

Move, eat, repeat: How to optimize muscle mass through diet and exercise

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Disclosures and acknowledgements



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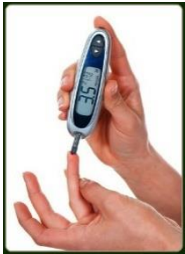
AJINOMOTO



Nestlé



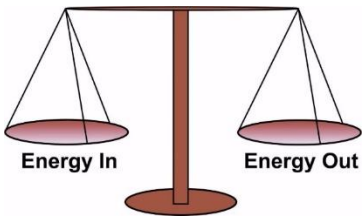
Muscle is vital for health



Glucose/fat
metabolism



Morbidity &
mortality



Energy
expenditure

Amino acid
'storage'



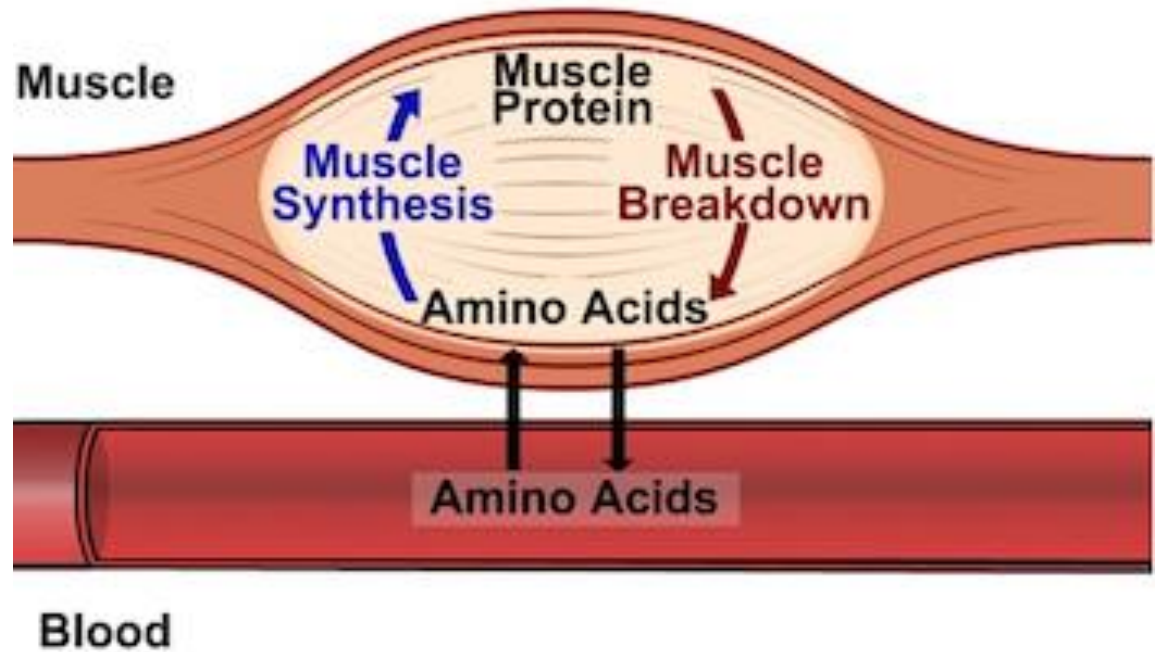
Mechanical
work



What I'm going to tell you

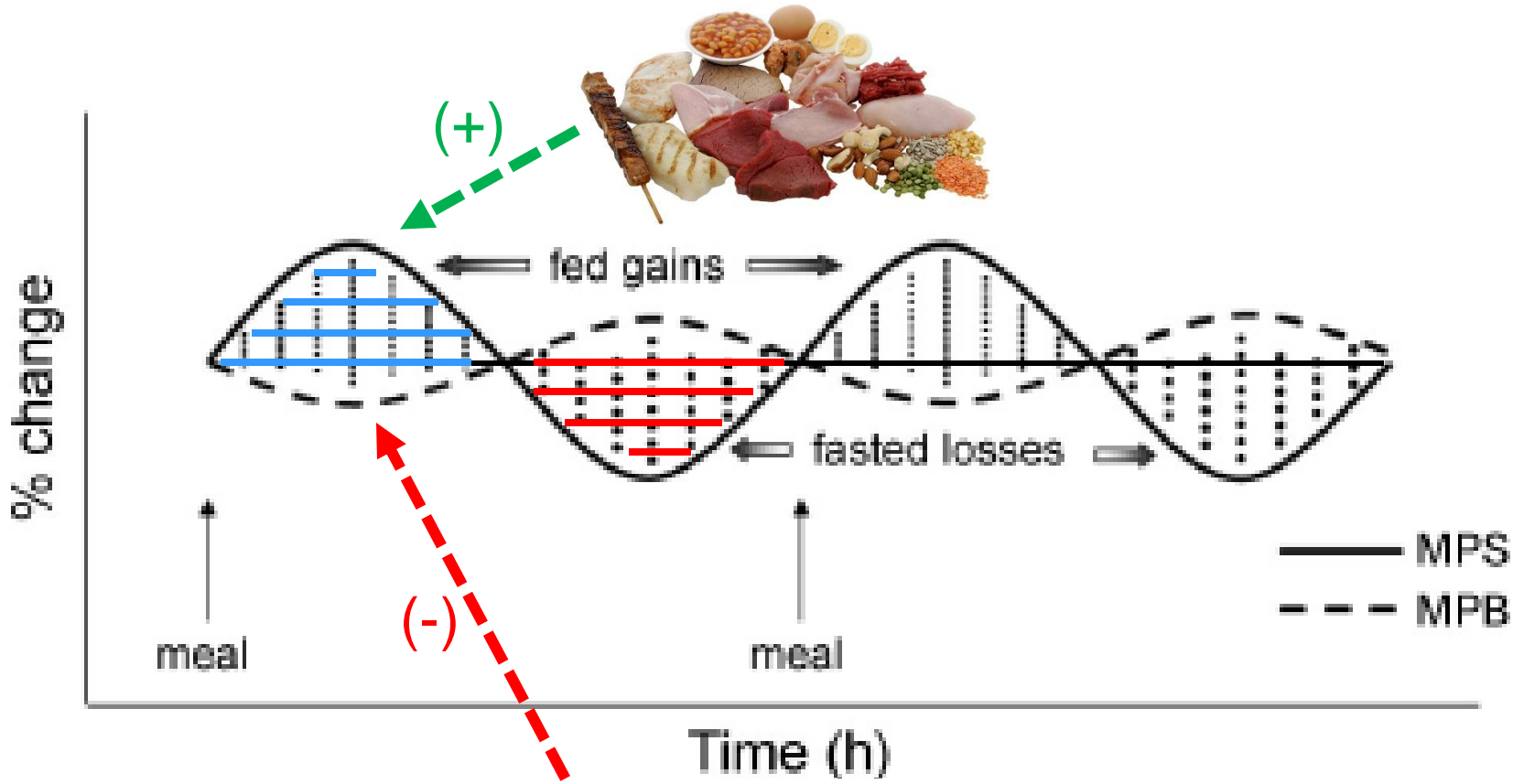
- Eating protein builds muscle in everyone
- Being active allows more dietary protein to be used to build muscle
- Inactivity leads to less dietary protein for muscle building (and muscle loss)
- Staying active allows you to be more of what you just ate

Lean body (and muscle) mass is dynamic and continually “turning over”

