Why the "strengthification" of Gen X & Baby Boomers is the greatest health challenge of the 21st Century

Presenter: Sean Wilson

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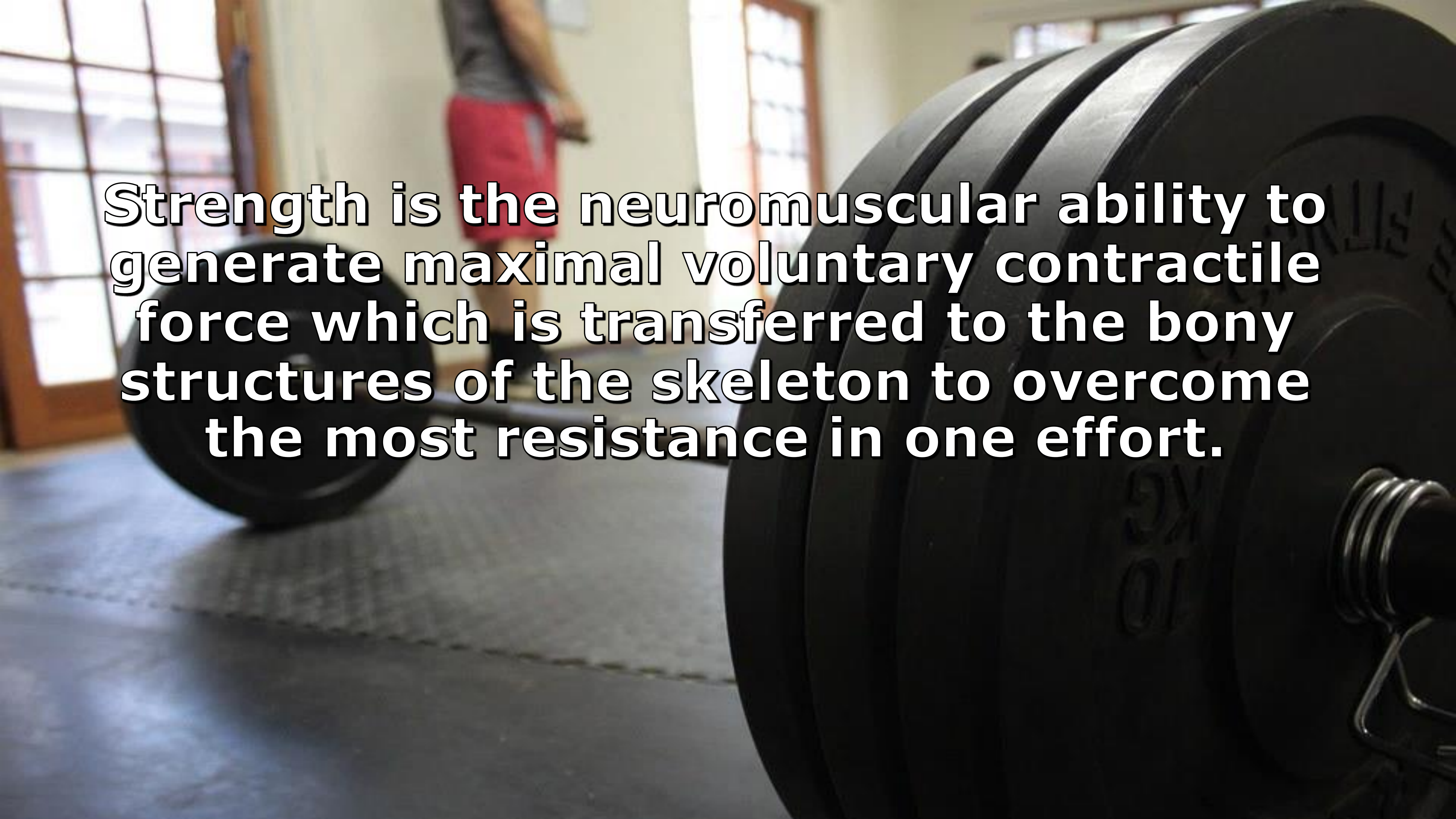
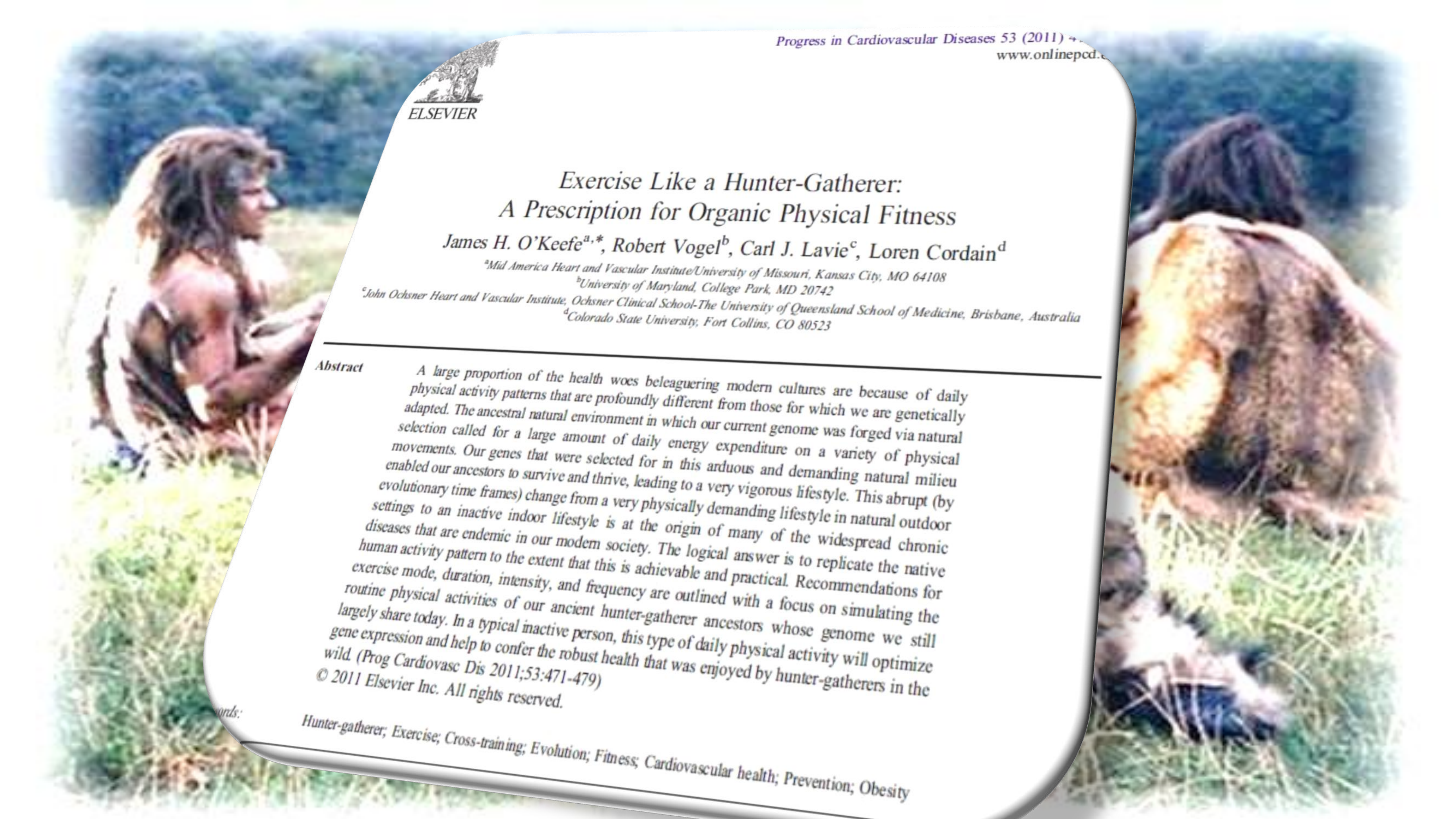
Overview


Strength?



Strength is the neuromuscular ability to generate maximal voluntary contractile force which is transferred to the bony structures of the skeleton to overcome the most resistance in one effort.

