

# RETHINKING THE EFFECTS OF STRETCHING

The latest research on the merits  
and misconceptions of stretching



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## COURSE OUTLINE



- Definitions
- Types of stretching
- How it works
- Tendons
- Summary
- Eccentrics
- Muscle architecture
- Performance & injury
- Summary

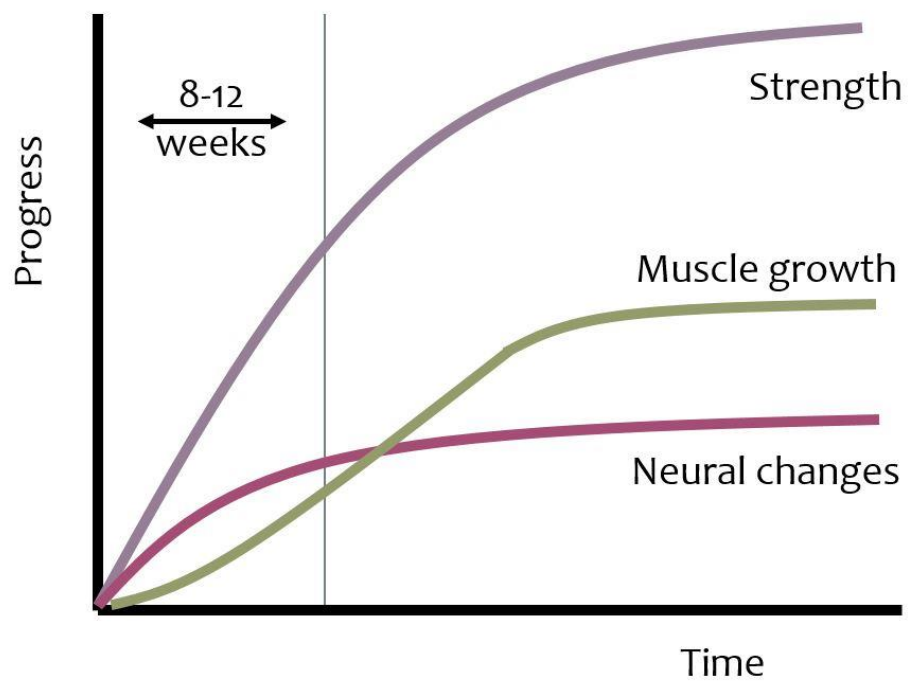
# FITNESS AND HEALTH

Component of Fitness	Example
Cardiorespiratory fitness	Distance running
Muscular strength and endurance	Weight lifting
Body composition	Body fat percentage
Flexibility	Stretching
Neuromuscular fitness	Yoga



# FLEXIBILITY TRAINING

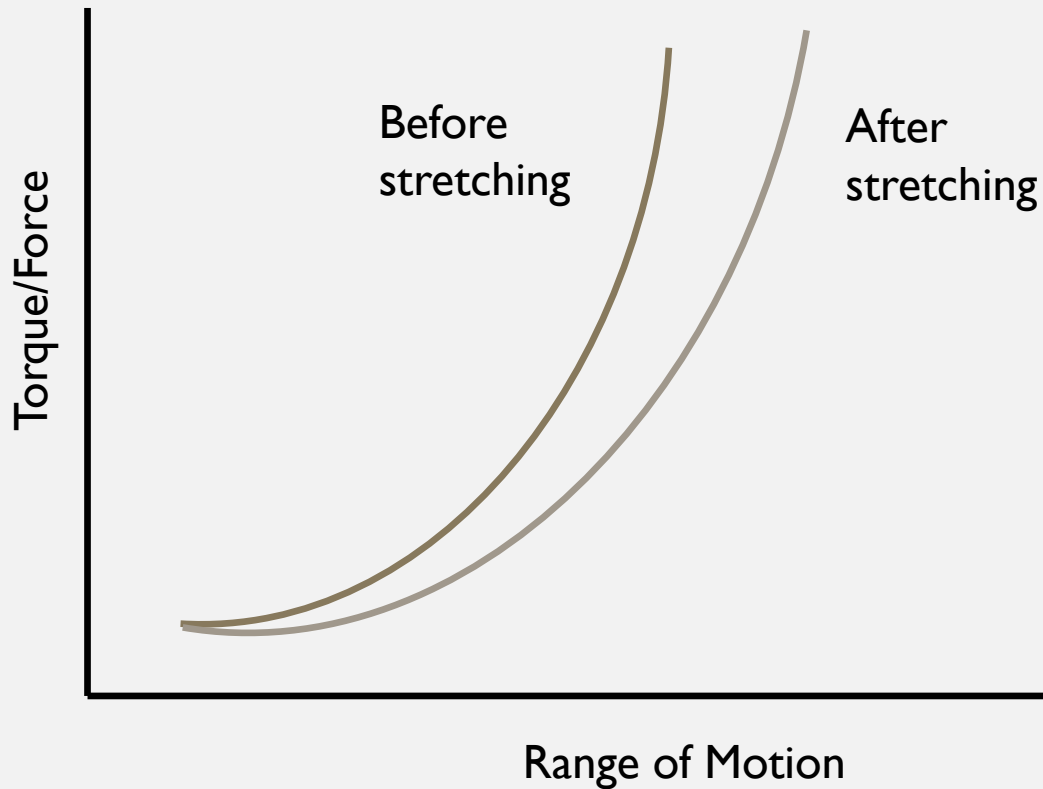
Stretching Techniques	Description
Ballistic	Bouncing movements using momentum to increase range
Dynamic	Slow, repeated movements progressively increasing range
Static	Holding a position for length of time, usually passive
Proprioceptive neuromuscular facilitation (PNF)	Combinations of muscular contractions and passive movements through ROM