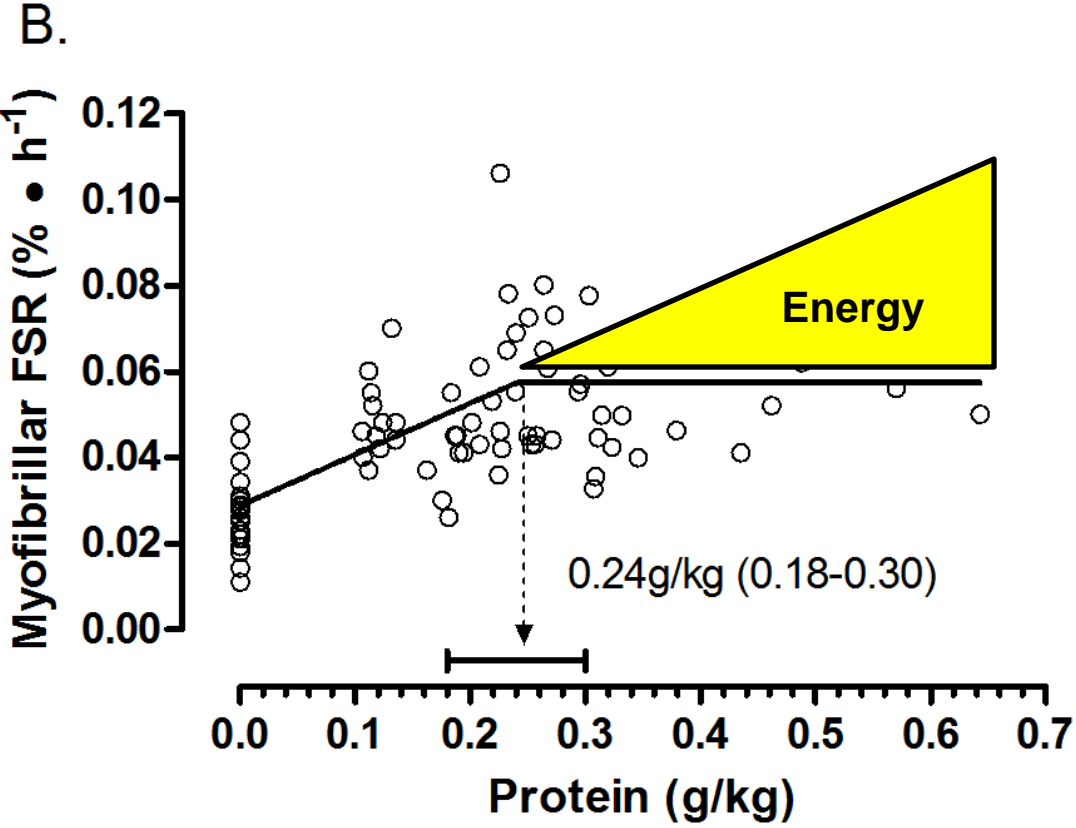


www.precisionnutrition.com

Meal (protein) intake builds new muscle protein primarily through the stimulation of synthesis



A moderate meal protein intake maximizes muscle protein synthesis in 'healthy' muscle

