Overview di effetti dell'allenamento eccentrico *vs.* concentrico

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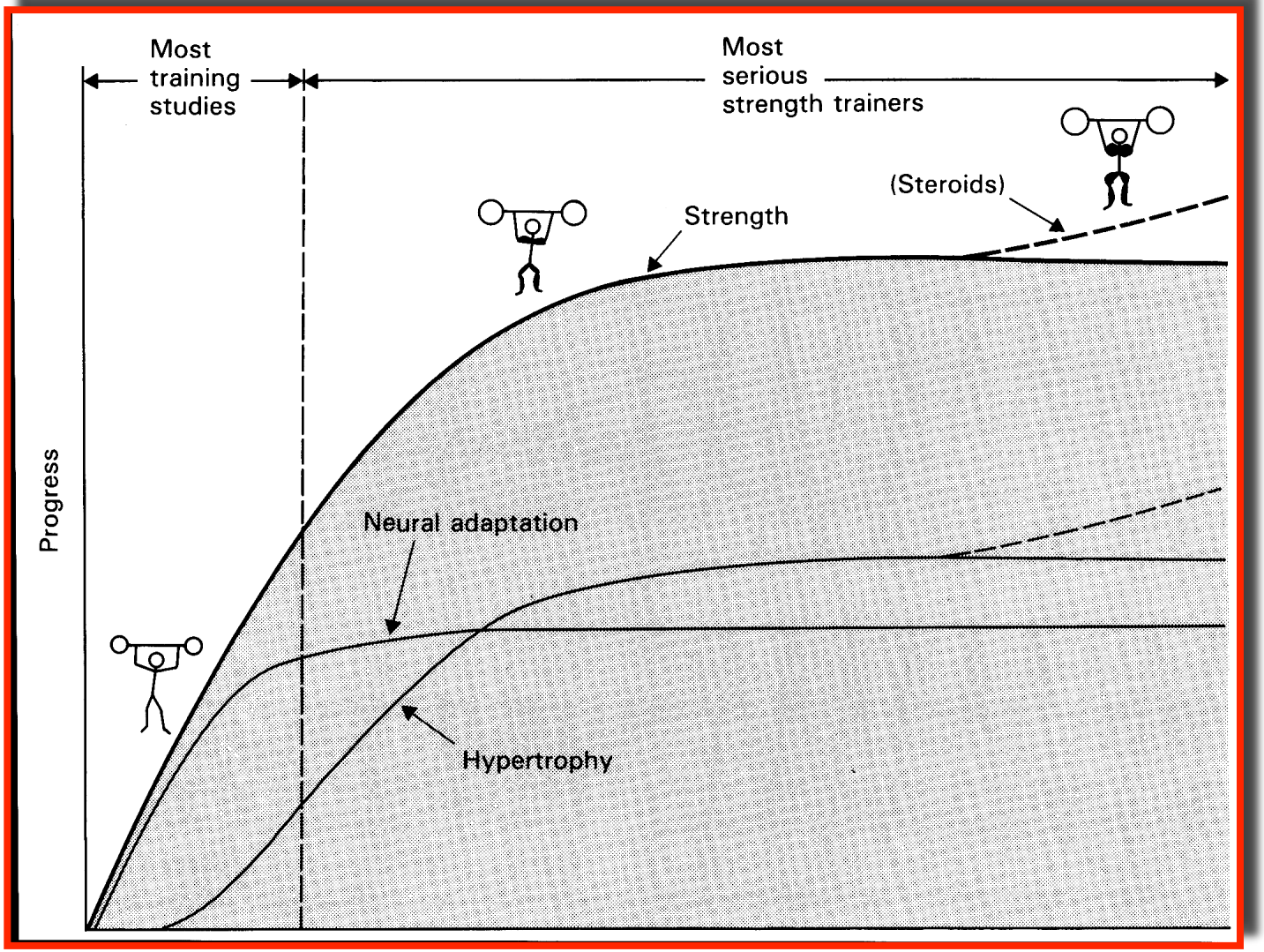
Strength training