RESISTED  
STRETCHING

# HOW DOES FLEXIBILITY TRAINING WORK?

# PASSIVE RESISTANCE TORQUE





STRETCH  
TOLERANCE

SENSORY THEORY EMERGED  
DUE TO NATURE OF  
HUMAN TRIALS

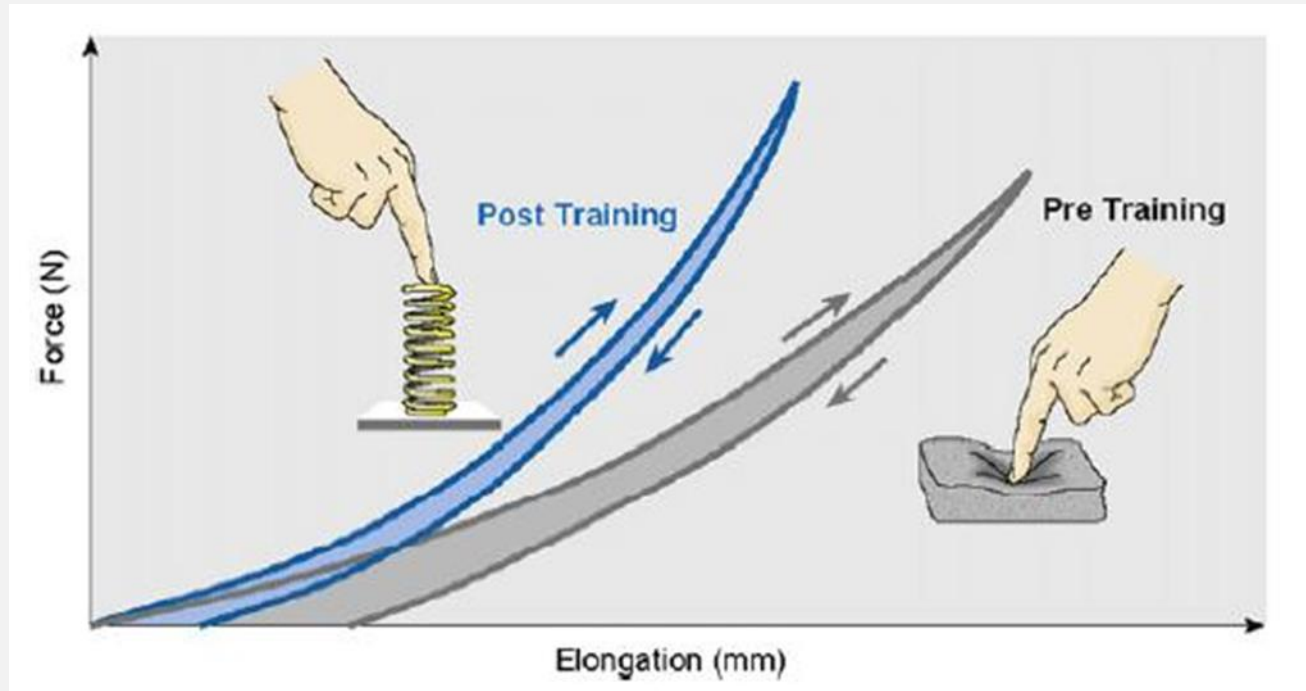
Magnusson 1996b, Weppeler 2010



# ANESTHESIA



# TENDON ADAPTATIONS



# LOADING TENDONS



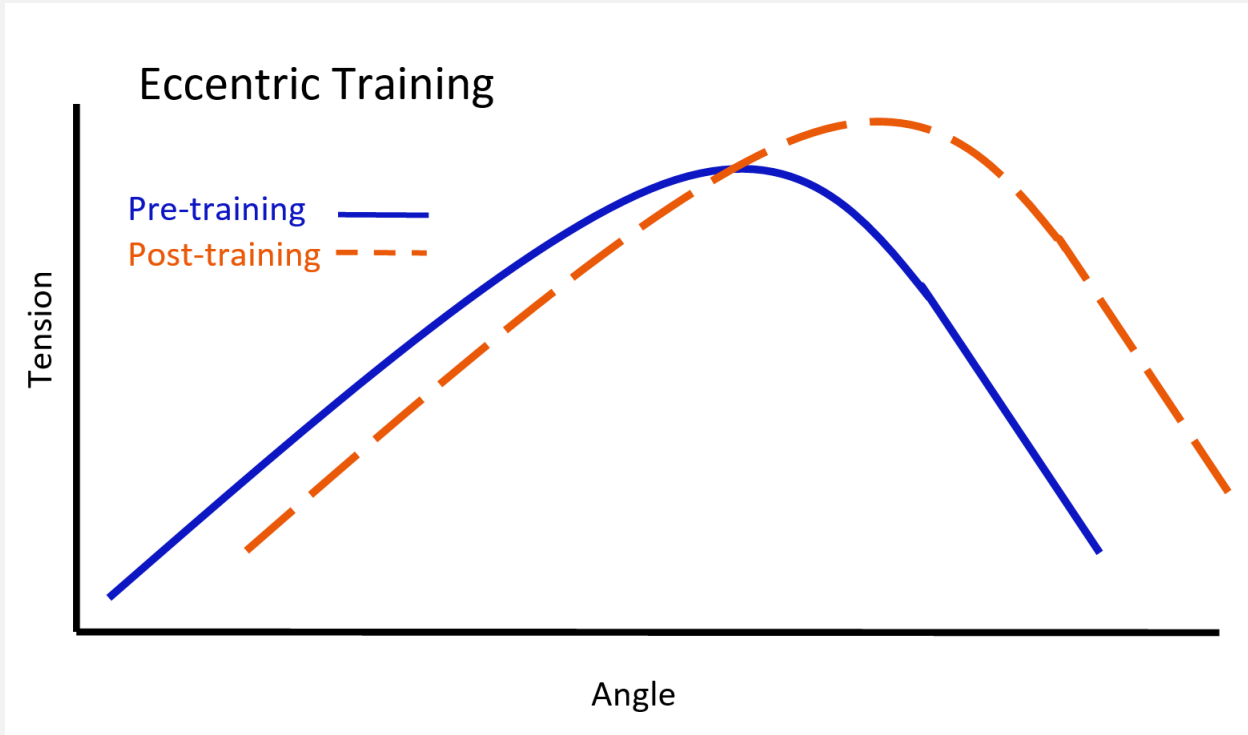
## SUMMARY

- Stretching can decrease MTU passive resistance to torque
- Strength training increases passive resistance to torque
- Strength training increases tendon stiffness
- Stretching may decrease tendon stiffness
- Stretching may **increase** efficiency (hysteresis curve)

