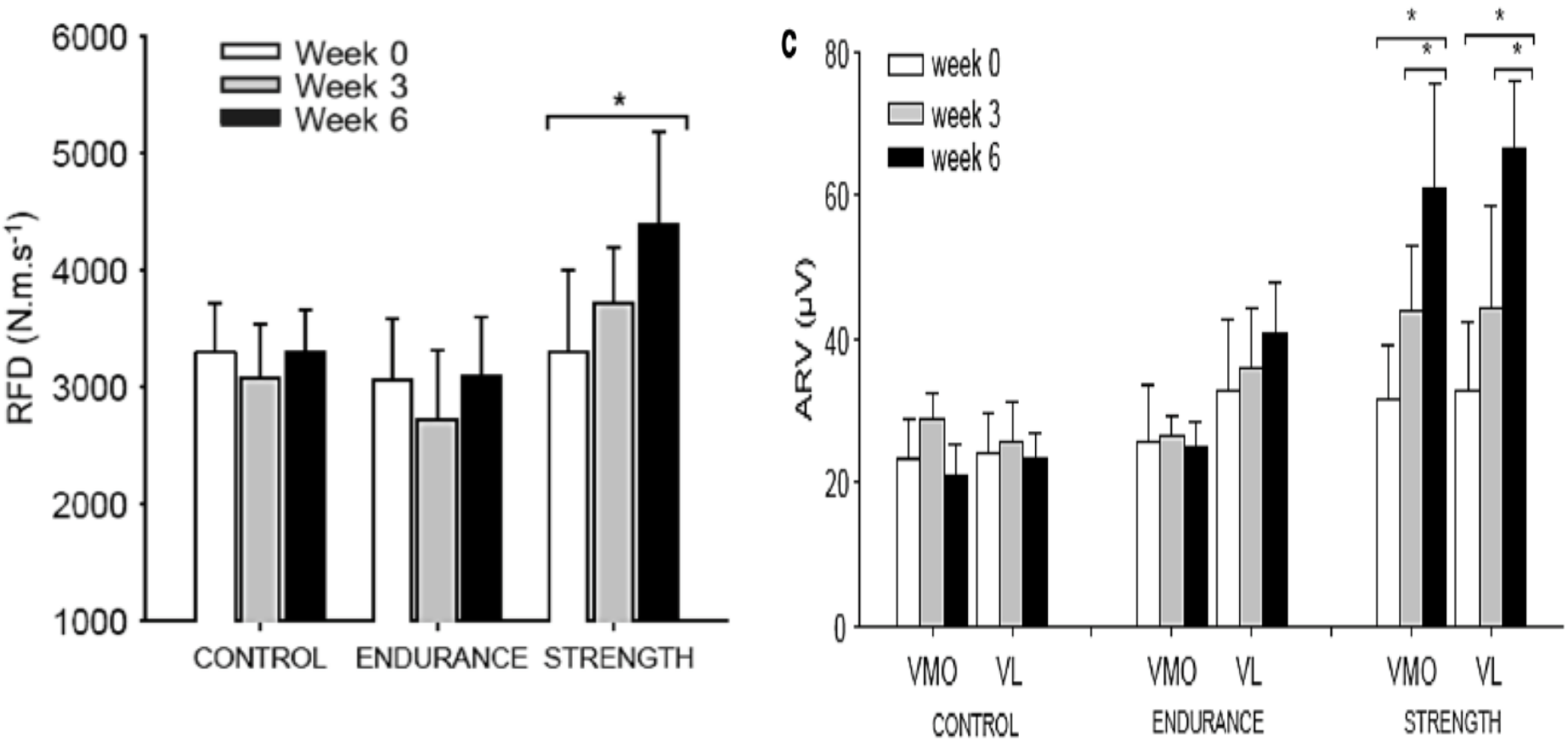


Van Cutsem et al. 1998

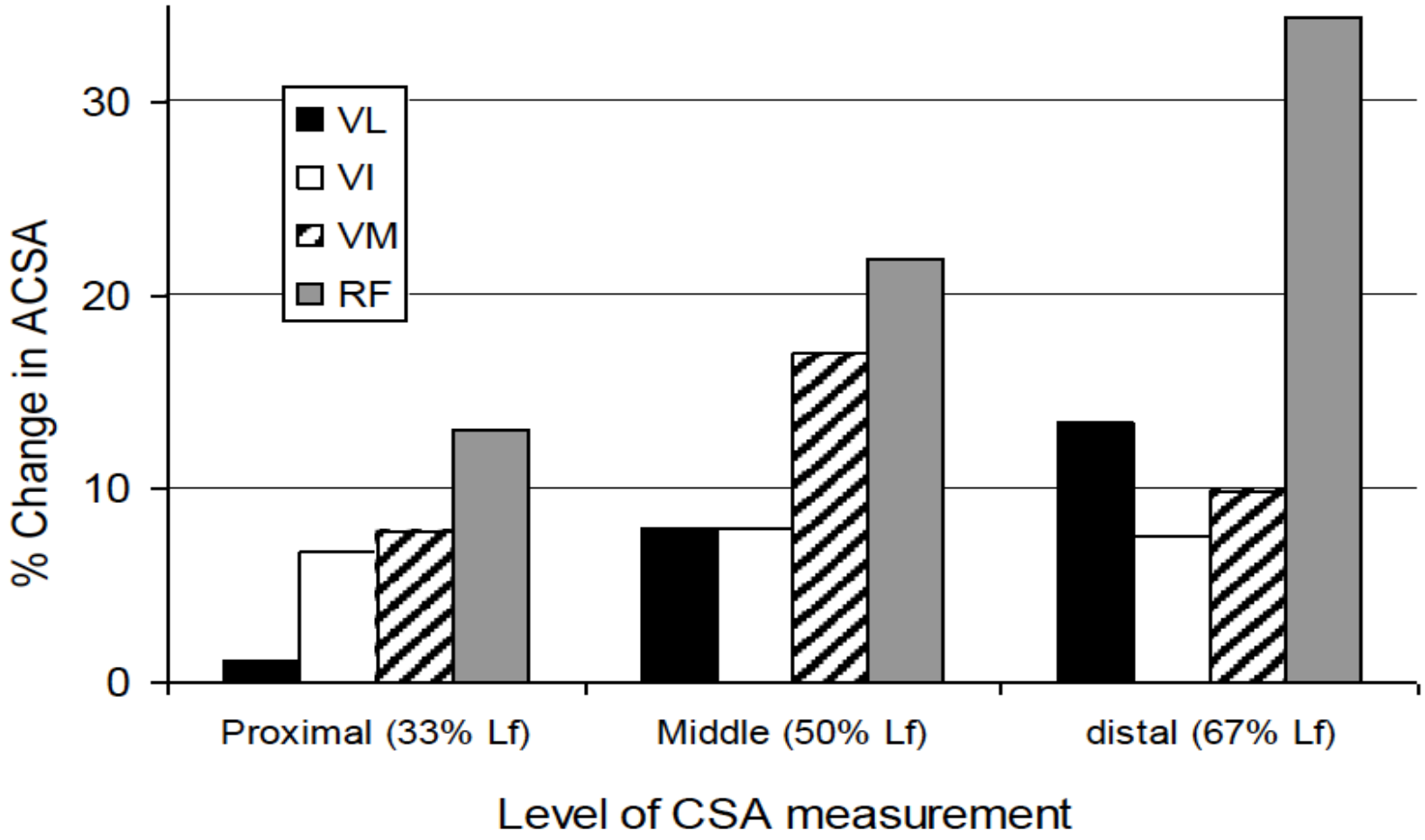


Aagard et al. 2003

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Explosivkraft*

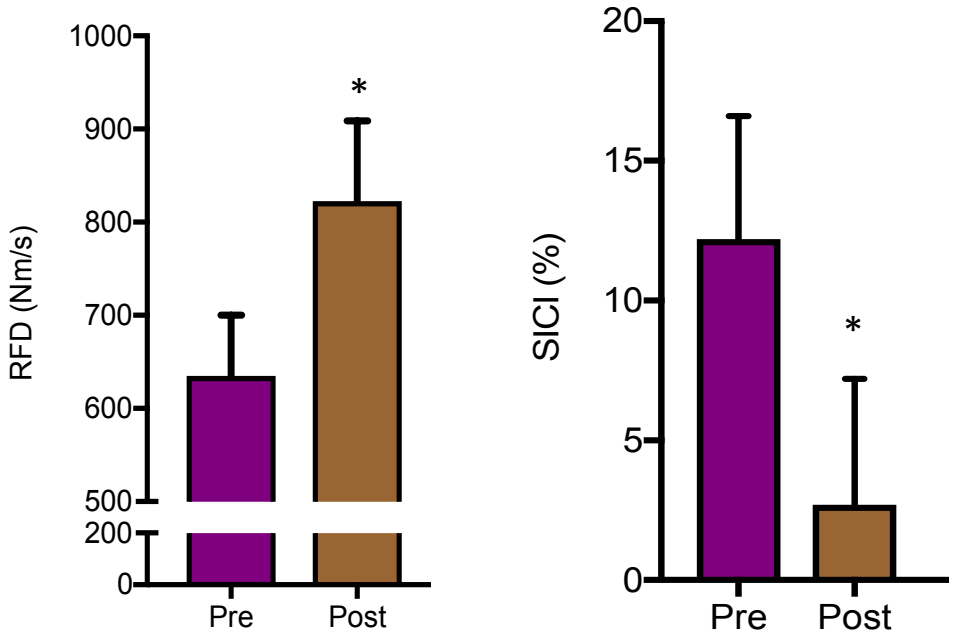