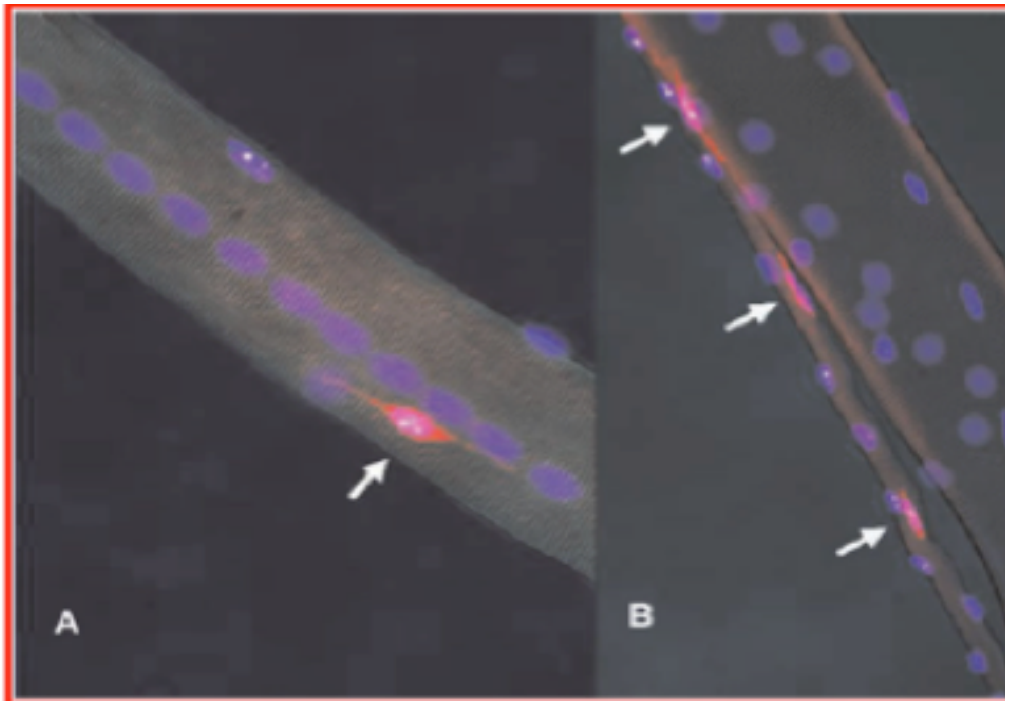


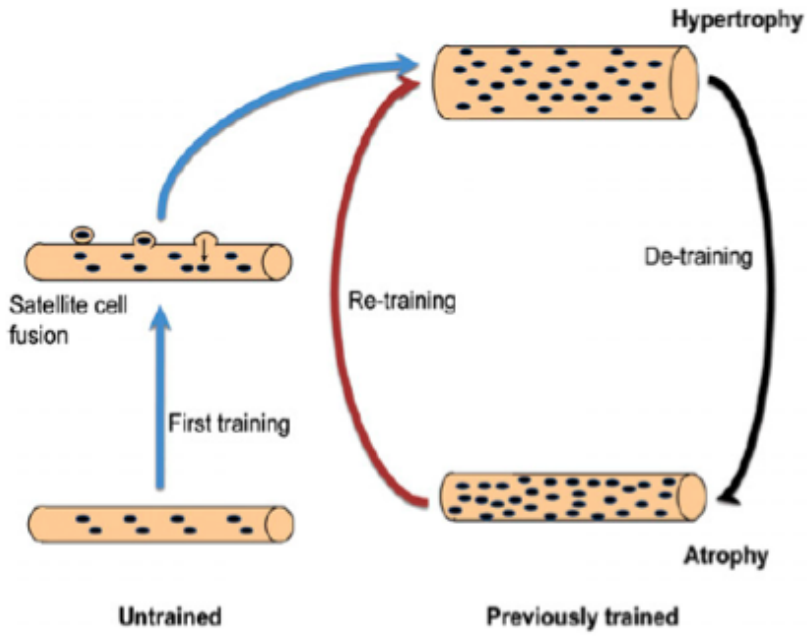
From Narici & Franchi, Scienza & Sport 2012

Factors influencing muscle strength

- Muscle Cross Sectional Area (CSA) (Hypertrophy)
- Muscle architecture
- Neural control
- Muscle length and joint angle
- Velocity

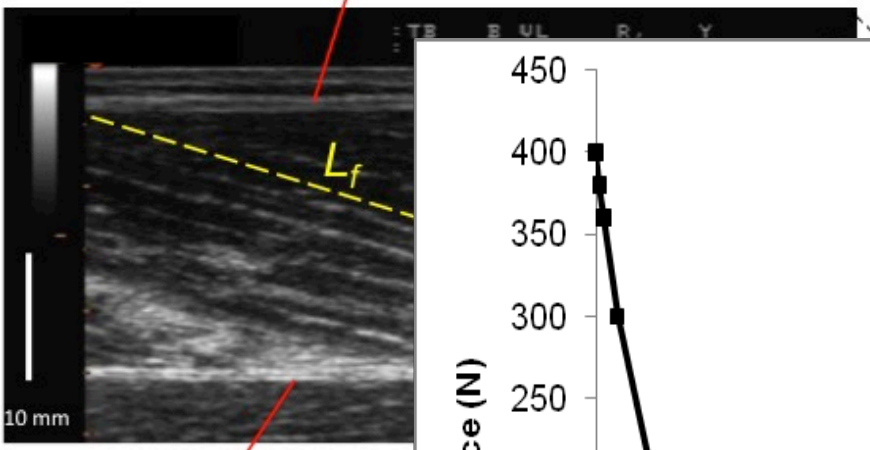
Mechanisms of hypertrophy: satellite cells