Strength: an ancestral perspective


Progress in Cardiovascular Diseases 53 (2011) 4…
www.onlinepcd.c…

ELSEVIER

Exercise Like a Hunter-Gatherer: A Prescription for Organic Physical Fitness

James H. O'Keefe[a,*], Robert Vogel[b], Carl J. Lavie[c], Loren Cordain[d]
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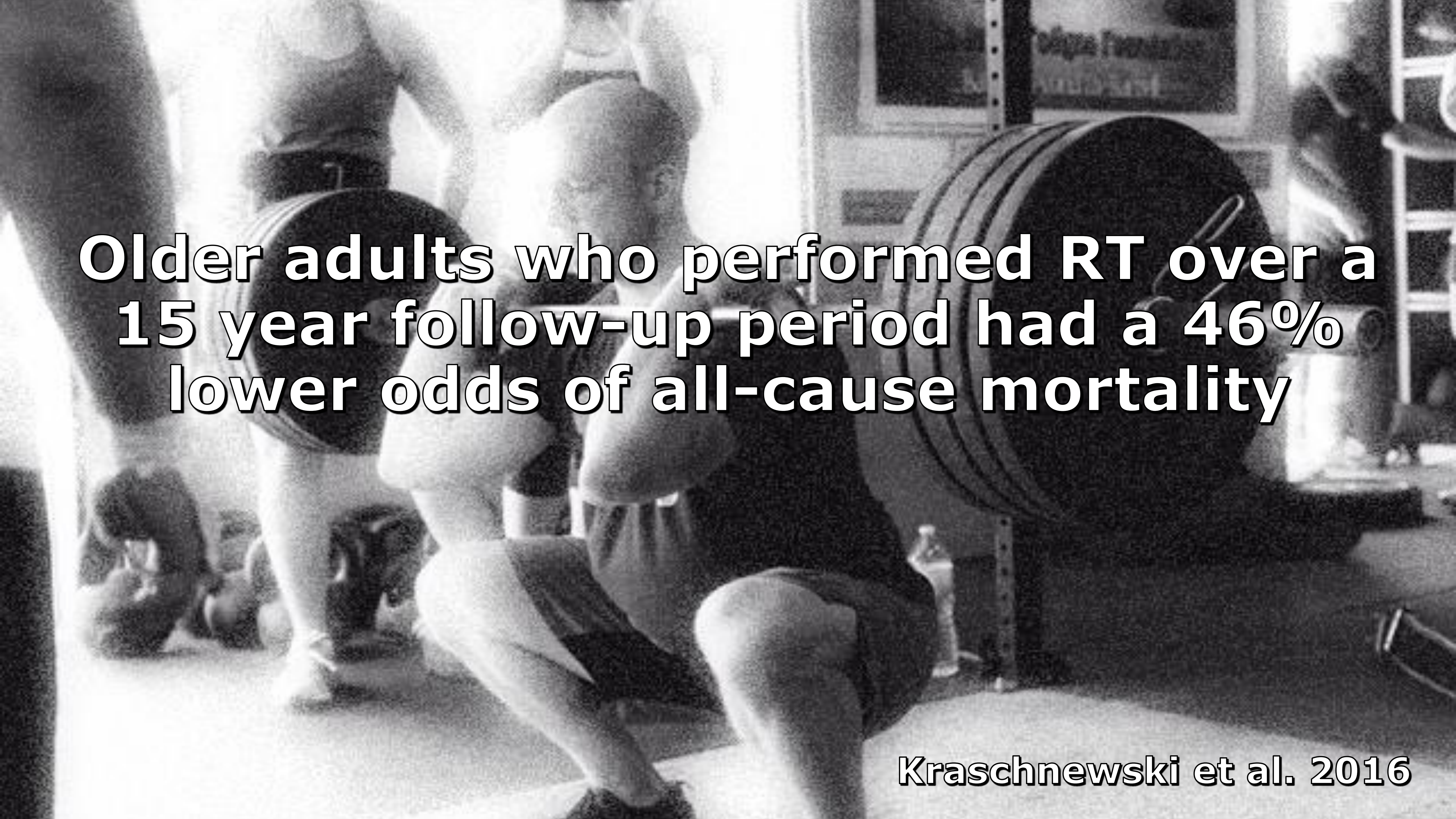
Abstract

A large proportion of the health woes beleaguering modern cultures are because of daily physical activity patterns that are profoundly different from those for which we are genetically adapted. The ancestral natural environment in which our current genome was forged via natural selection called for a large amount of daily energy expenditure on a variety of physical movements. Our genes that were selected for in this arduous and demanding natural milieu enabled our ancestors to survive and thrive, leading to a very vigorous lifestyle. This abrupt (by evolutionary time frames) change from a very physically demanding lifestyle in natural outdoor settings to an inactive indoor lifestyle is at the origin of many of the widespread chronic diseases that are endemic in our modern society. The logical answer is to replicate the native human activity pattern to the extent that this is achievable and practical. Recommendations for exercise mode, duration, intensity, and frequency are outlined with a focus on simulating the routine physical activities of our ancient hunter-gatherer ancestors whose genome we still largely share today. In a typical inactive person, this type of daily physical activity will optimize gene expression and help to confer the robust health that was enjoyed by hunter-gatherers in the wild. (Prog Cardiovasc Dis 2011;53:471-479)

…ords: Hunter-gatherer; Exercise; Cross-training; Evolution; Fitness; Cardiovascular health; Prevention; Obesity

Ancestral activity	Modern equivalent activity
Anaerobic-based	
Carrying heavy objects, lugging prey, stacking rocks	**Resistance training (RT)**
Hunting, stalking animals	HIIT
Escaping predators	Sprinting, jumping
Aerobic-based	
Running (cross-country)	Running (cross country)
Dancing (ceremonial)	Dancing (nightclubs, festivals)


Does strength improve QoL?
Does strength protect us from disease, disability & premature death?


Older adults who performed RT over a 15 year follow-up period had a 46% lower odds of all-cause mortality
Kraschnewski et al. 2016

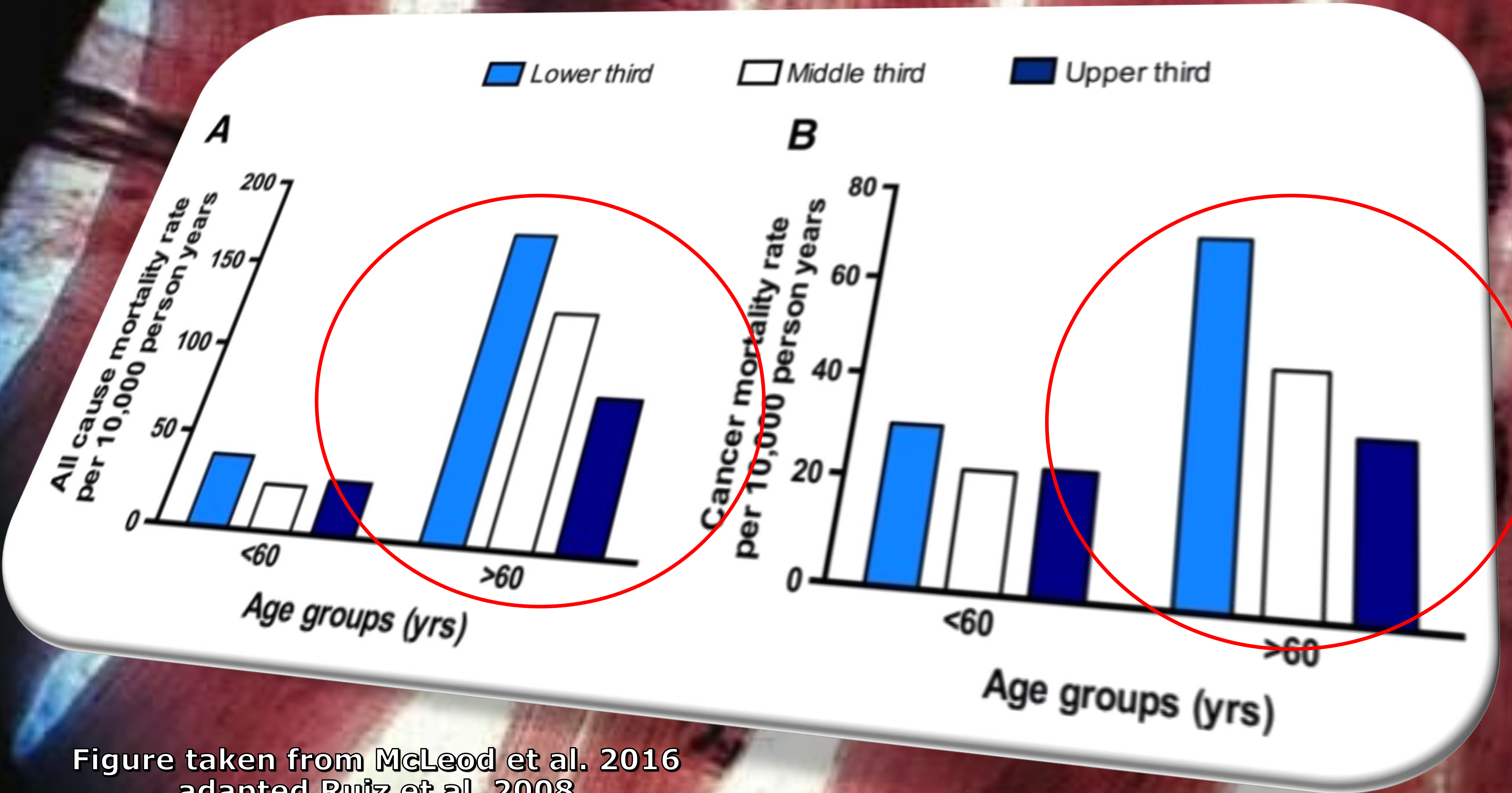


Figure taken from McLeod et al. 2016
adapted Ruiz et al. 2008

Bergland et al. BMC Health Services Research (2017) 17:22
DOI 10.1186/s12913-016-1950-0

BMC Health Services Research

RESEARCH ARTICLE Open Access

Mobility as a predictor of all-cause mortality in older men and women: 11.8 year follow-up in the Tromsø study

Astrid Bergland[1*], Lone Jørgensen[2,3], Nina Emaus[2] and Bjørn Heine Strand[4,5,6]