Vila-Cha et al. 2010



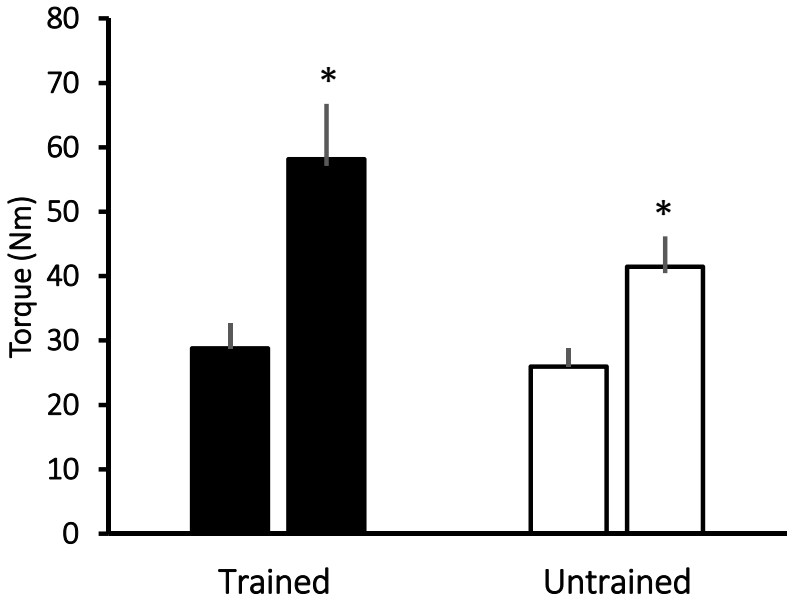
Houch et al. 1999

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Explosivkraft*



Lauber et al. 2017 (submitted)

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Explosivkraft*