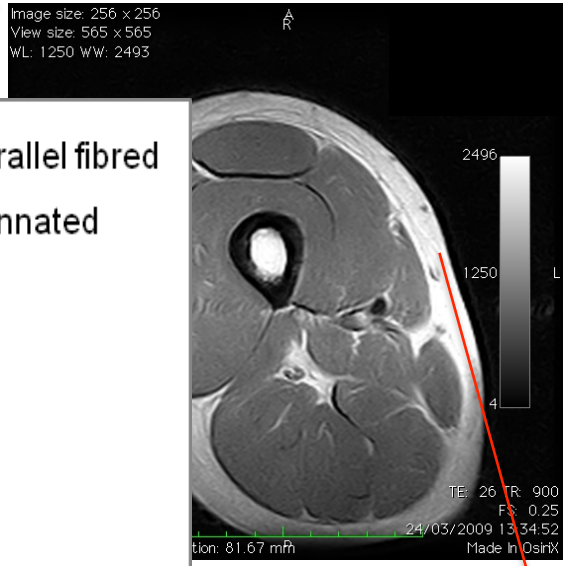


From Bruusgaard et al. 2009

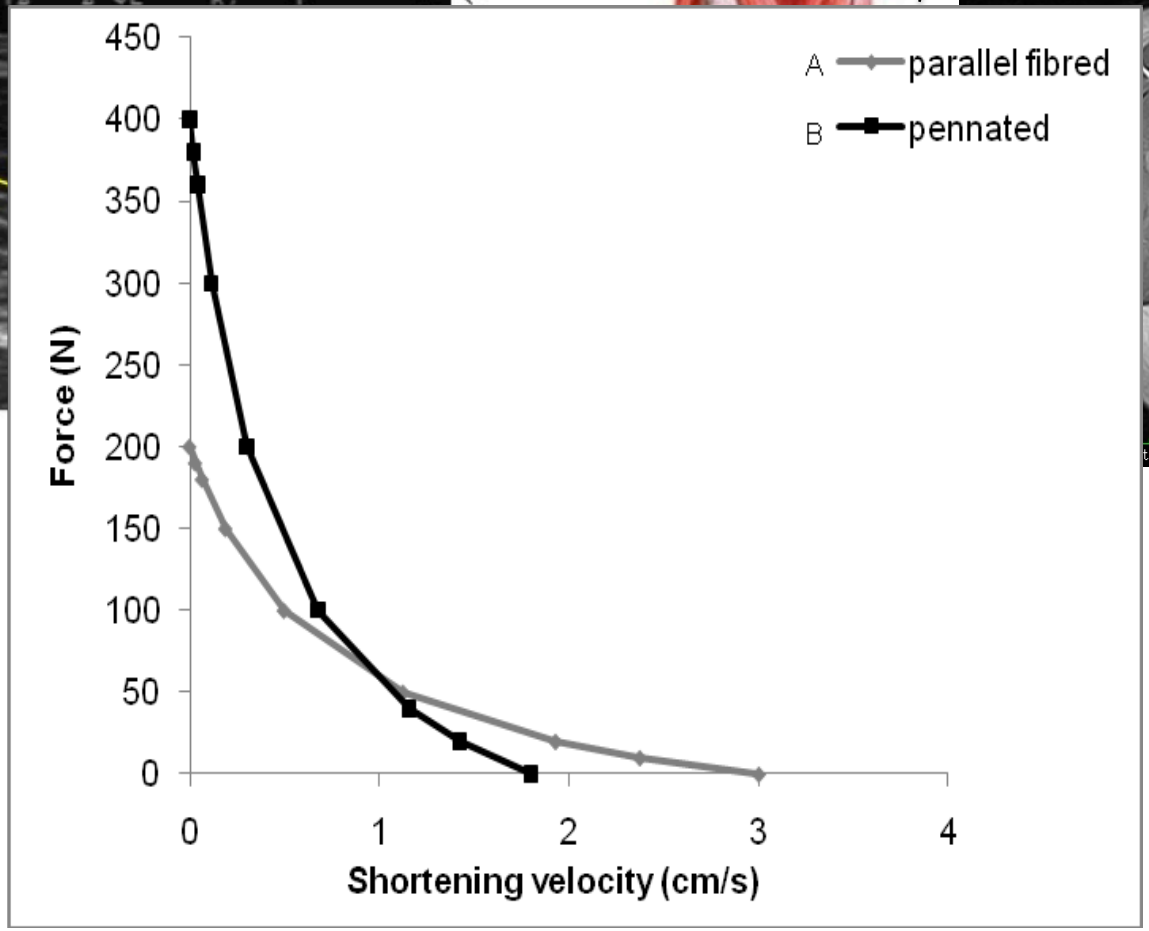
Muscle morphology and architecture



anterior



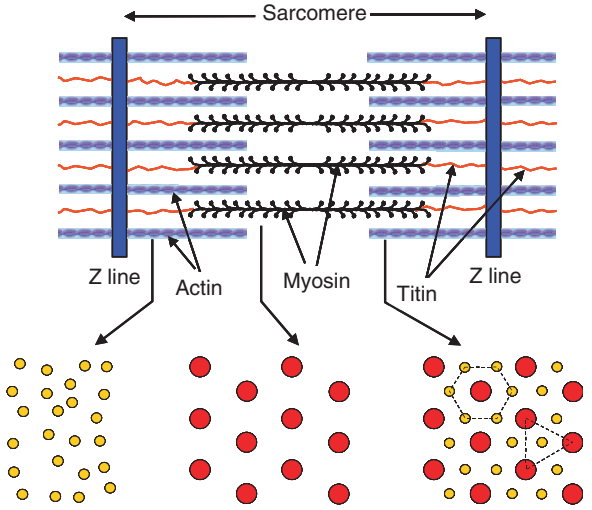
medial



Eccentric and *Concentric* contractions

- Main components of RET
- Completely different types of contraction
- Different production of muscle force
- Differential muscle adaptations in response to training

Concentric *vs.* Eccentric



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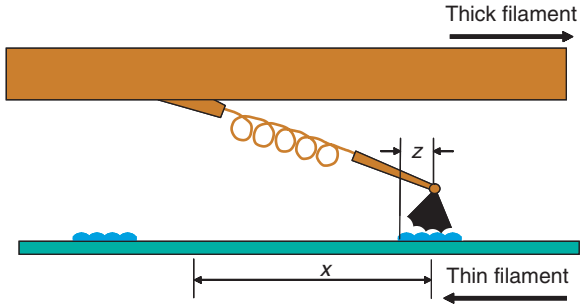

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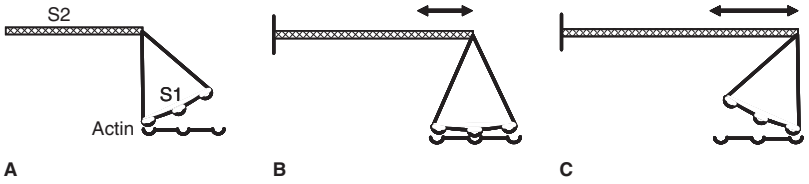

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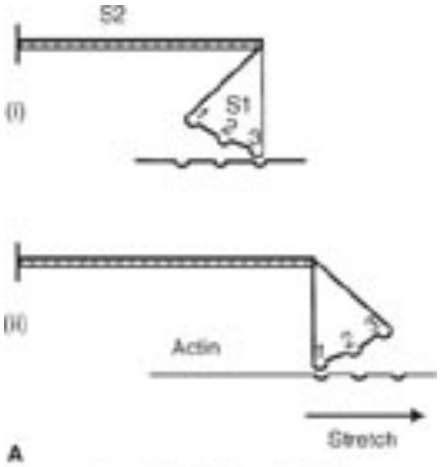

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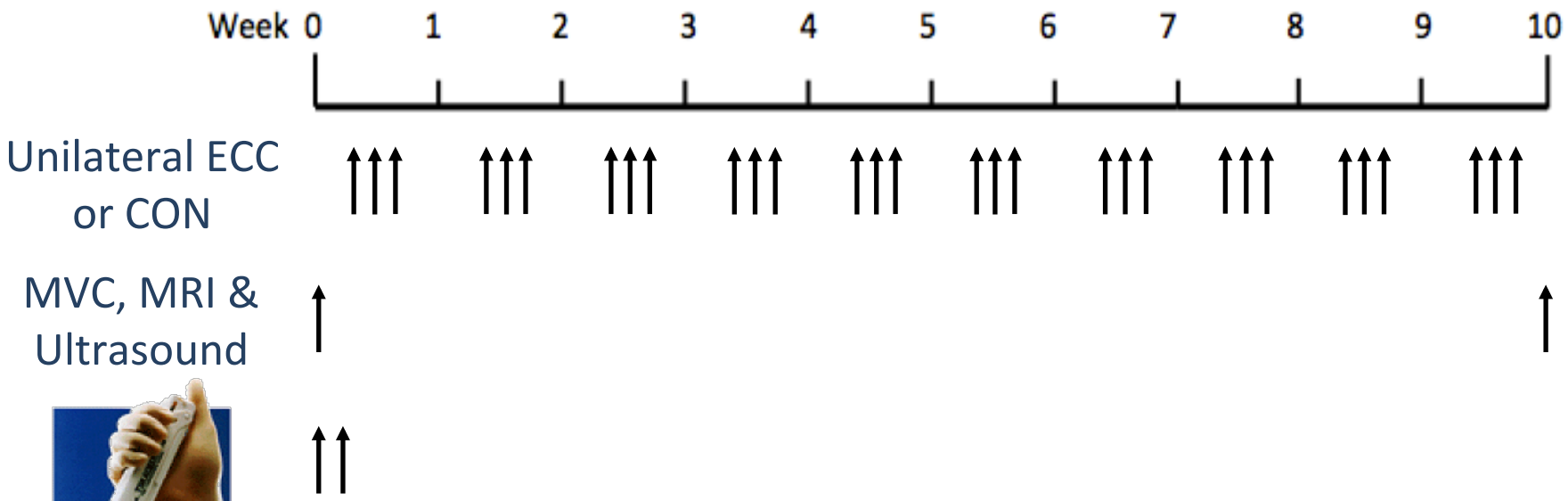
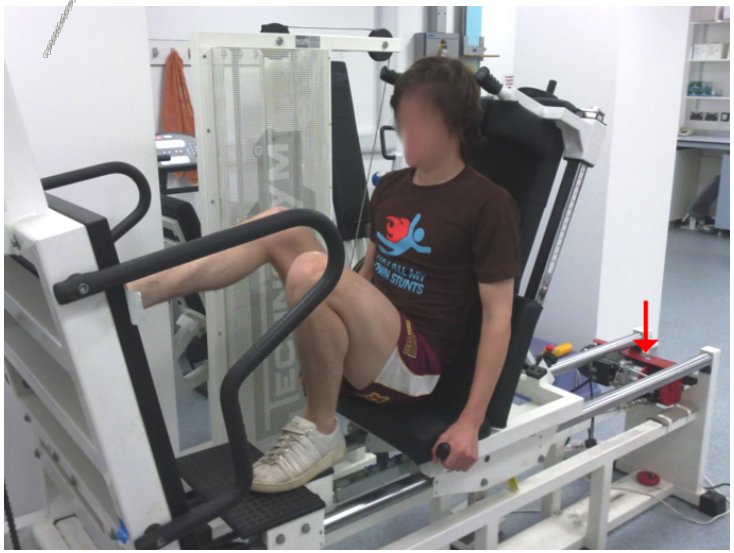
Jones et al. Skeletal Muscle from molecules to movement, 2004