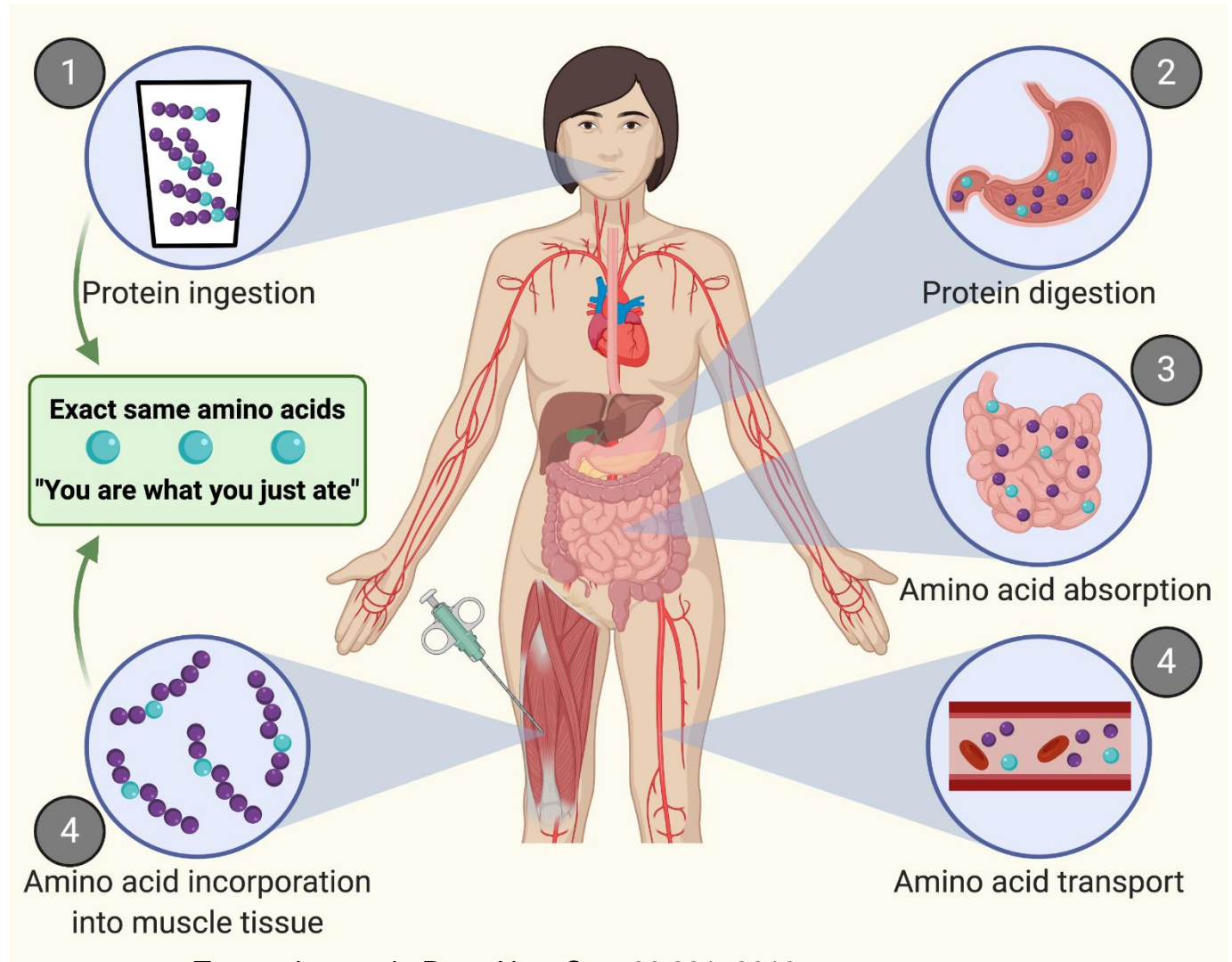


~0.3g protein/kg

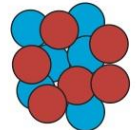


Moore DR et al., J Gerontol A Biol Sci Med Sci. 2015 Jan;70(1):57-62

Eating metabolic 'tracers' tells you where your food goes



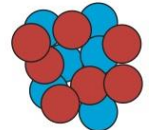
carbon-12



^{12}C

6 protons
6 neutrons
light

carbon-13