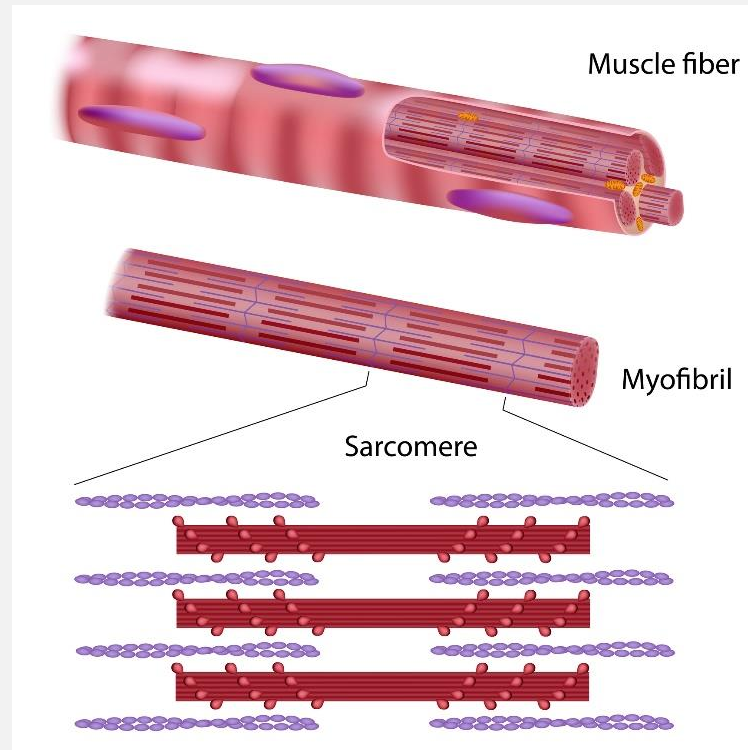
ECENTRIC  
TRAINING



# LENGTH TENSION CURVE



# SARCOMEROGENESIS



# MUSCLE ARCHITECTURE





# MUSCLE ARCHITECTURE





## RESISTANCE STRETCHING

# EFFECTS OF STRETCHING

# STRENGTH AND POWER

Duration	Performance
Less than 60 sec.	-1.1%
More than 60 sec.	-4.6%

Power	Strength
-1.3%	-4.8% *

\* Duration longer in strength data

# PERFORMANCE

Type of Stretch	Performance
Static	-3.7%
Dynamic	+1.3%
PNF	-4.4%

ROM	Performance
Short length	-10.2% *
Long length	+2.2% *

\* Static stretching

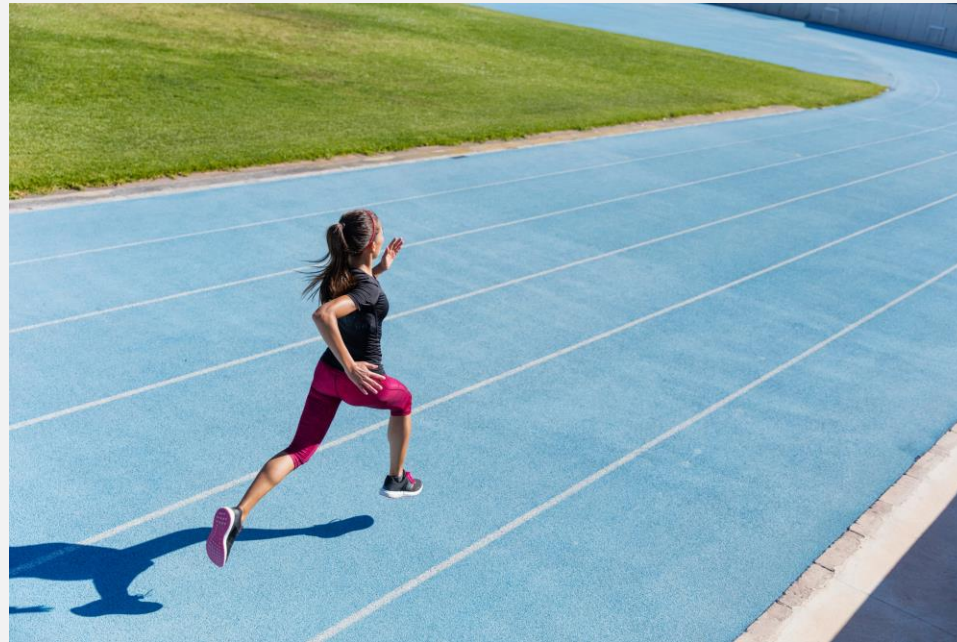
# INJURY

Type of Sport	Benefit *
Sprinting	5/6
Endurance	2/5

ROM	Benefit *
Overall injuries	2/8
Muscle strains	54%
Ankle sprains	1/5

\* Any type of stretching

## SPRINT AND VERTICAL JUMP



*“In fact, the supposition that stretching is harmful to performance has led to the removal of SS from the warm-up routines of many athletes. It may be that this kind of recommendation should be considered somewhat premature since the effects of SS prior to sports activities remain unclear.”*

# BASEBALL AND SOCCER





# SUMMARY

## MERITS

- Improved ROM
- Tendons adapt
- Eccentrics and sarcomerogenesis
- No definitive impact on performance and injury

## MISCONCEPTIONS

- Must push past ROM
- Tendons adapt
- Passive stretching and sarcomerogenesis
- Improves/diminishes performance and injury

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