STUDY DESIGN

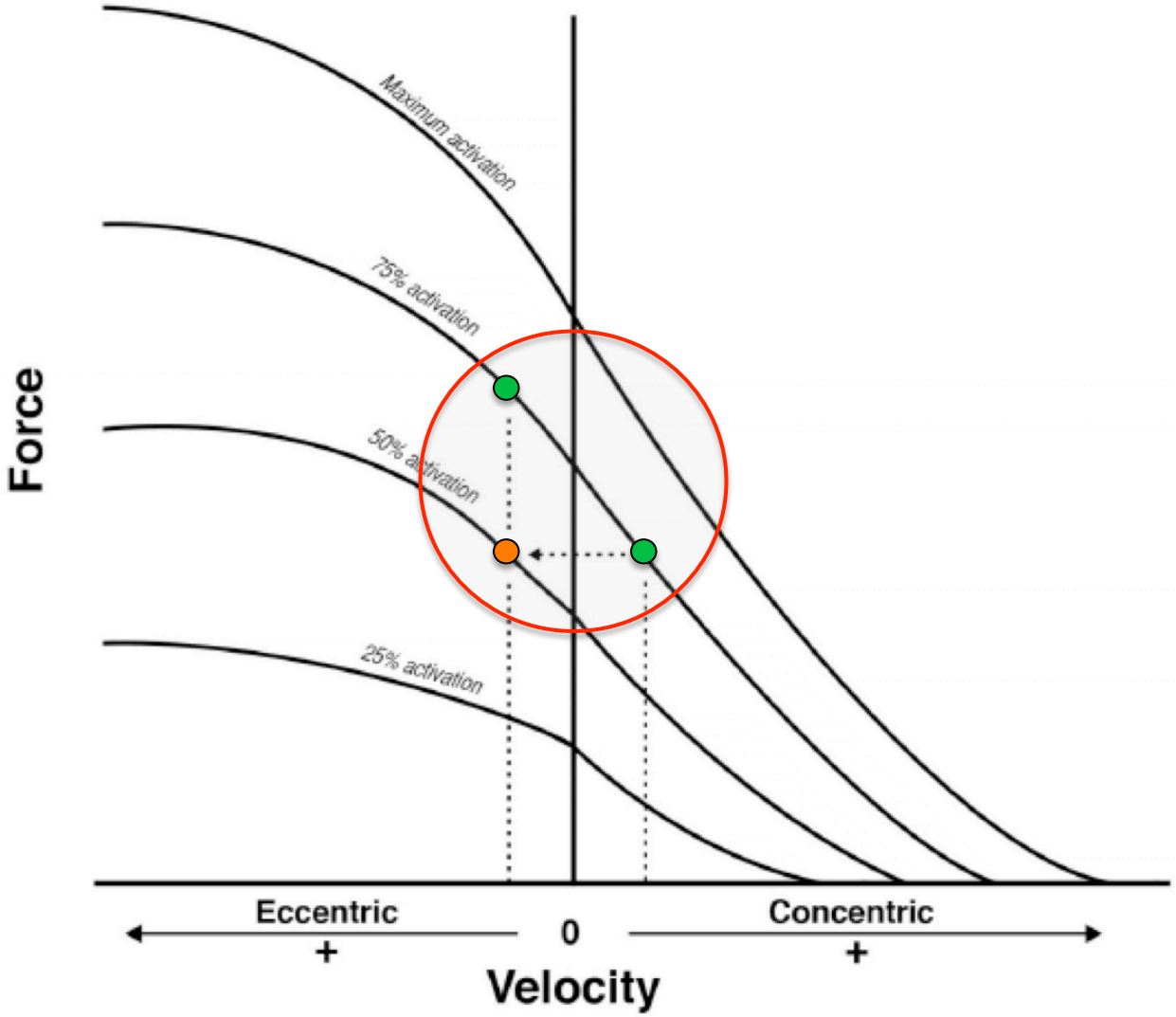


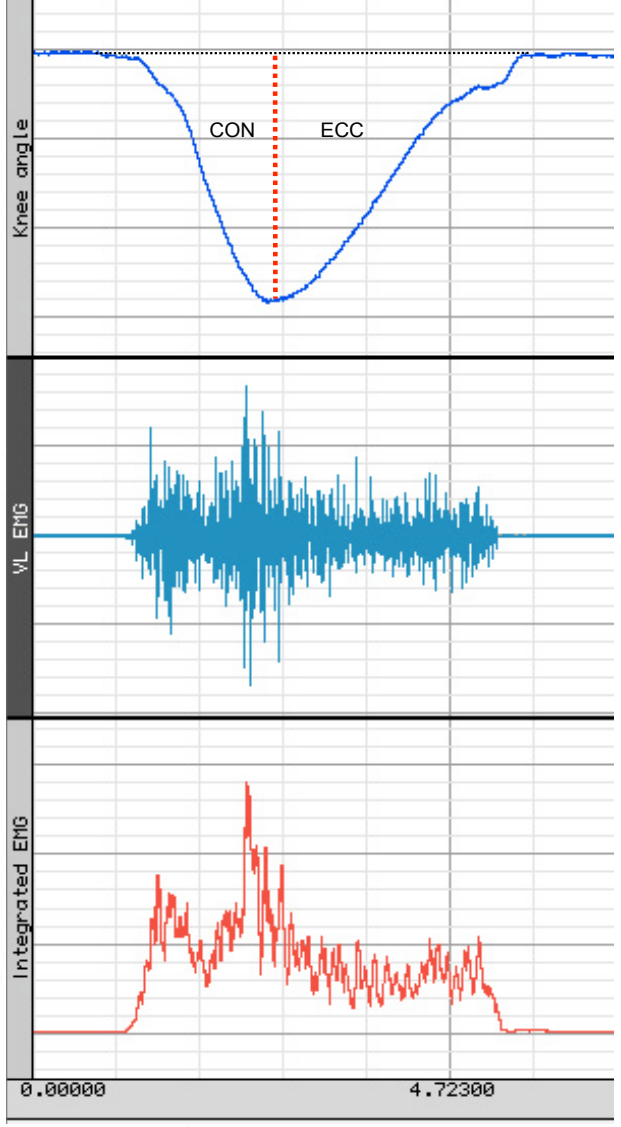


12 healthy young males (25 ± 3 y.o.)
2 training groups: CON vs. ECC

Training: 4 series of 8-10 reps at 80% of either CON or ECC 1RM, 3 times per week for 10 weeks