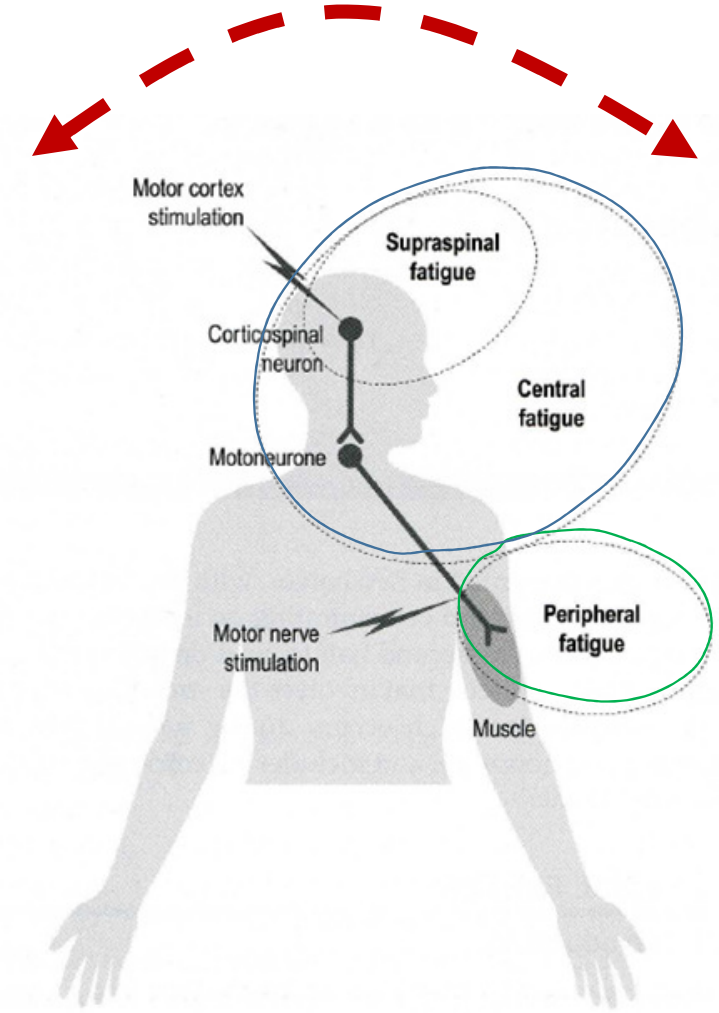


Lauber et al. 2017

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Ermüdung*

Peripheral

refers to events occurring at or distal to the neuromuscular junction (Taylor 2008)