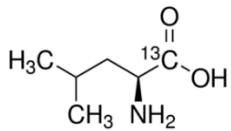
^{13}C

6 protons
7 neutrons
heavy

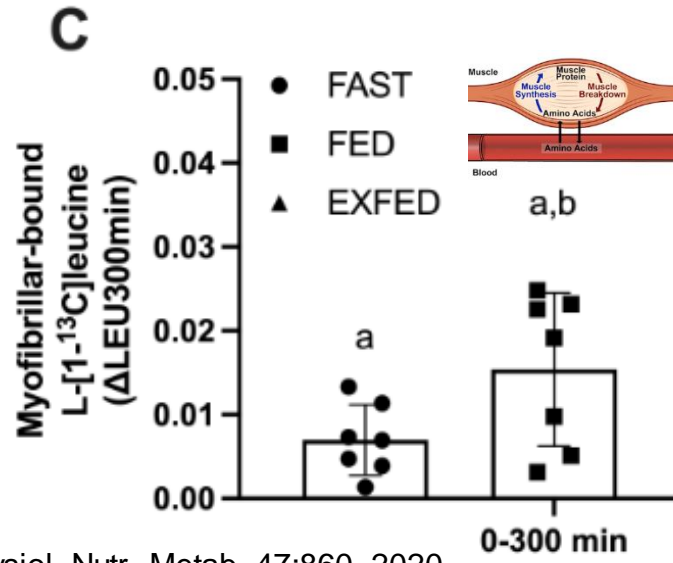
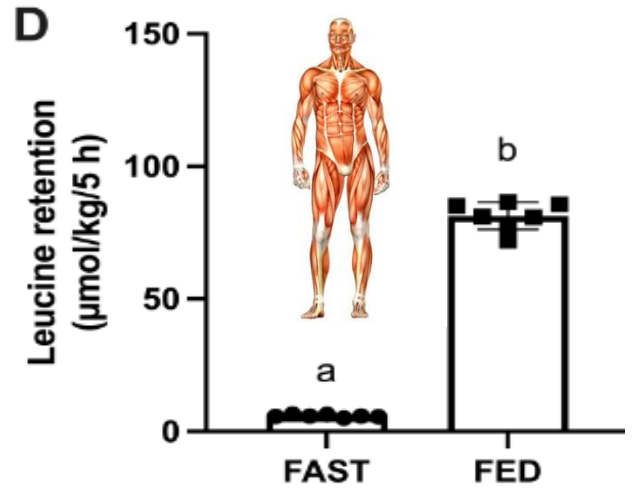
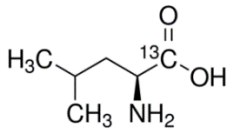
Dietary amino acids are used to build body and muscle protein after a meal



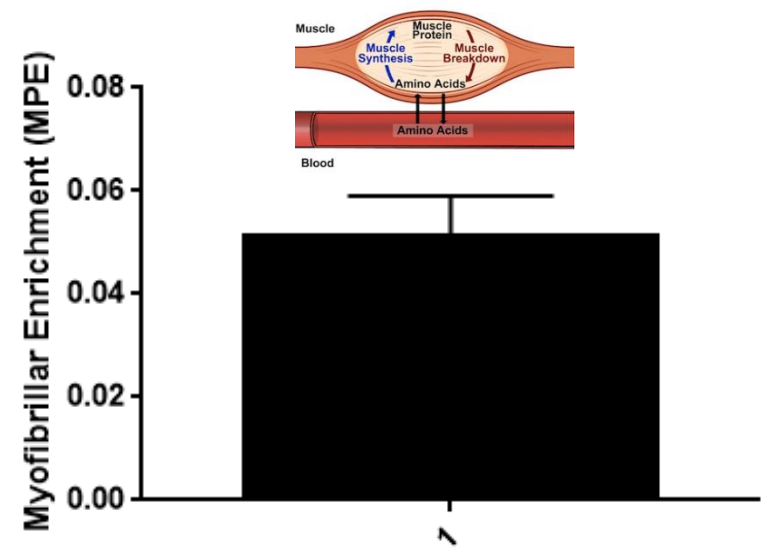
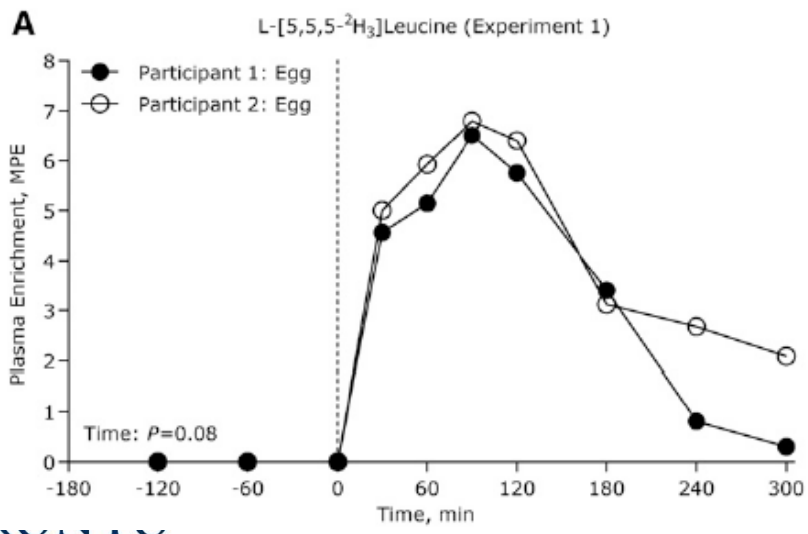
+