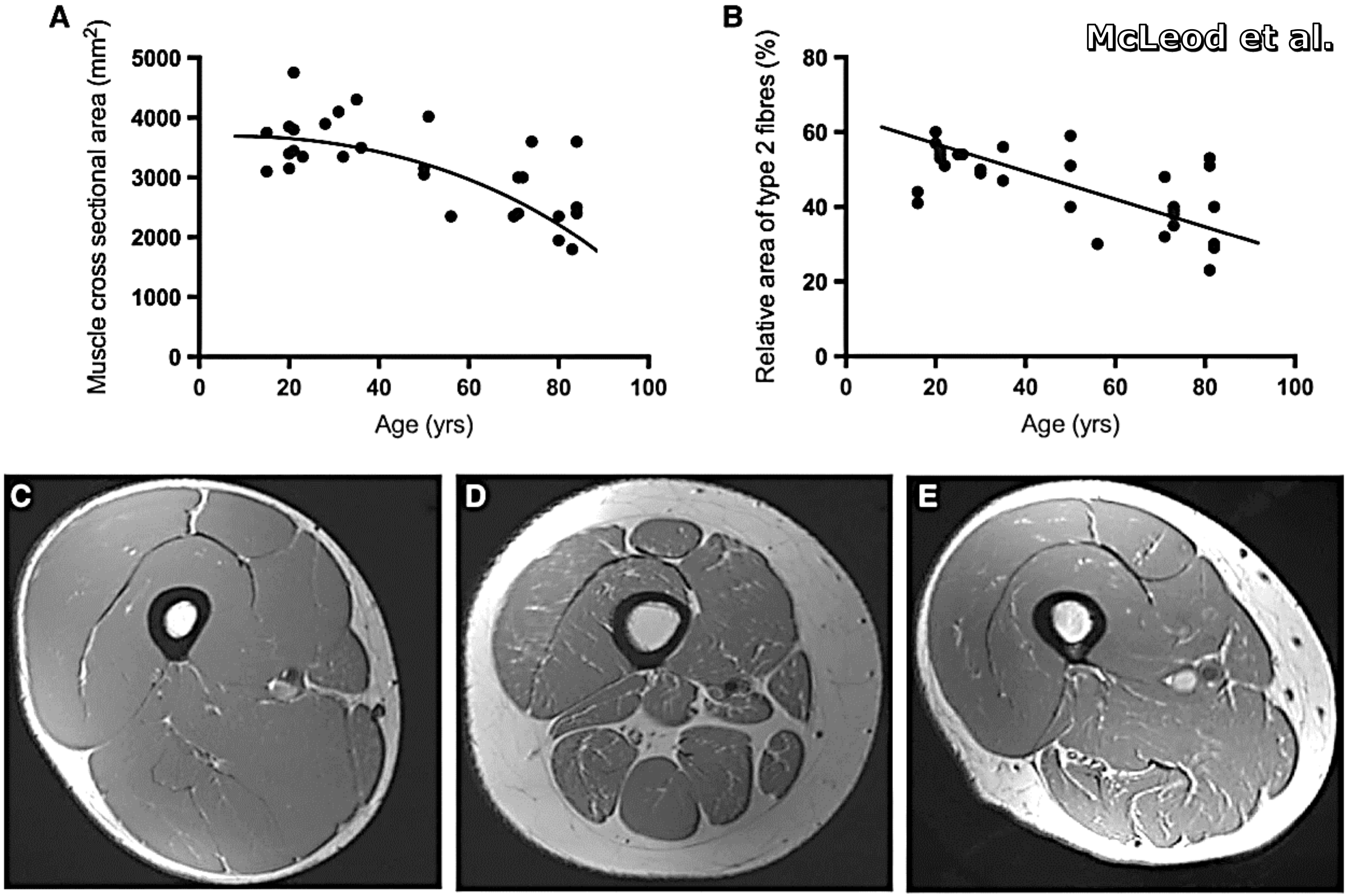
Abstract

Background: Disability in older adults is associated with loss of independence, institutionalization, and death. The aim of this study was to study the association between the Timed Up and Go (TUG) test and all-cause mortality in a population-based sample of older men and women.

Bergland et al 2016


Age-related skeletal
muscle changes

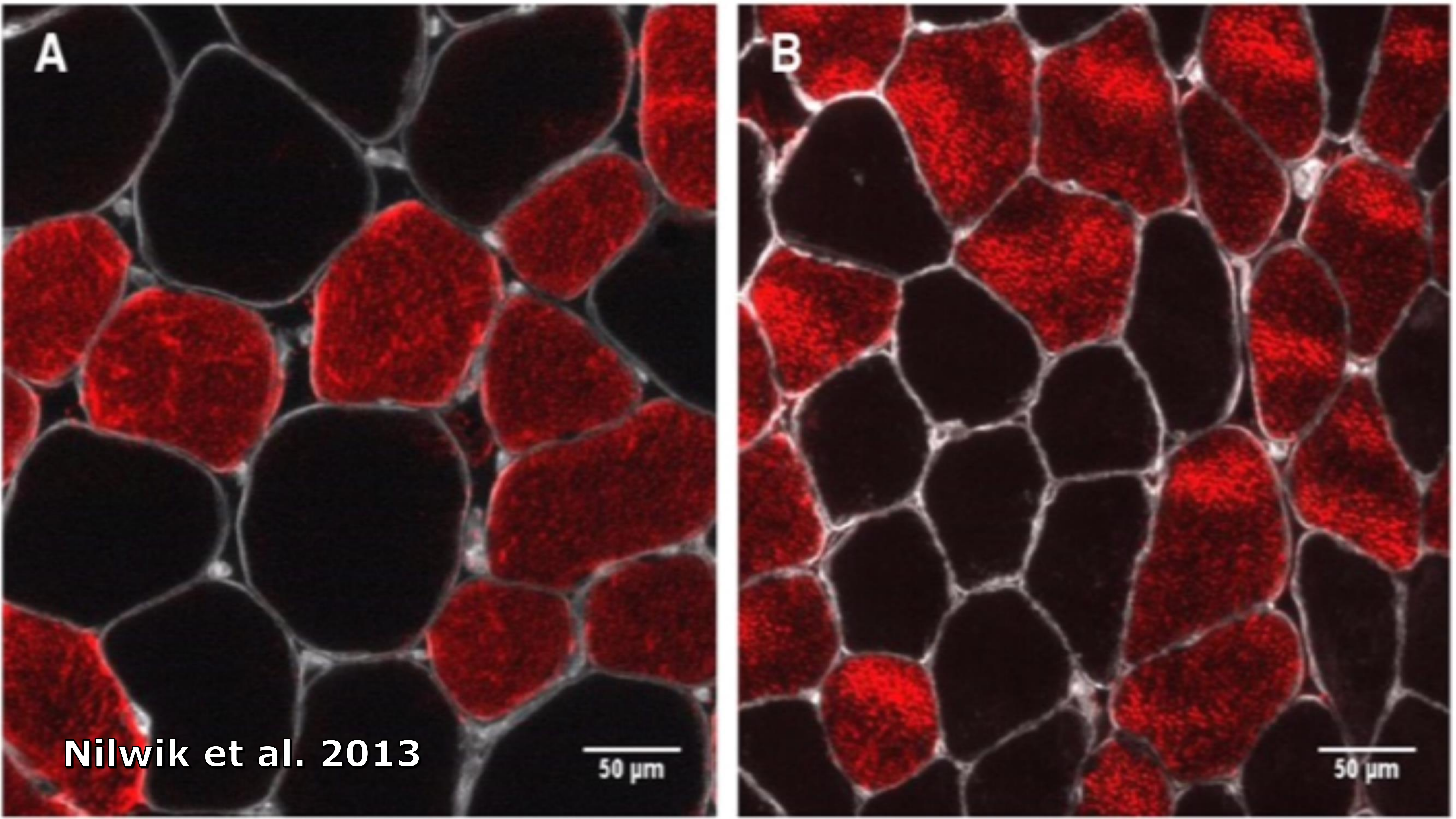
McLeod et al. 2016



Male – 24 yrs
Body mass – 76kg
Fat mass – 10kg
Fat free mass – 57kg

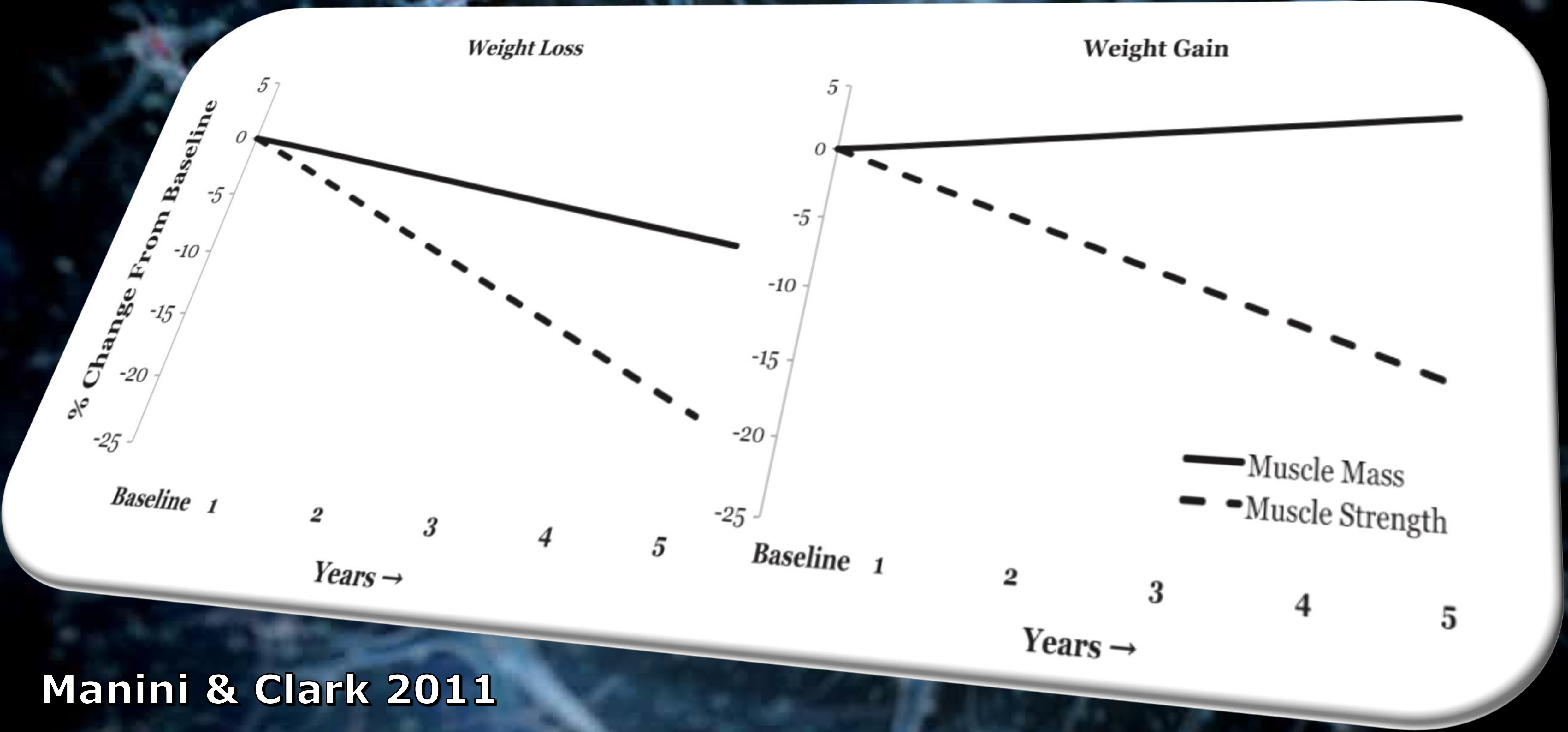
Male – 66 yrs
Body mass – 81kg
Fat mass – 57kg
Fat free mass – 13kg
Average daily steps = 3141
PA >3MET per/day = 22mins