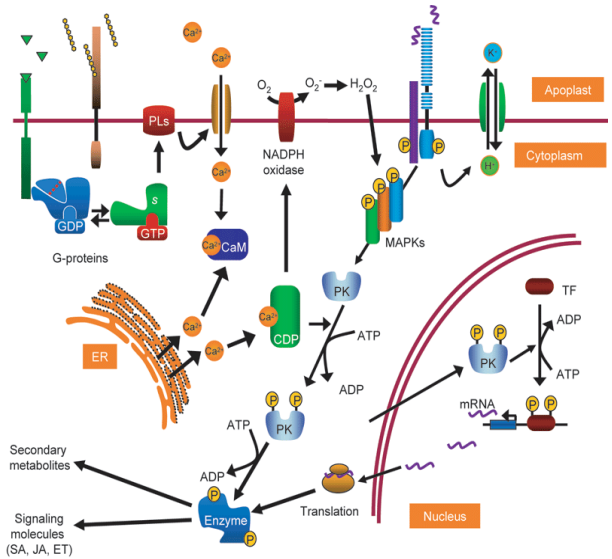


Central

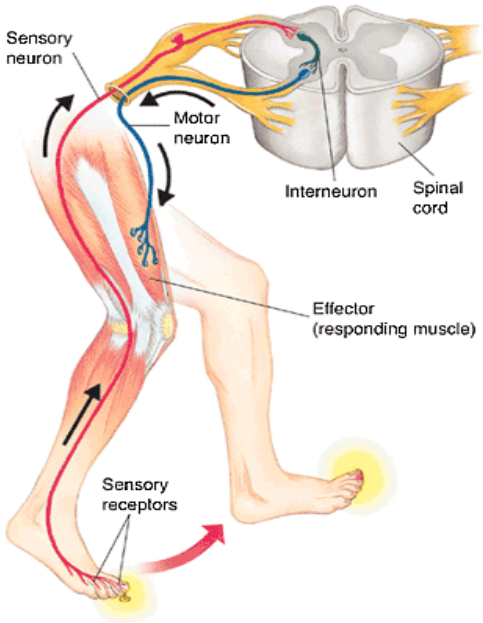
involves events occurring in the brain and spinal cord (Kirkendall 1990)