+



Whole food approach: 'Label' eggs, eat eggs, build muscle

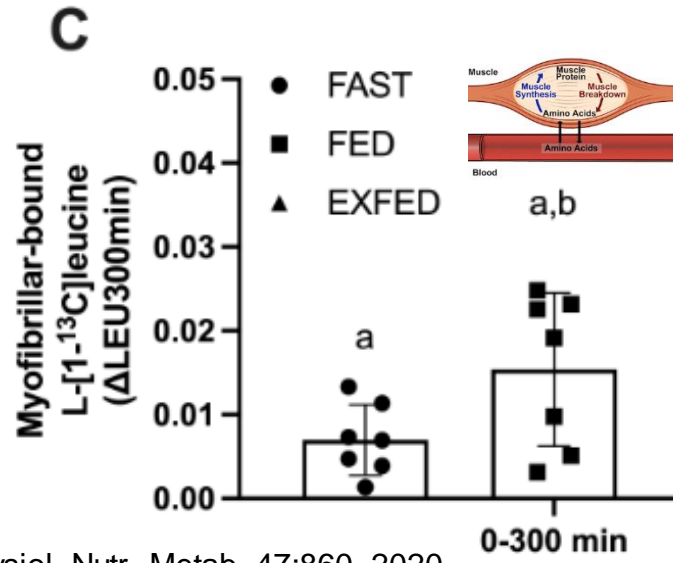
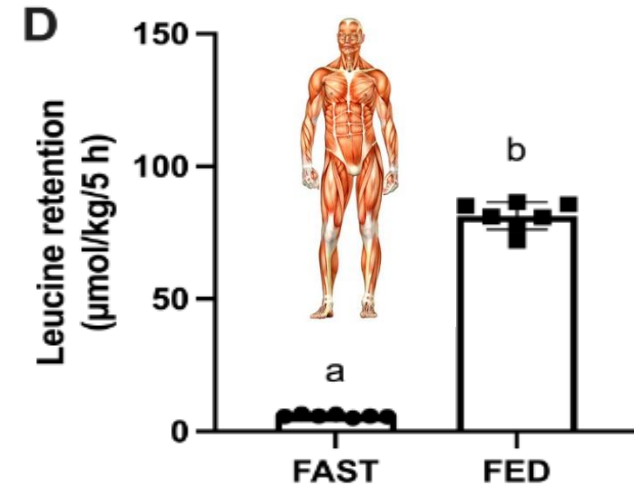


Resistance exercise allows more dietary amino acids to build body and muscle protein after a meal