Muscle biopsies collected at 30 mins after a single ECC or CON training session

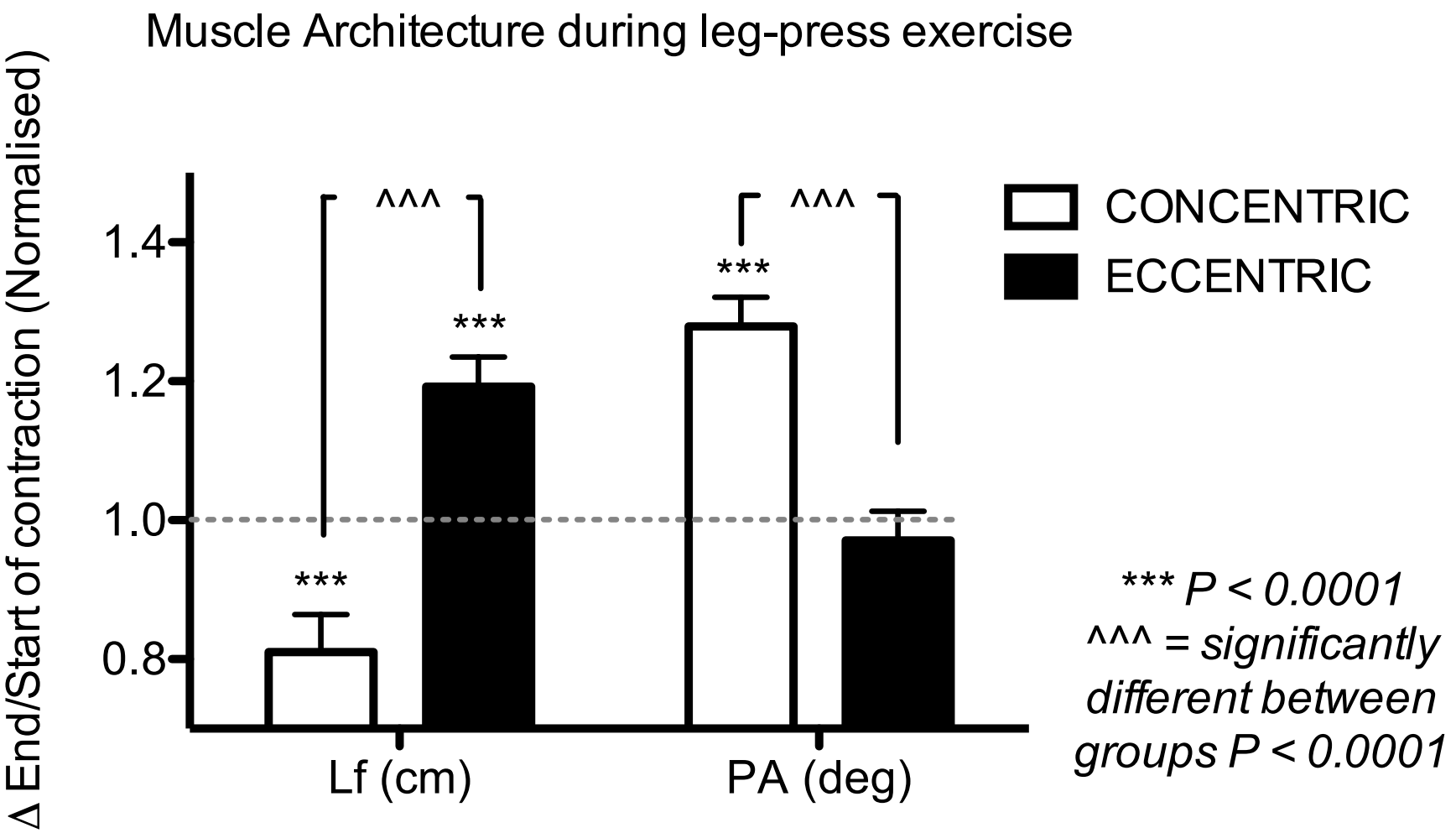




	1RM (kg) conc	1RM (kg) ecc	EMG (mV) conc phase	EMG (mV) ecc phase
MEAN	**192**	**233**	**0.33**	**0.31**
S.D.	**± 40**	**± 32**	**± 0.118**	**± 0.095**

Reeves, Maganaris, Longo & Narici. 2009, Exp Physiol

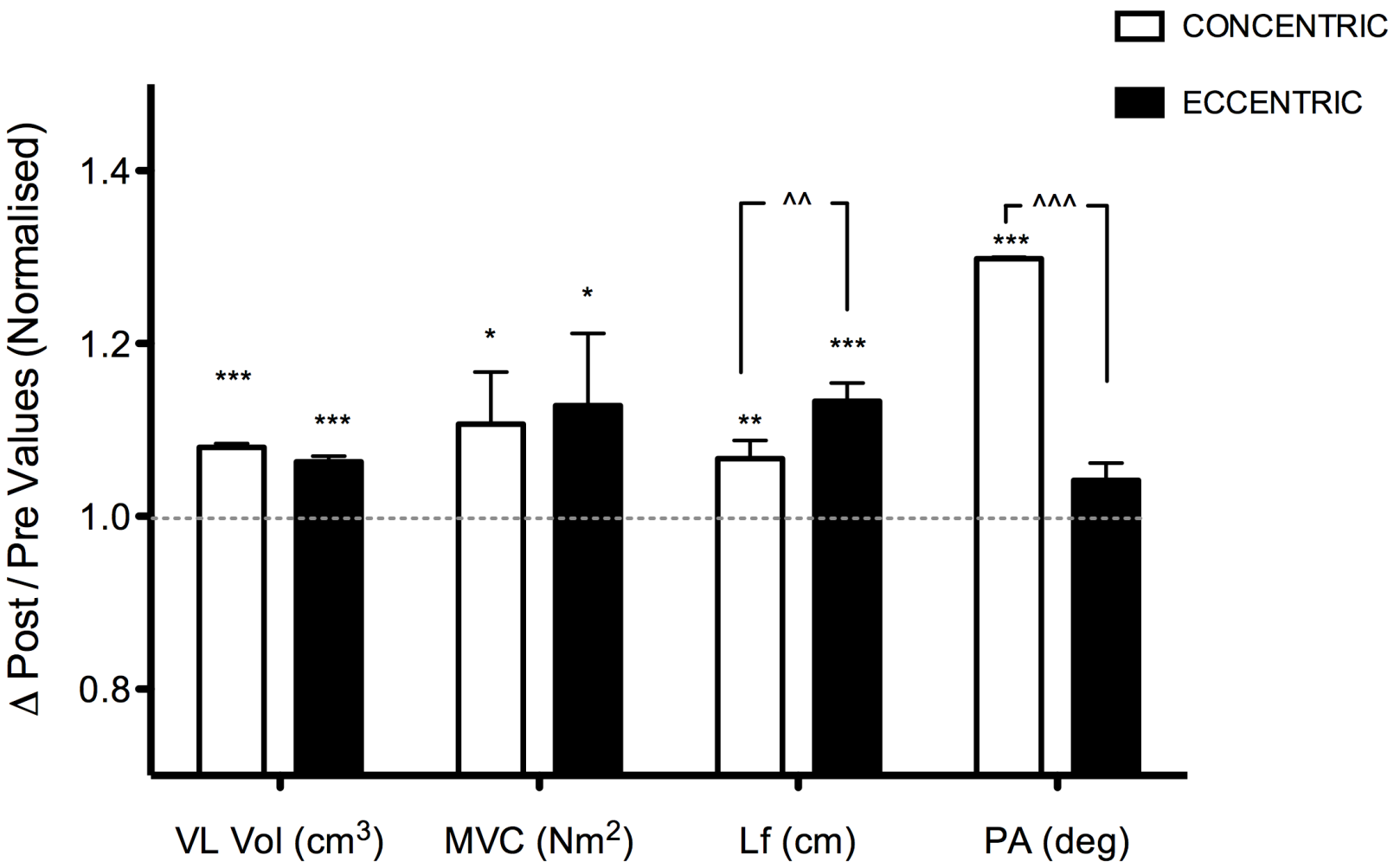
VL fascicle behaviour during CON and ECC exercise