Male – 66 yrs
Body mass – 79kg
Fat mass – 34kg
Fat free mass – 36kg
Average daily steps = 12445
PA >3MET per/day = 130mins

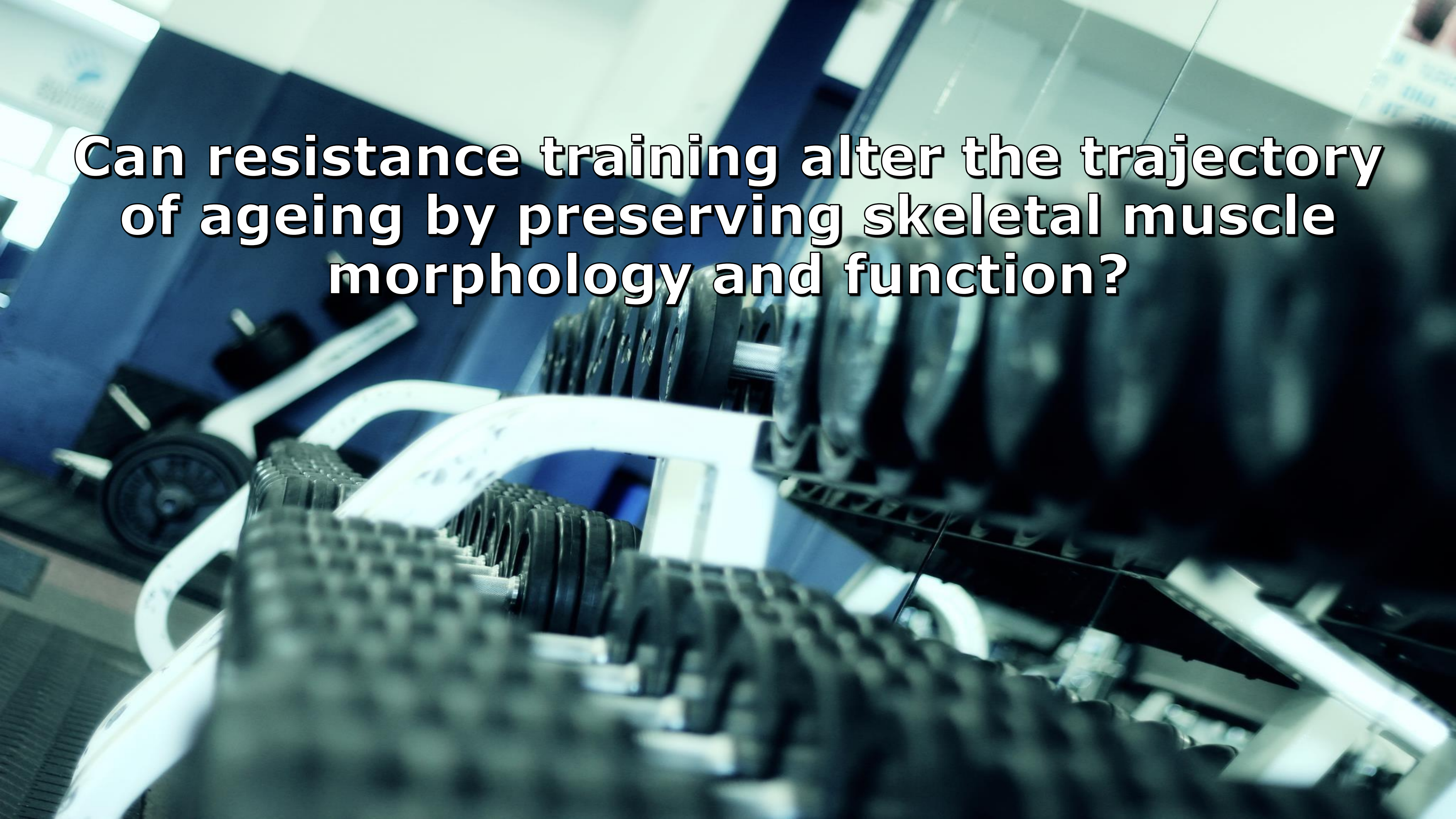

A
B
50 µm
50 µm
Nilwik et al. 2013


…however it's not just about muscle mass:
Dynapenia vs Sarcopenia

It's not just about muscle mass: dynapenia versus sarcopenia



Manini & Clark 2011


Can resistance training alter the trajectory of ageing by preserving skeletal muscle morphology and function?

Perkins & Kaiser (1961)

Approximately 60% increase in quadriceps strength in 6 weeks in adults >60

Klitgaard et al. (1990)


Fiatarone et al. (1990)