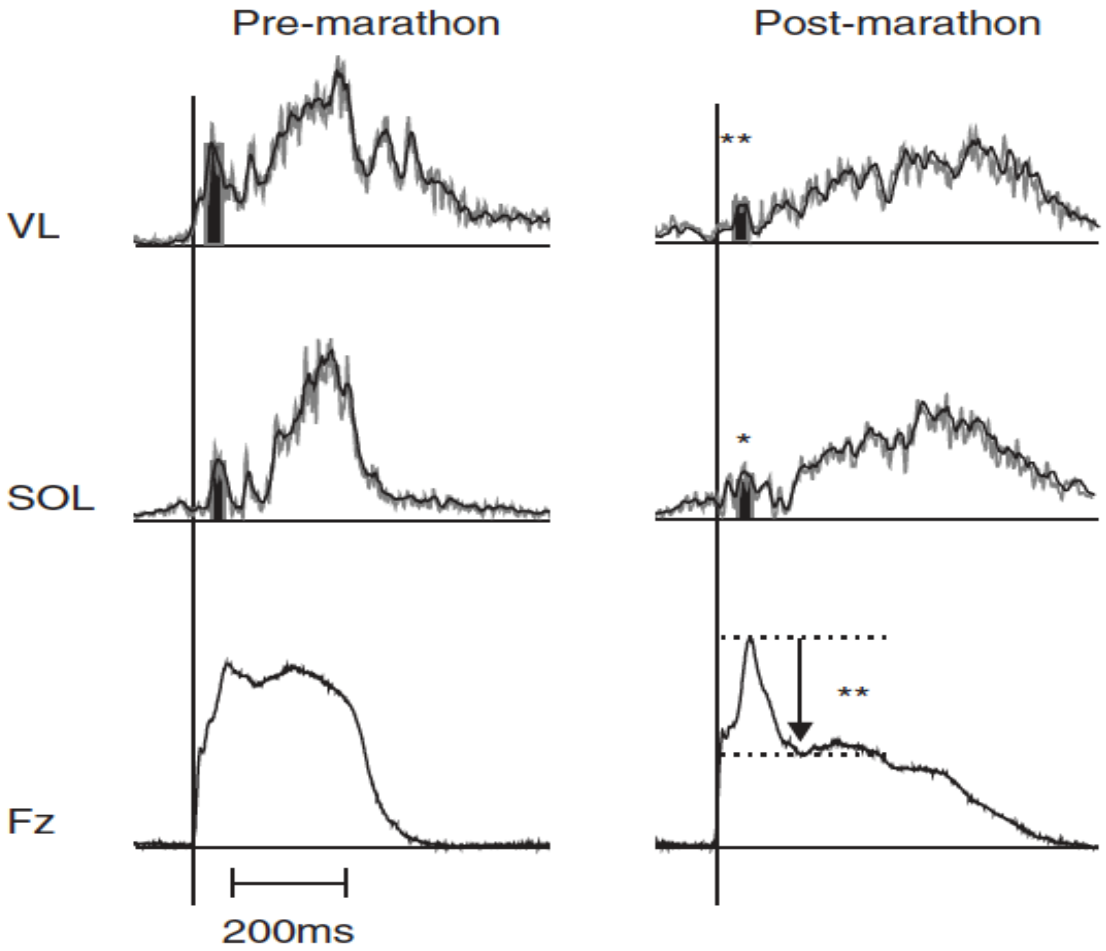
Fatigue and Exercise

Accumulation of metabolites

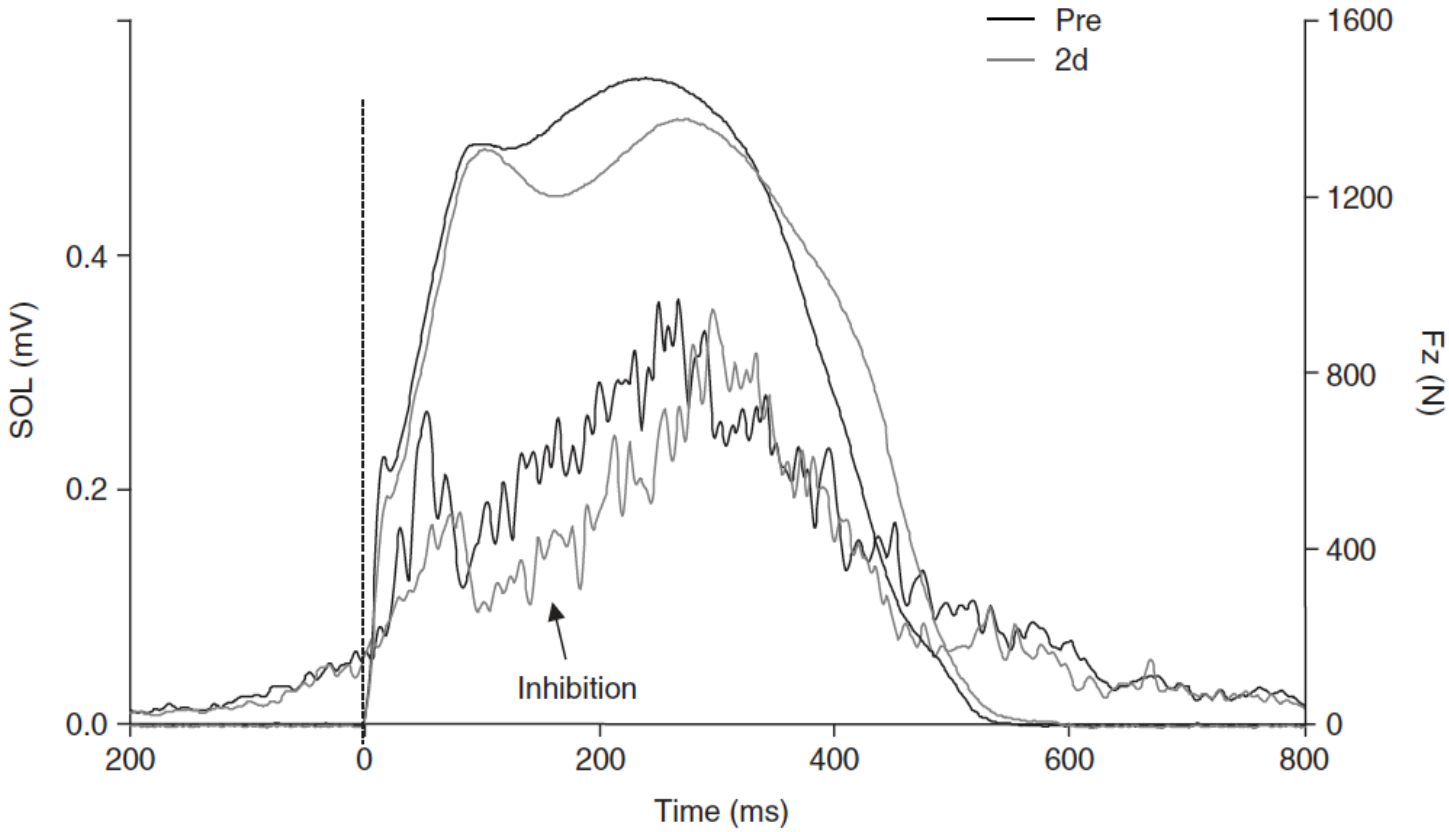


Inadequate motor commands

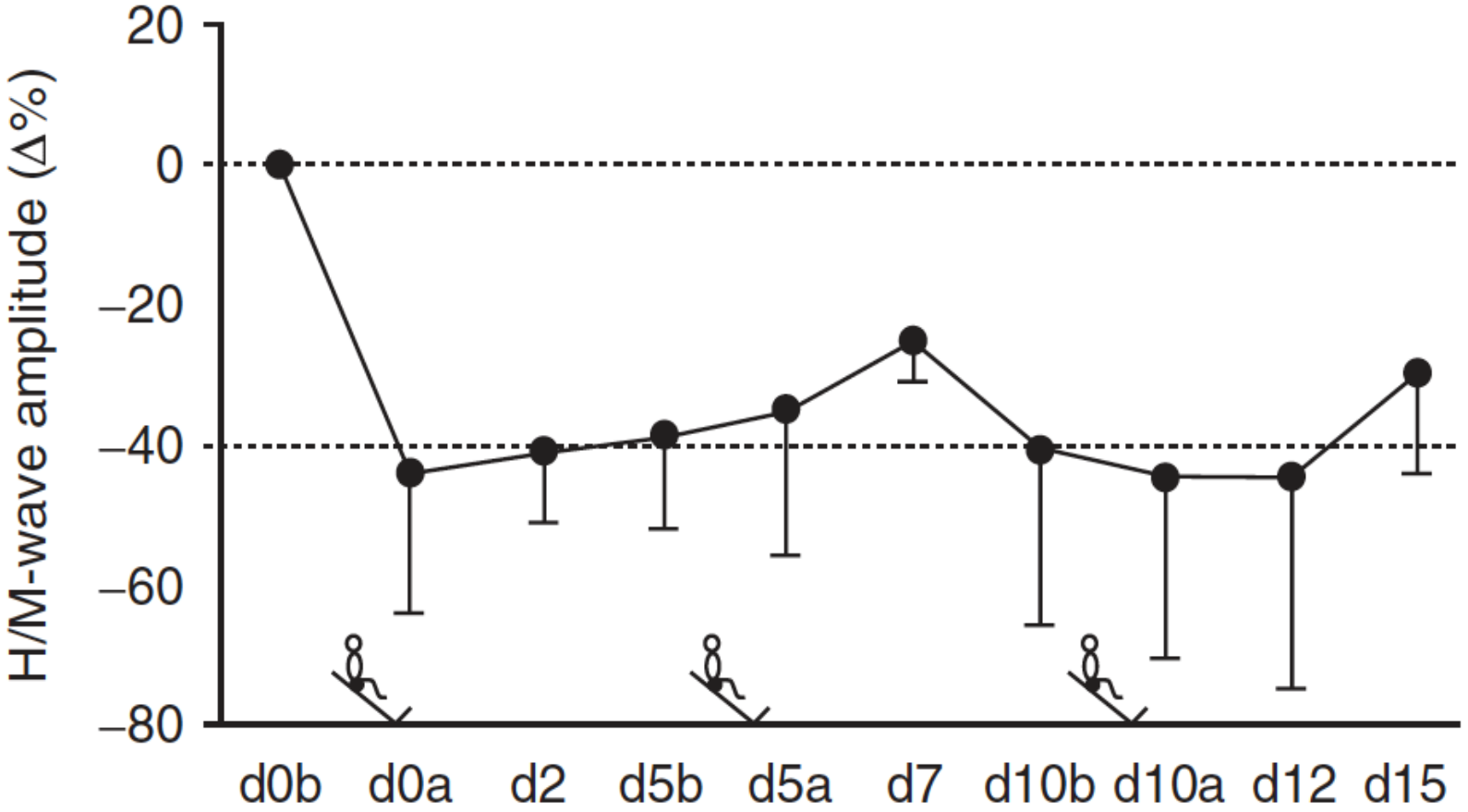




Avela et al. 1999