Franchi et al. 2013, in revision

RESULTS

Morphological, functional and architectural adaptations



** P<0.05 ** P<0.001 *** P<0.0001*
^, ^^ = P < 0.05 and P < 0.01, respectively

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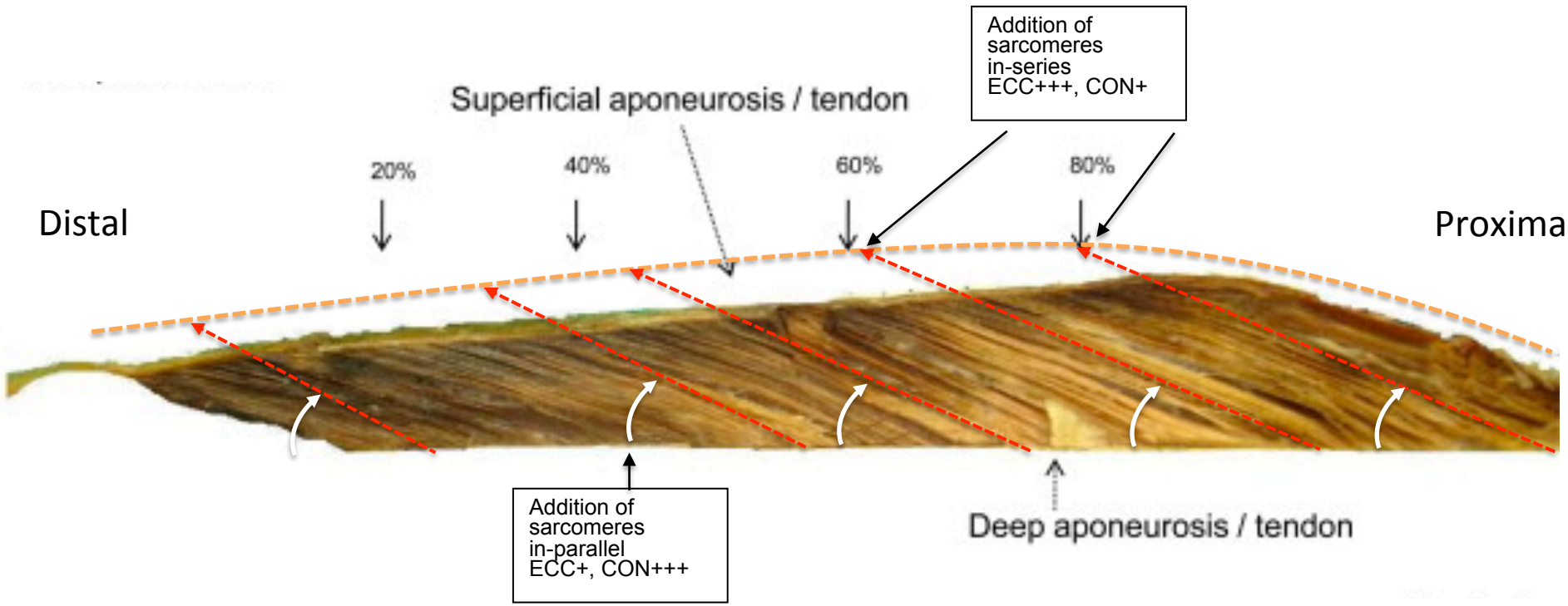
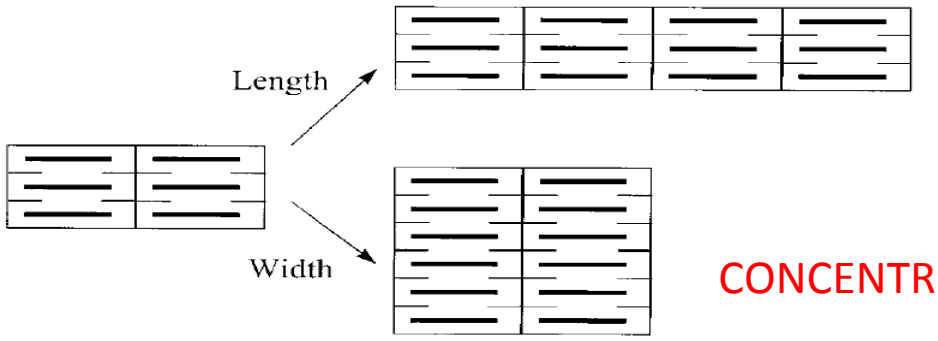
Hypertrophy of pennate muscle