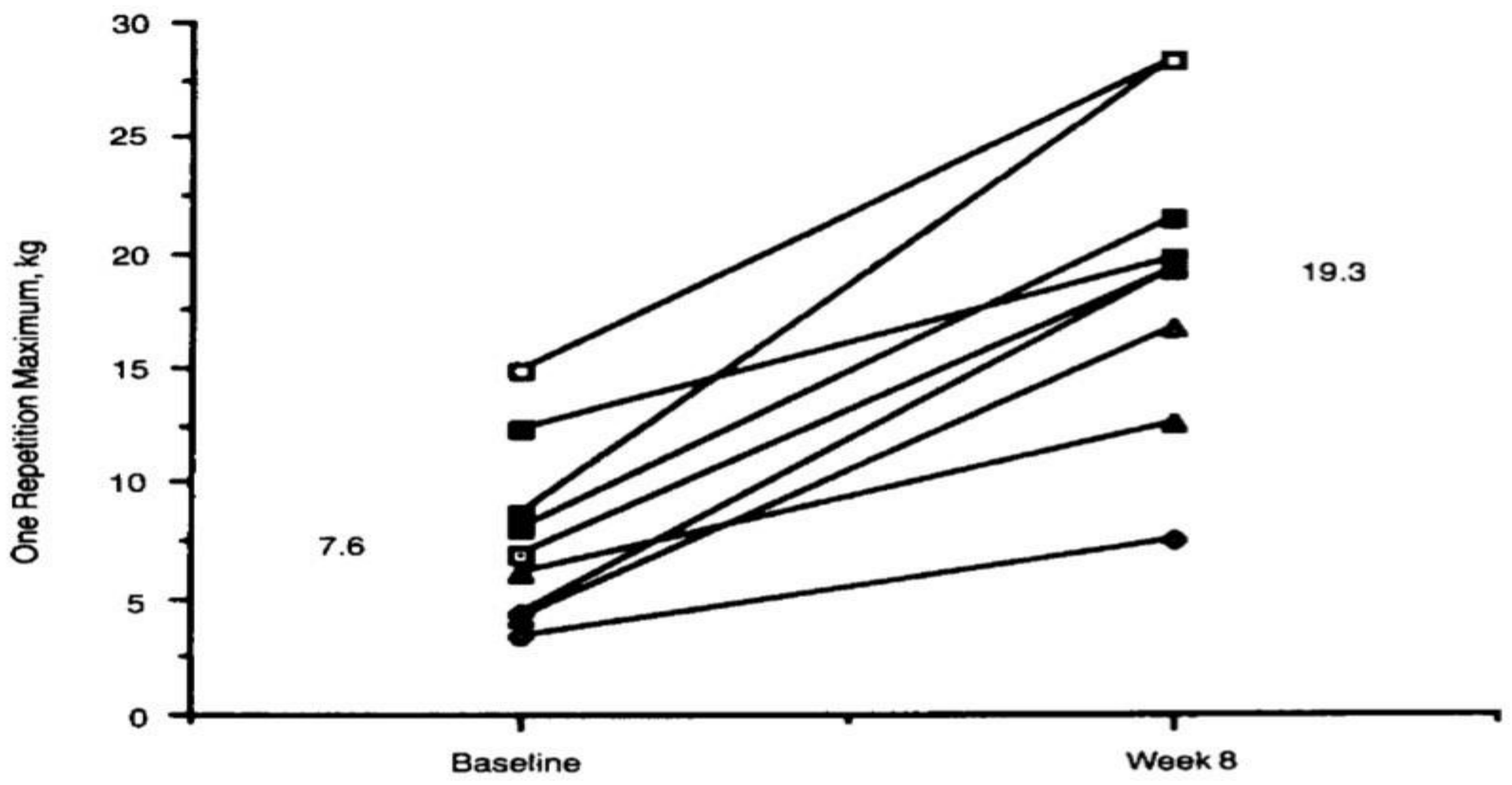
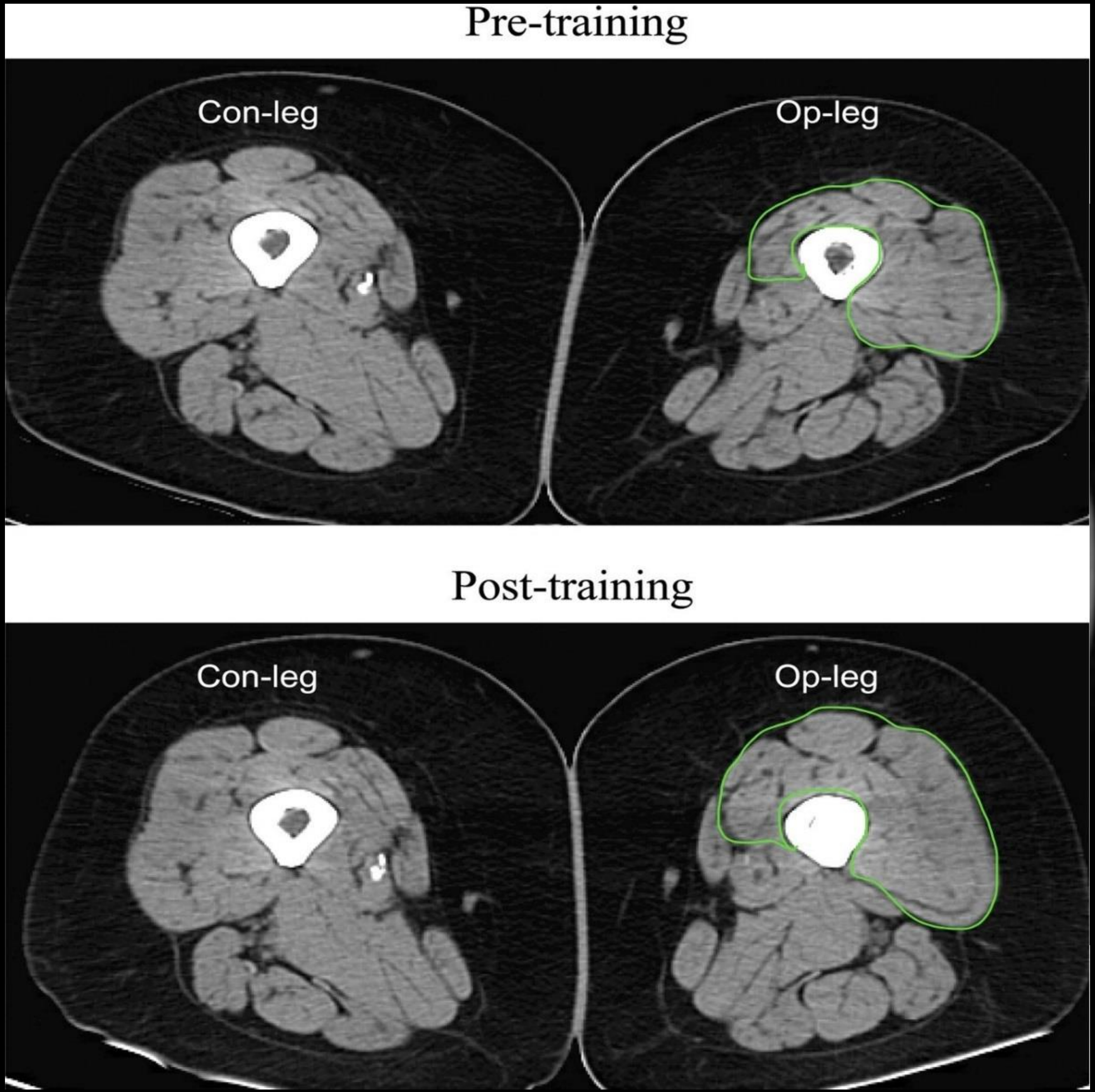
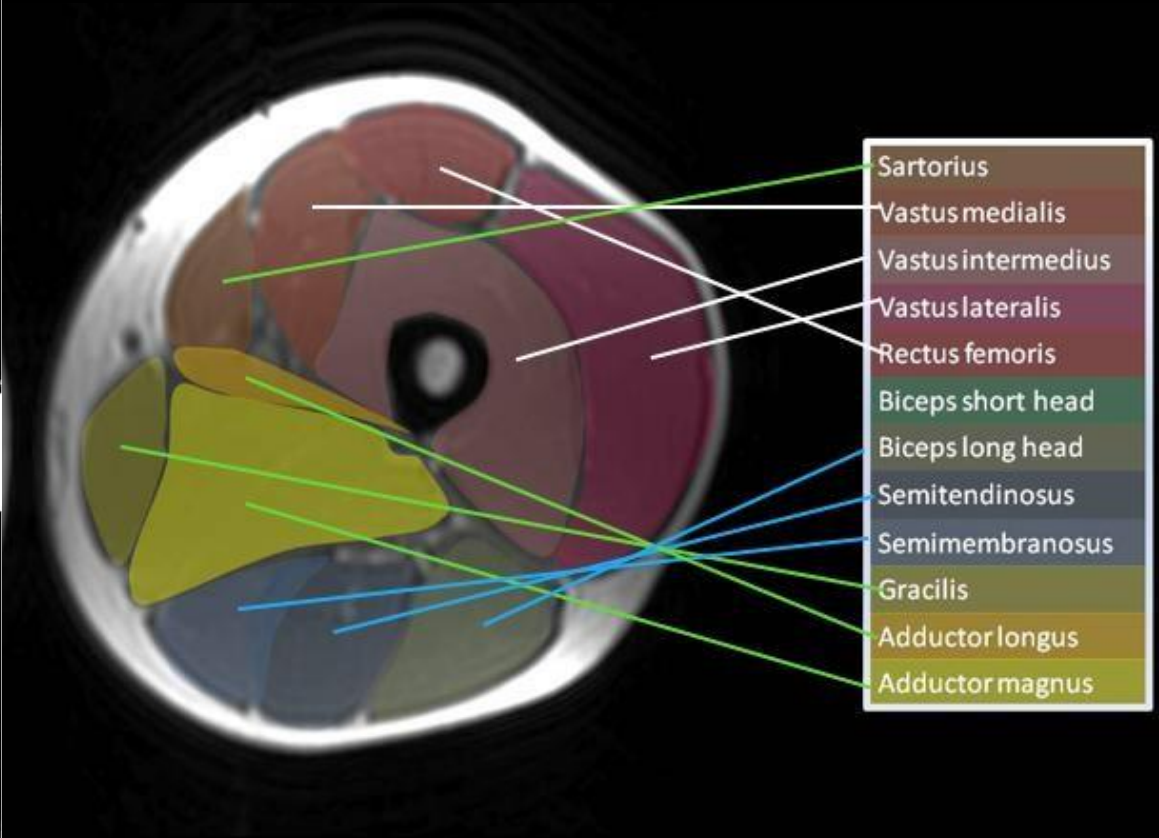
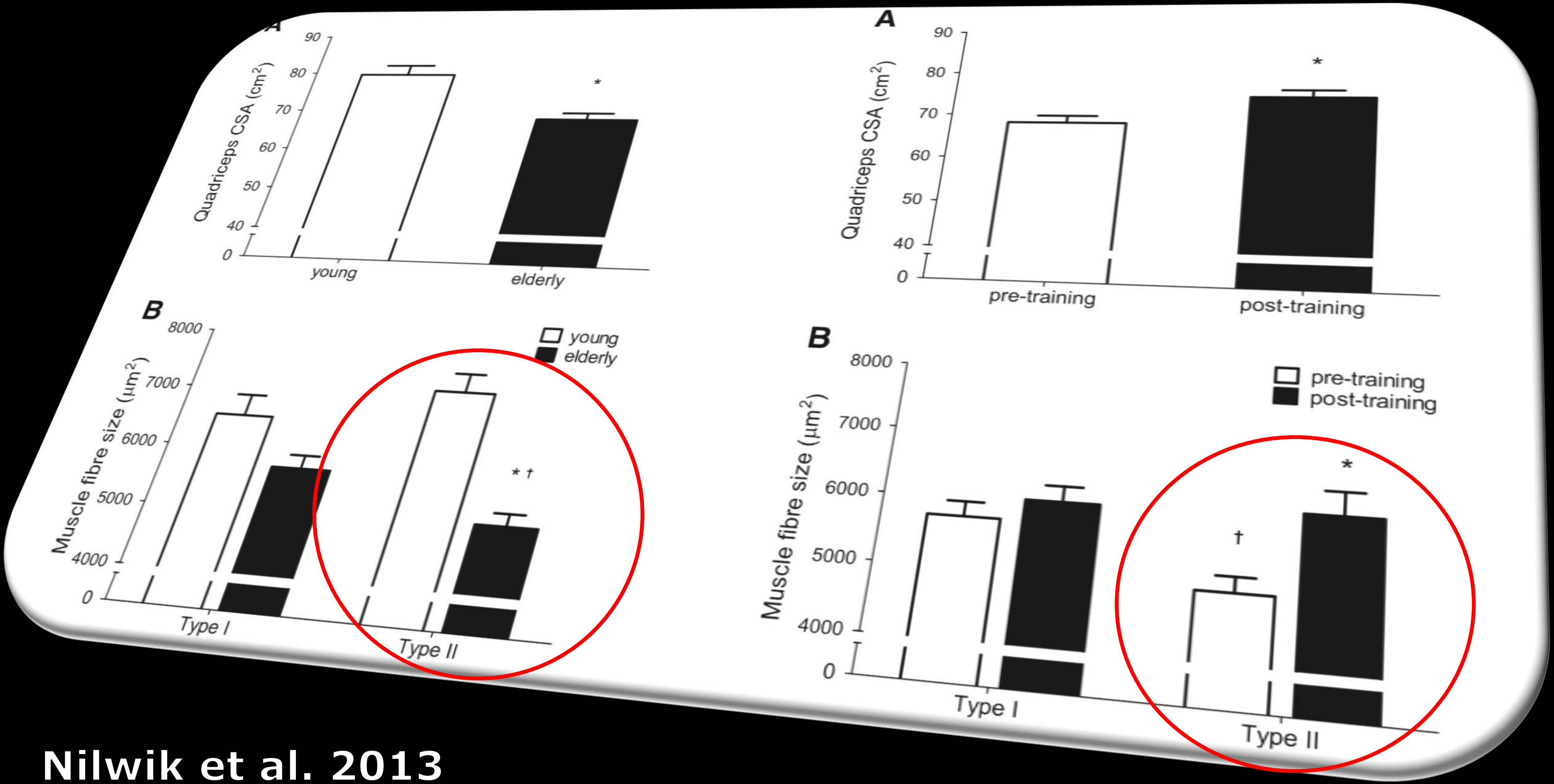