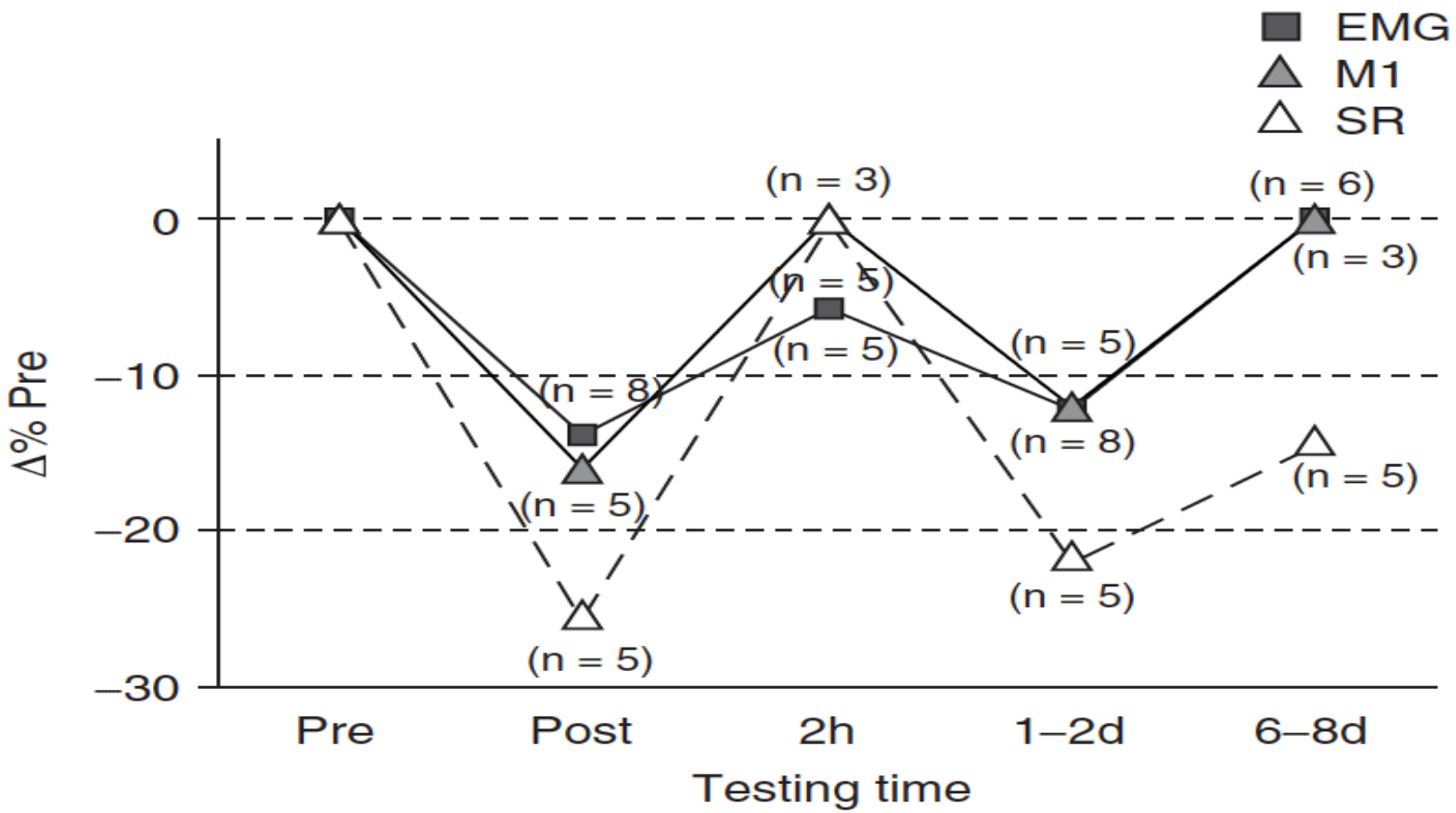


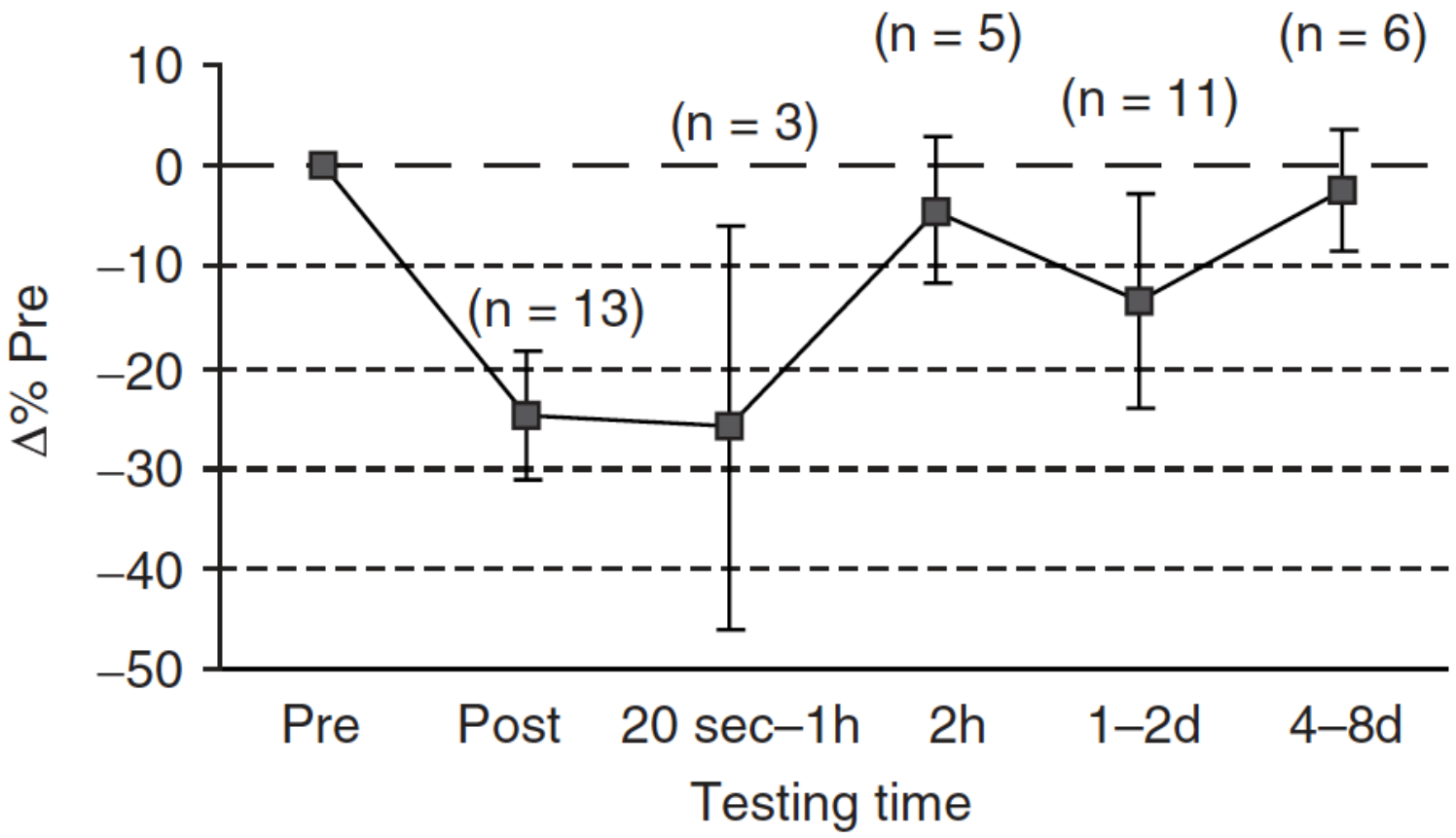
Nicoll et al. 2006

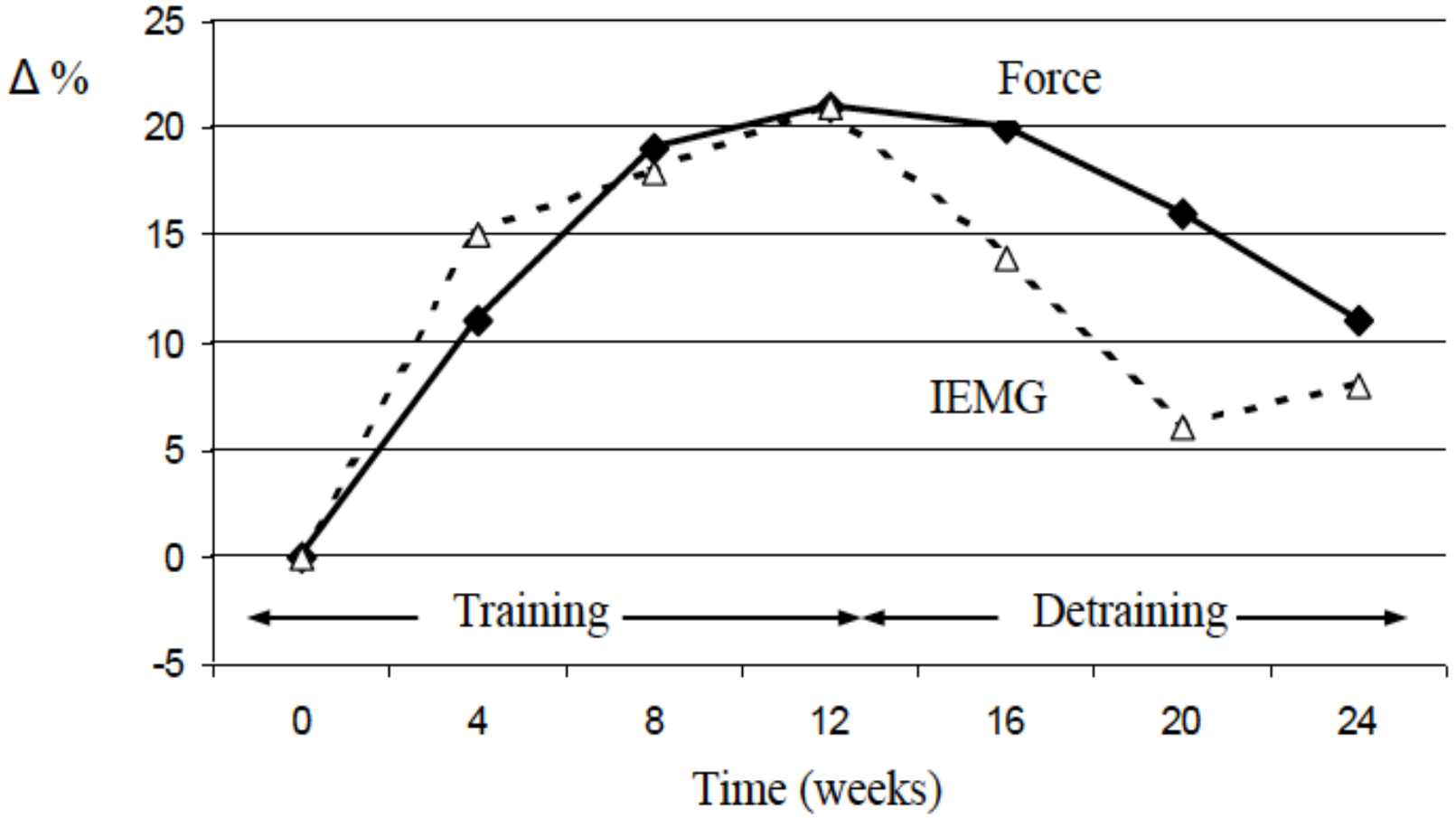


Nicoll et al. 1996

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Ermüdung*




(n = 5)
(n = 6)
(n = 11)
(n = 3)
(n = 13)
10
0
–10
–20
–30
–40
–50
Δ% Pre
Pre
Post
20 sec–1h
2h
1–2d
4–8d
Testing time



Hakkinen et al. 1983

Funktionsweise des Nervensystems in Zusammenhang mit hoch explosiven Belastungen- *Fazit*

- neuronale Faktoren (mit-) ausschlaggebend
- Schnelle Anpassungen im Nervensystem
- Ermüdung senkt neuronale Aktivität
- Leistung kann mehrere Tage beeinträchtigt sein

Kontakt: benedikt.lauber@sport.uni-freiburg.de

Vielen Dank für die Aufmerksamkeit!!!