ECCENTRIC

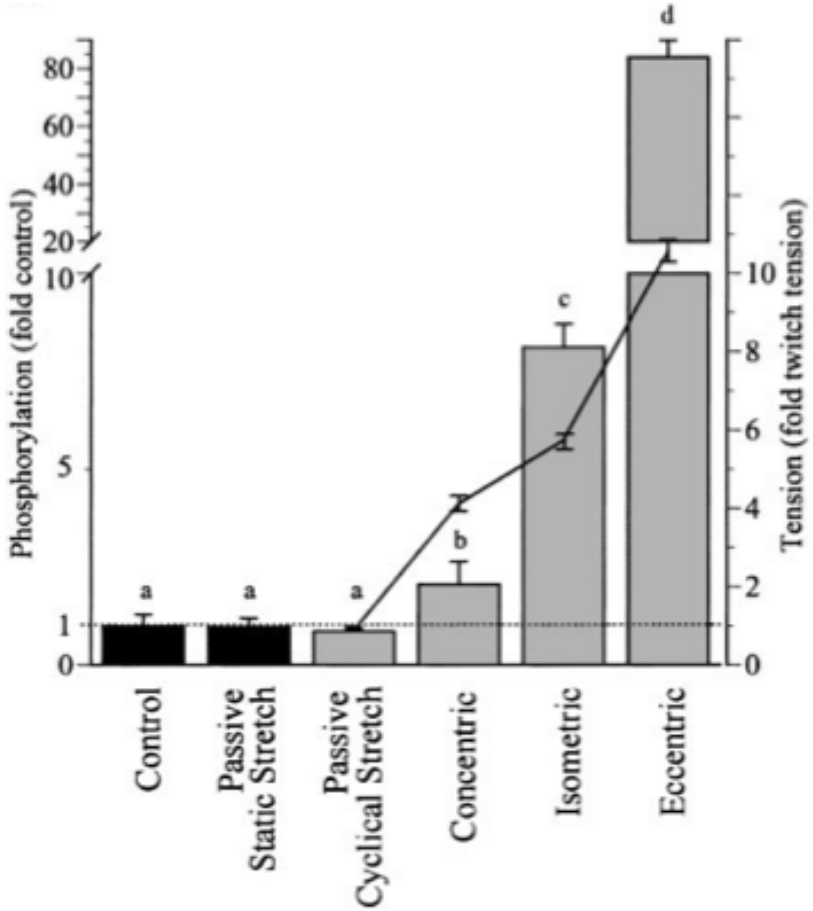
CONCENTRIC

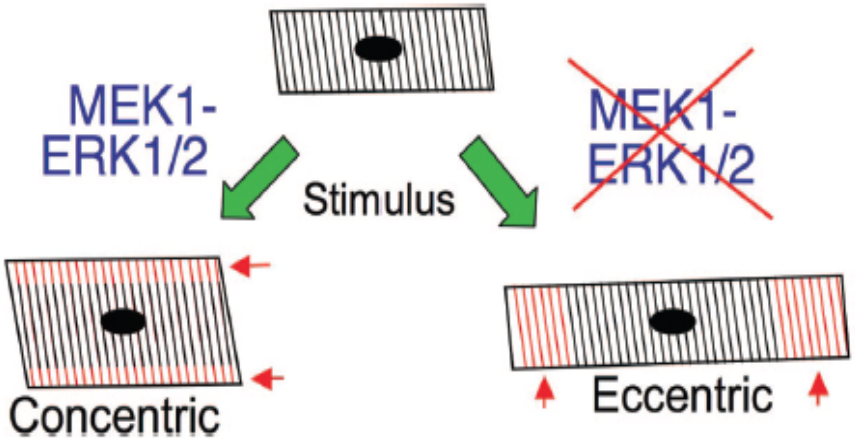
Russel B et al. *J. Appl. Physiol*. (2000) 88: 1127–1132

Insight into skeletal muscle mechanotransduction: MAPK activation is quantitatively related to tension

Louis C. Martineau and Phillip F. Gardiner

J Appl Physiol 91:693-702, 2001. ;

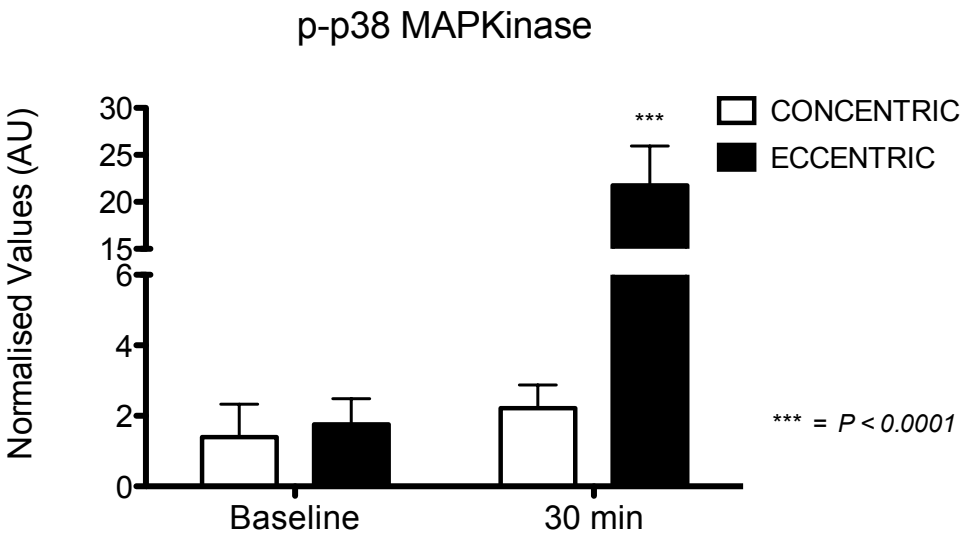


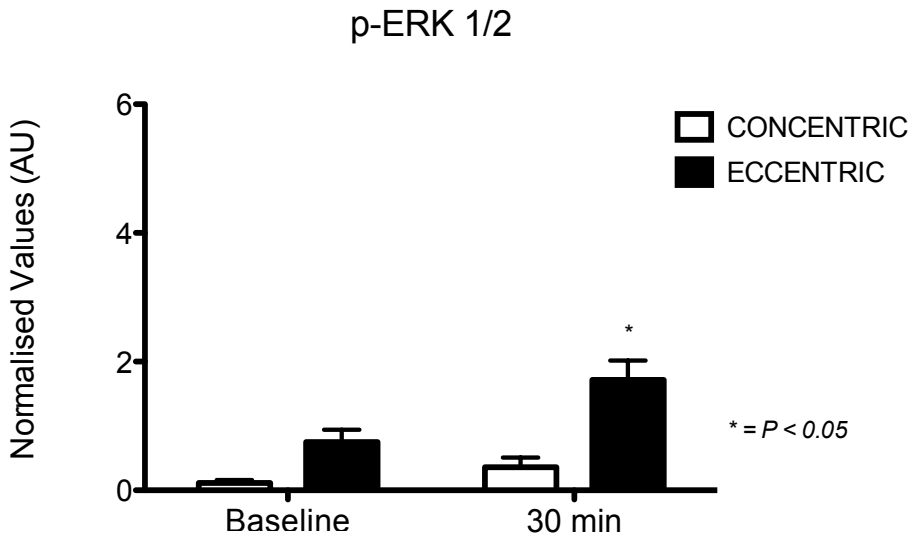


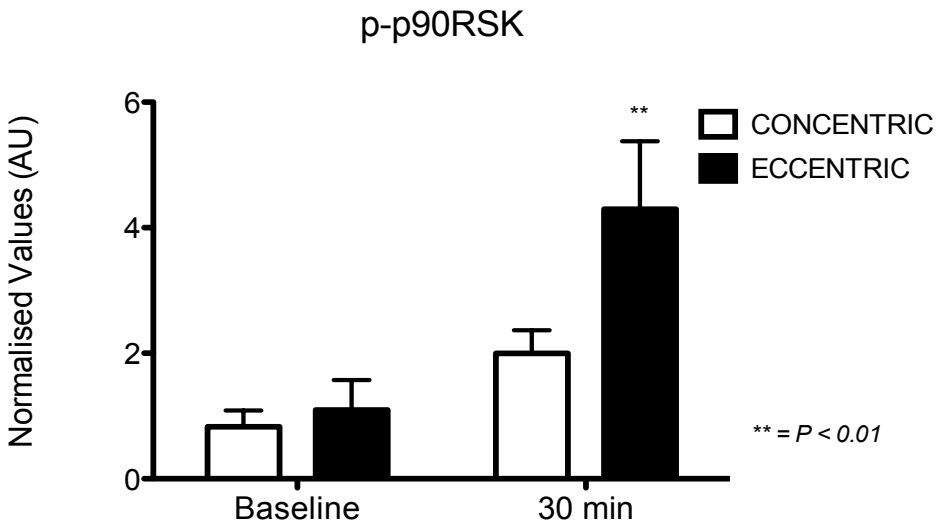
Kehat et al. *Circ Res*. 2011: 108: 176-183