Fig 3.—Effects of weight training on knee extensor strength. Maximum left knee extensor strength before and after 8 weeks of high-intensity progressive-resistance training in nine subjects aged 87 to 96 years ($P<.0001$ compared with baseline). Similar strength gains were seen in the right leg (see text). Symbols represent individual subjects.





Suetta et al. 2004



Nilwik et al. 2013


...but have we really learnt anything
new over the last 30-40 years?

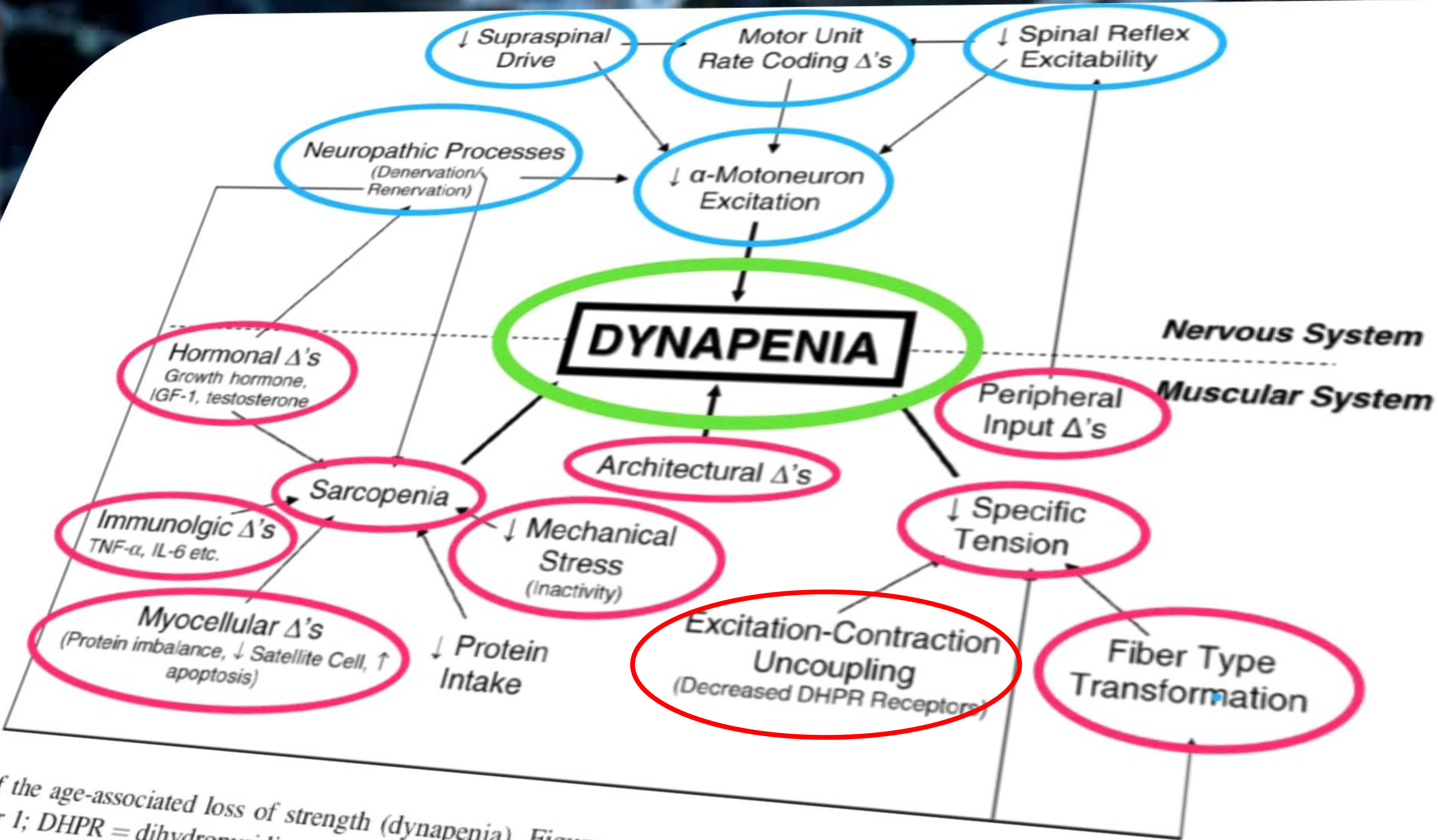


Figure 3. Etiology of the age-associated loss of strength (dynapenia). Figure summarizes the influence of multiple factors that may lead to dynapenia. IGF-1 = ulin-like growth factor 1; DHPR = dihydropyridine receptors; TNF-α = tumor necrosis factor-α; IL-6 = interleukin 6.

Clark & Manini 2008

Experimental Gerontology 91 (2017) 51–56

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Resistance training performed at distinct angular velocities elicits velocity-specific alterations in muscle strength and mobility status in older adults

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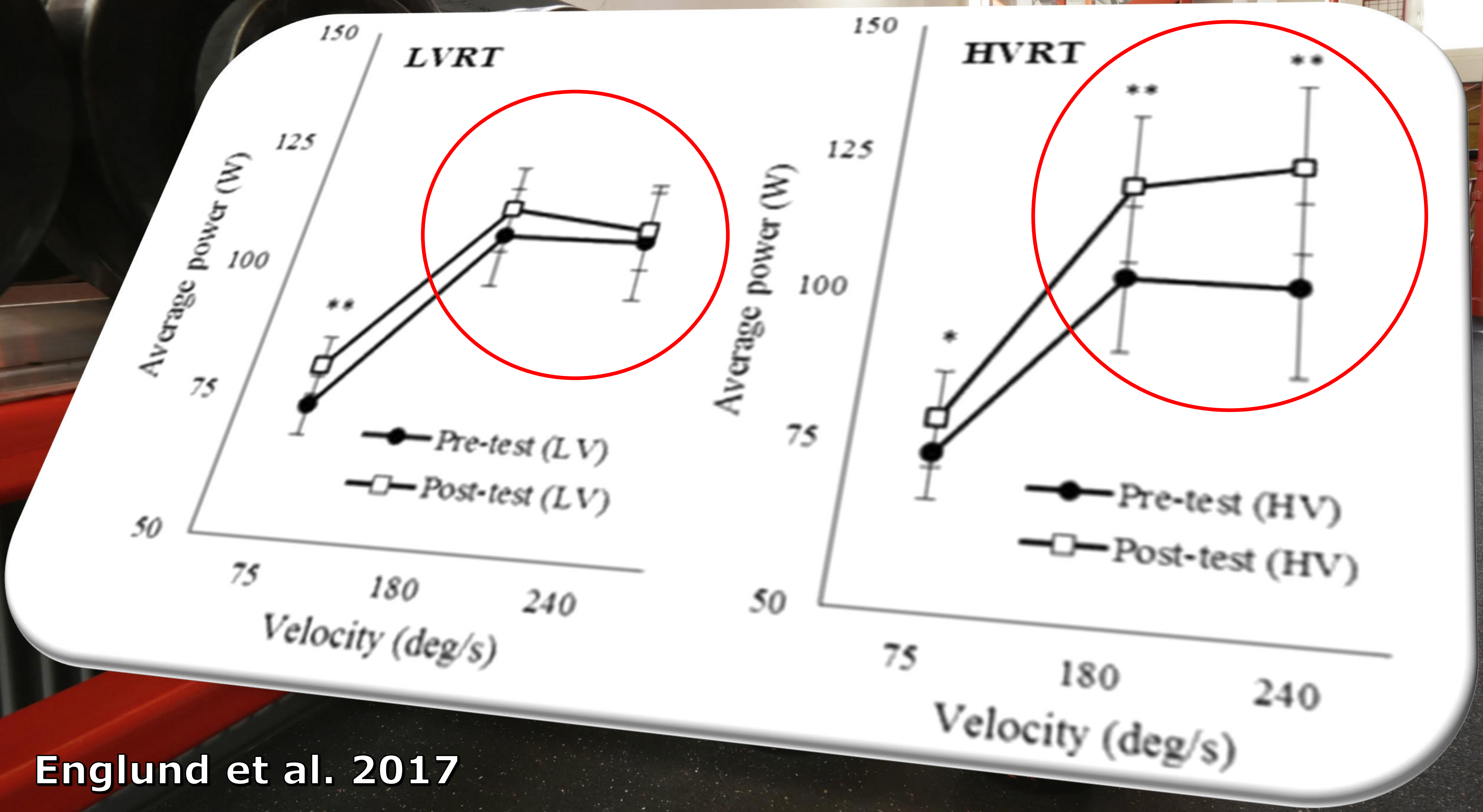
Isokinetic

ABSTRACT

Background: The purpose of this study was to compare the effects of high and low velocity knee extension training on changes in muscle strength and mobility status in high-functioning older adults.
Methods: Twenty-six (16 female, 10 male) older adults (mean age of 65) were randomized to either 6 weeks of low velocity resistance training (LVRT) performed at 75°/s or high velocity resistance training (HVRT) performed at 240°/s. Both groups performed 3 sets of knee extension exercises at maximal effort, 3 times a week. Muscle strength was assessed through a range of testing velocities on an isokinetic dynamometer. Mobility status was assessed with the short physical performance battery (SPPB) and myosin heavy chain (MyHC) transcript levels were quantified via qRT-PCR.
Results: From baseline to post-training, there were several significant ($P < 0.05$) differences in muscle strength and functional characteristics in LVRT ($n = 13$) and HVRT ($n = 13$) groups. From baseline to post-training, MyHC-α mRNA and MyHC-IIa mRNA showed a significant ($P < 0.05$) increase within HVRT but MyHC-IIx mRNA did not change significantly. Our results demonstrate HVRT provides a greater number of muscular enhancements when compared to LVRT, particularly under conditions of high velocity muscle contraction.
Conclusion: HVRT is emerging as the optimal training stimulus for the older adult. The present study demonstrates, in addition to increased strength and functional outcomes, HVRT elicits a potentially therapeutic (i.e., slow to fast) transcriptional response in MyHC.

Englund et al. 2017



Englund et al. 2017


CNS strength training:
untapping the untapped

Clinical Trial/Experimental Study

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Motor effort training with low exercise intensity improves muscle strength and descending command in aging

Changhao Jiang (PhD)[a], Vinoth K. Ranganathan (MS)[a,b], Junmei Zhang (PhD)[a], Vlodek Siemionow (PhD)[a,b], Guang H. Yue (PhD)[a,b,*]

Abstract

This study explored the effect of high mental effort training (MET) and conventional strength training (CST) on increasing voluntary muscle strength and brain signal associated with producing maximal muscle force in healthy aging. Twenty-seven older adults (age: 75±7.9 yr, 8 women) were assigned into 1 of 3 groups: MET group—trained with low-intensity (30% maximal voluntary contraction [MVC]) physical exercise combined with MET, CST group—trained with high-intensity muscle contractions, or control (CTRL) group—no training of any kind. MET and CST lasted for 12 weeks (5 sessions/week). The participants' elbow flexion strength of the right arm, electromyography (EMG), and motor activity-related cortical potential (MRCP) directly related to the strength production were measured before and after training. The CST group had the highest strength gain (17.6%, $P<0.001$), the MET group also had significant strength gain (13.8%, $P<0.001$), which was not statistically different from that of the CST group even though the exercise intensity for the MET group was only at 30% MVC level. The CTRL group did not have significant strength changes. Surprisingly, only the MET group demonstrated a significant augmentation in the MRCP (29.3%, $P<0.001$); the MRCP increase in CST group was at boarder-line significance level (12.11%, $P=0.061$) and that for CTRL group was only 4.9% ($P=0.539$). These results suggest that high mental effort training combined with low-intensity physical exercise is an effective method for voluntary muscle strengthening and this approach is especially beneficial for those who are physically weak and have difficulty undergoing conventional strength training.

Abbreviations: AEMG = average electromyography, ANOVA = one-way analysis of variance, BB = biceps brachii, CST = conventional strength training, CTRL = no-practice control, EMG = electromyography, FFT = fast Fourier transform, M1 = primary motor cortex, MET = mental effort training, MI = motor imagery, MIT = motor imagery training, MRCP = motor activity-related cortical potential, MVC = maximal voluntary contraction, TB = triceps brachii.

Keywords: aging, maximal voluntary contraction (MVC), mental effort, motor activity-related cortical potential (MRCP), muscle strength, power of EEG frequency

Jiang et al. 2016

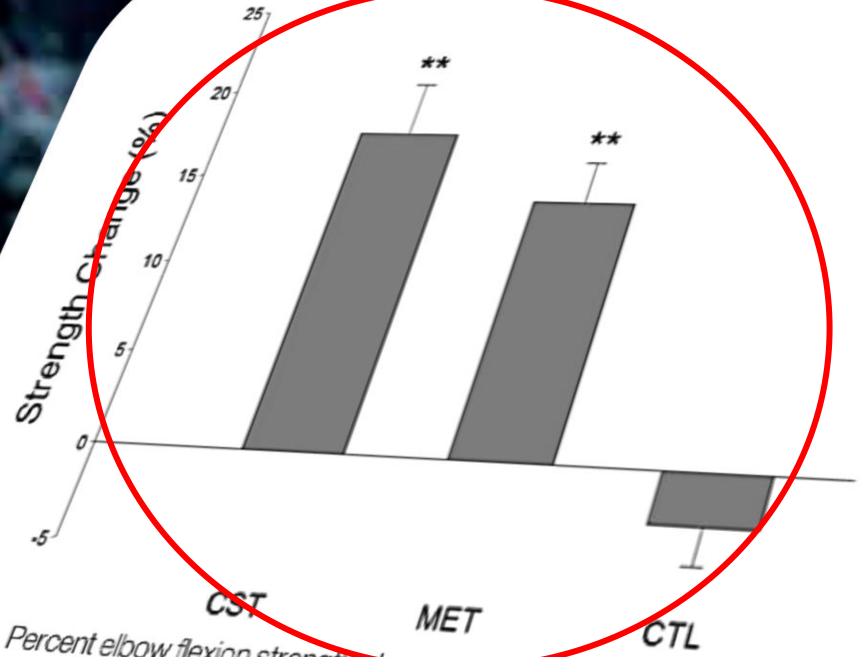


Figure 2. *Percent elbow flexion strength changes in conventional (CST), motor effort (MET), and no-training control (CTL) groups following a 12-week training program. There was no significant difference in pretraining strength among the 3 groups. Both the CST and MET groups had significant strength gains after training. The CTL group did not have significant strength increase.* $^{**}P<0.01$.