RESULTS

Molecular responses to a single CON vs. ECC training session







Franchi et al. 2013, in revision

SUMMARY

	ECC	CON
VL VOLUME	++	++
MVC	++	++
Lf	+++	+
PA	+	+++
p-p38	+++	X
p-ERK 1/2	+	X
p-p90RSK	++	X

Franchi et al. 2013, in revision

CONCLUSIONS

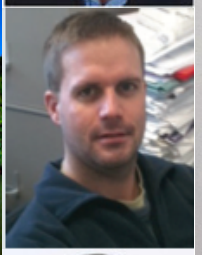
- Distinct fascicle behaviour during ECC and CON contraction
- Pure ECC and CON training produced similar gains in muscle mass and strength…
- …but **through distinctly different architectural adaptations**
- Differential acute molecular responses to ECC vs. CON exercise (MAPK activation)

Distinct architectural and molecular adaptations may be linked as a result of contraction-specific responses to ECC vs. CON RET

What's next?

- Eccentric/Concentric and Sarcopenia
- Stretch-shortening cycle (SCC, Plyometrics)
- Protein turnover in response (anabolic response) to specific training protocols (measured by stable isotope tracing techniques)

Acknowledgements



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Dr A Selby, UoN

Manchester Metropolitan University

The University of Nottingham

Neural control

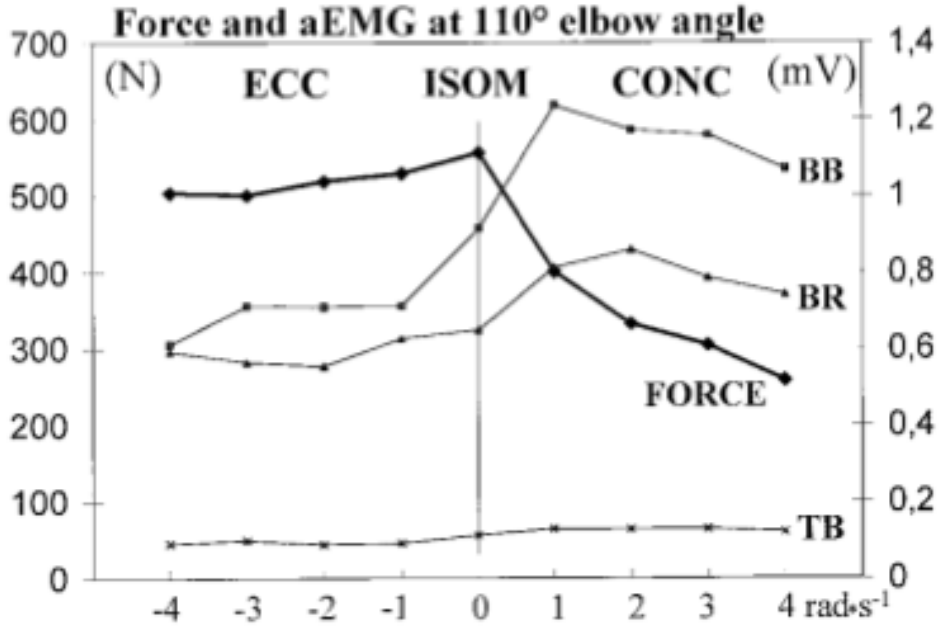
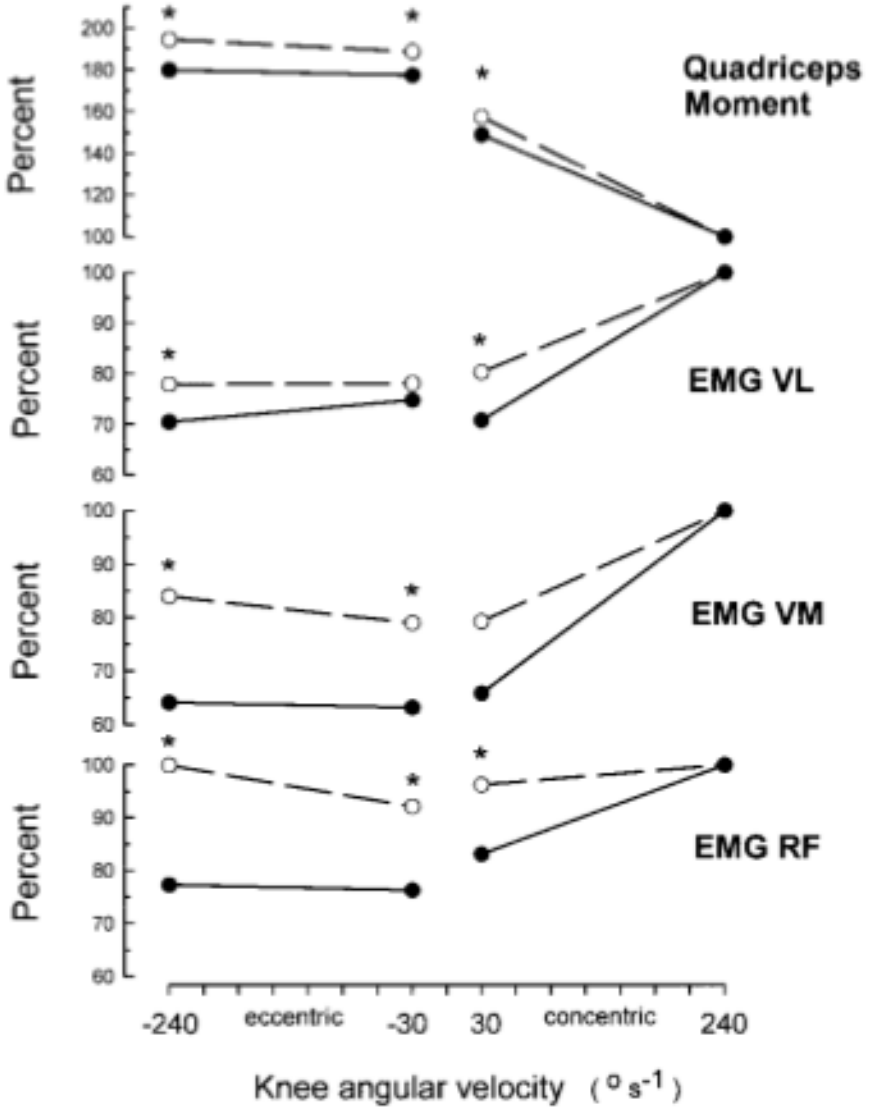


Figure 5—Force and aEMG of biceps brachii (BB), brachioradialis (BR) and triceps brachii (TB) with different movement velocities in eccentric, isometric and concentric action at elbow angle 110°.

From Komi et al. 2000



From Aagaard et al. 2000