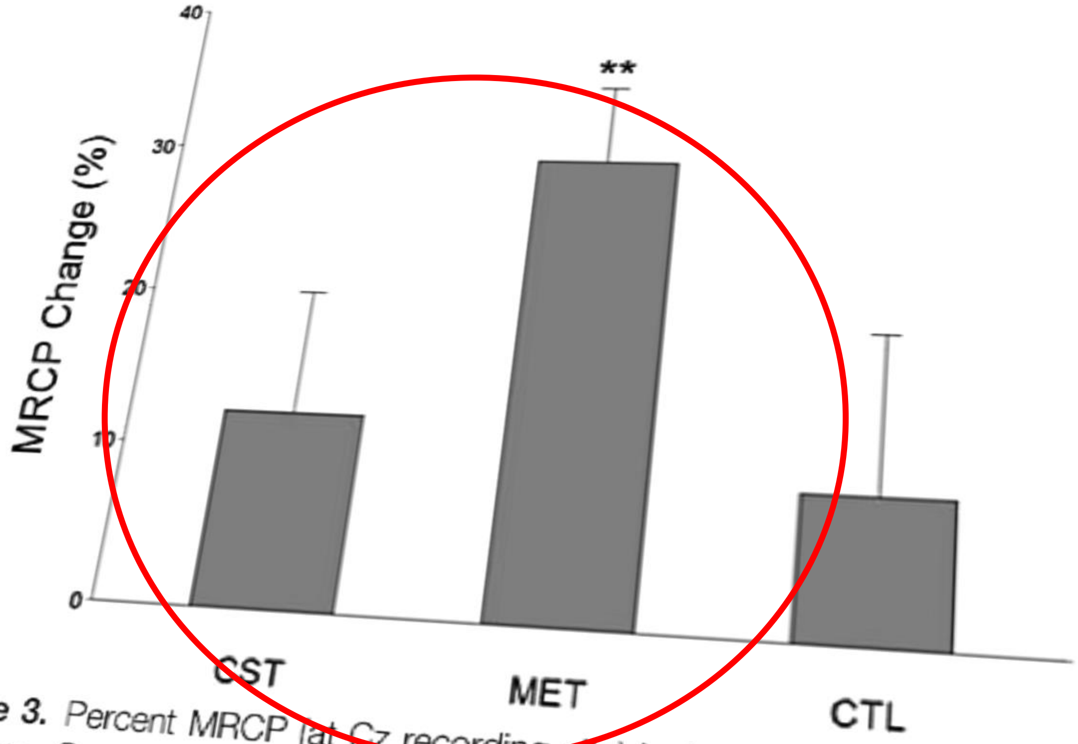
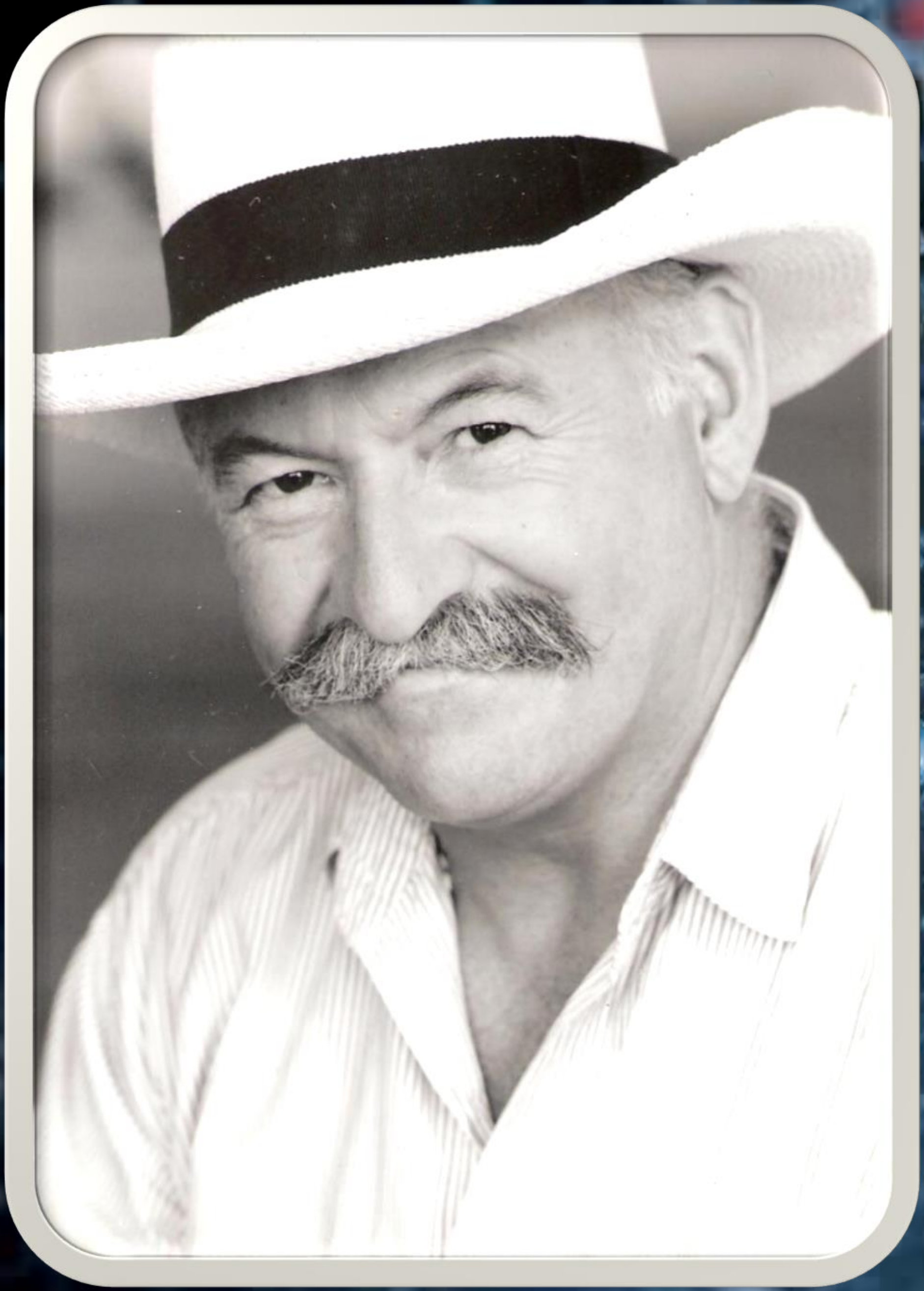


Figure 3. Percent MRCP (at Cz recording site) before and after the training program. Compared with the pretraining values, the MVC-related MRCP increased significantly for the MET group at the end of the 12 weeks of training. Even though the strength gain was highest for the CST group, the MRCP increase only attained boarder-line significance ($P=0.061$). $^{**}P<0.01$.

Jiang et al. 2016

Case study:

How RT kept one man on his feet



Peter Wilson
74 y.o.

Assessment/problem list

- Suffered GBS aged 14 with very poor recovery
- Major peripheral nerve damage
- >80% atrophy in lower limb muscles
- Virtually no functional ability of triceps surae
- Substantial muscle weakness, coordination & mobility and gait impairment
- Negatively impacted other bodily systems (metabolic, CV)

Goals of RT program

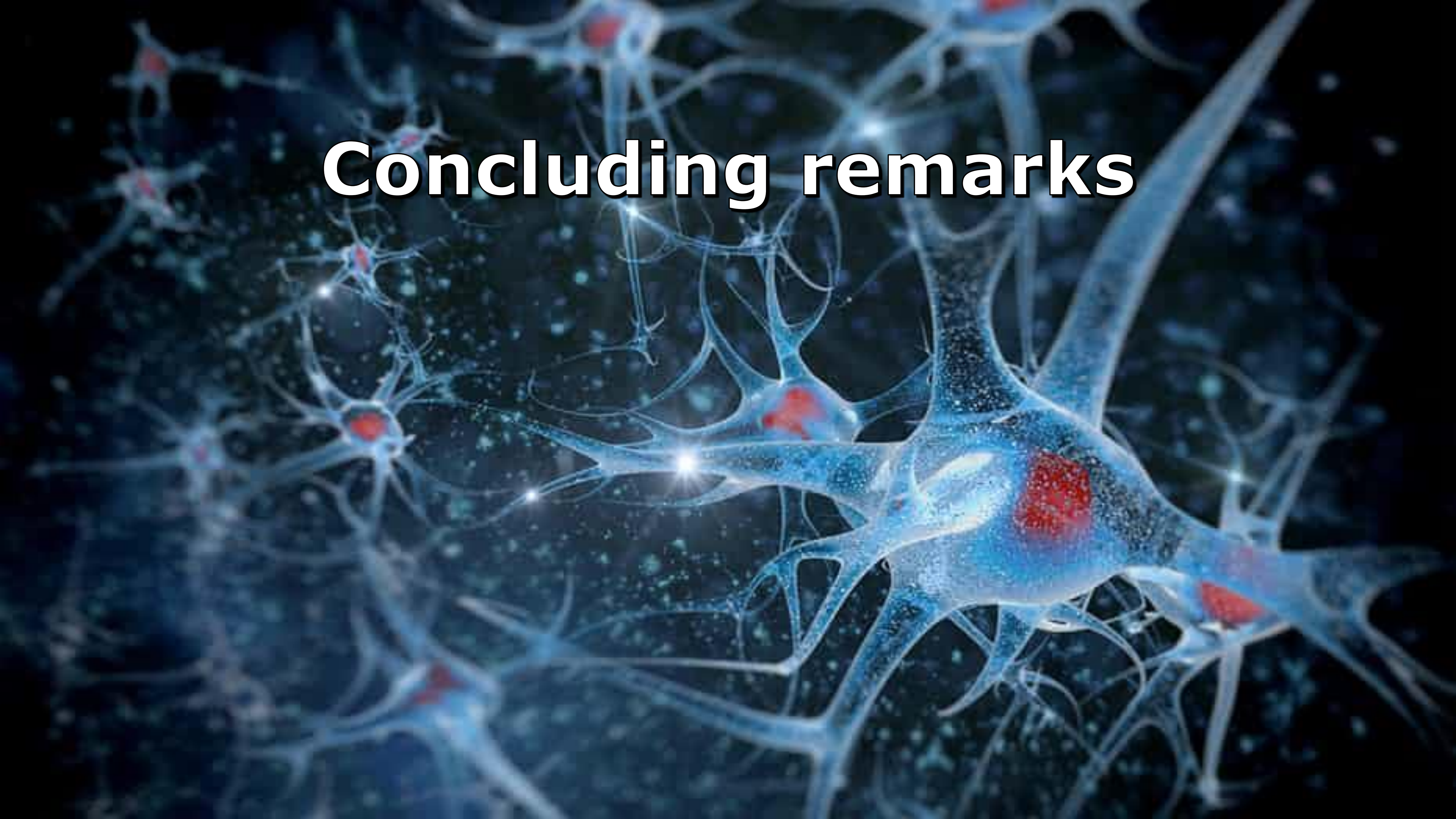
- Improve QoL
- Increase functional mobility & ADL
- Increase strength (lower body)

RT exercise plan

Program B

Exercises	Warm-up sets	Work sets	Tempo	Rest/set	Notes
Theraband eccentric-resisted plantar flexion	Manual massage	2-3 x 6-12	4010	60 secs	Seated
Motor effort training (tibilais anterior)	Mental focus/readiness	2 x 15 (5 on: 5 off)	max ME	120 secs	Seated
45º leg press	2 x 10 @50% ME	1 x 12 @20kg 1 x 5 @30kg	4110 20*1	90 secs	
Glut bridge	no warm-up set	2 x 6-15	3011	90 secs	
Lying eccentric resisted hamstring curl	no warm-up set	1 x 8-10 @>85%max	4010	60 secs	
Lat pulldown	1 x 10 @60%	1-2 x 8-12 1 x 4	4110 20*0	90 secs	
Db shoulder press	1 x 10 @60%	1-2 x 8-12 1 x 4	4111 20*0	90 secs	
Triceps pushdown	no warm-up set	1-2 x 12,20	3111	60 secs	
Back extension (lying prone)	no warm-up set	2 x (1 x 6 each side)	self-paced		

Concluding remarks



"What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?"


fitgreystrong