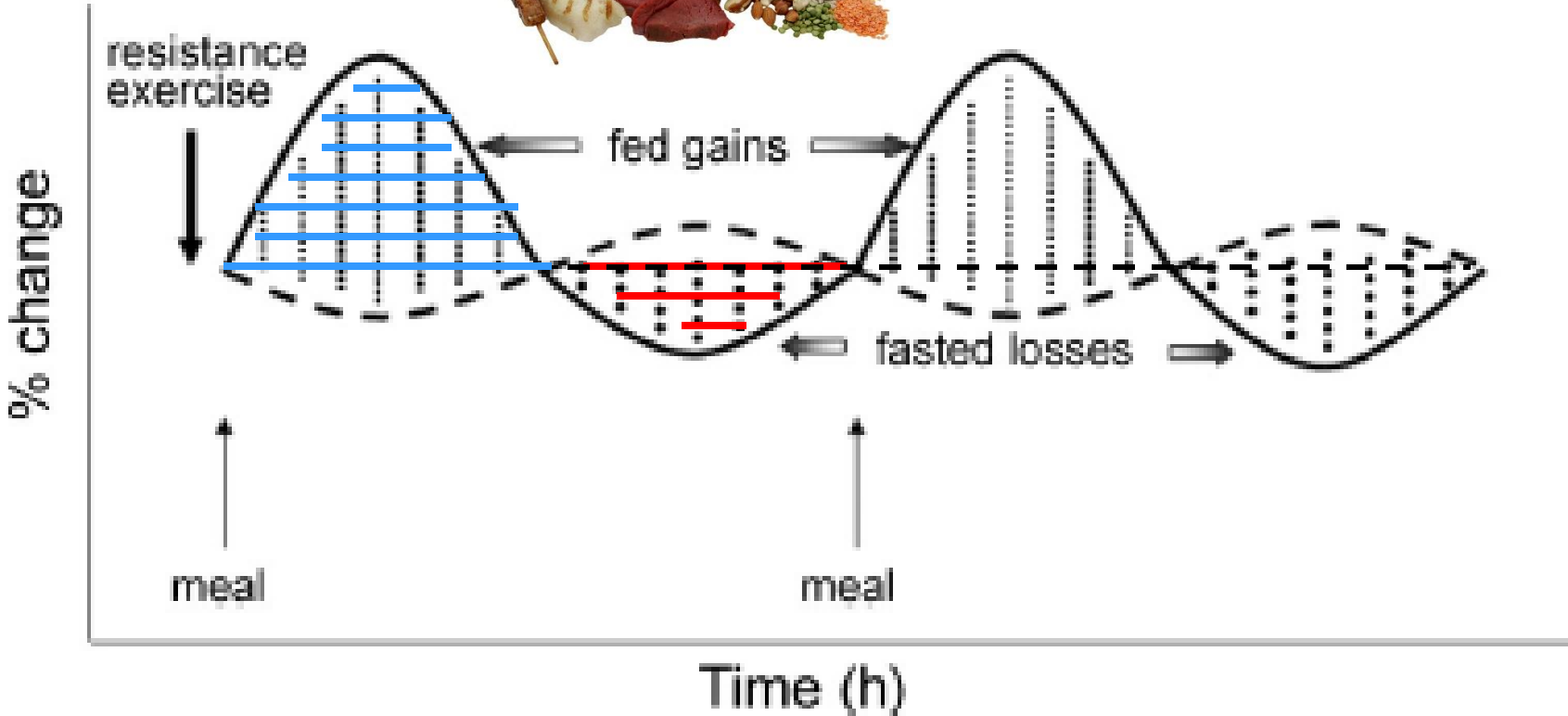
The diagram illustrates three conditions:

- Sitting + L-leucine-13C6
- Sitting + L-leucine-13C6 + powder
- Squatting + L-leucine-13C6 + powder

 The chemical structure of L-leucine-13C6 is shown as CC(C)C(C)C(=O)O with a ¹³C label on the alpha-carboxyl group.



Resistance exercise enhances muscle protein synthesis balance after meal intake

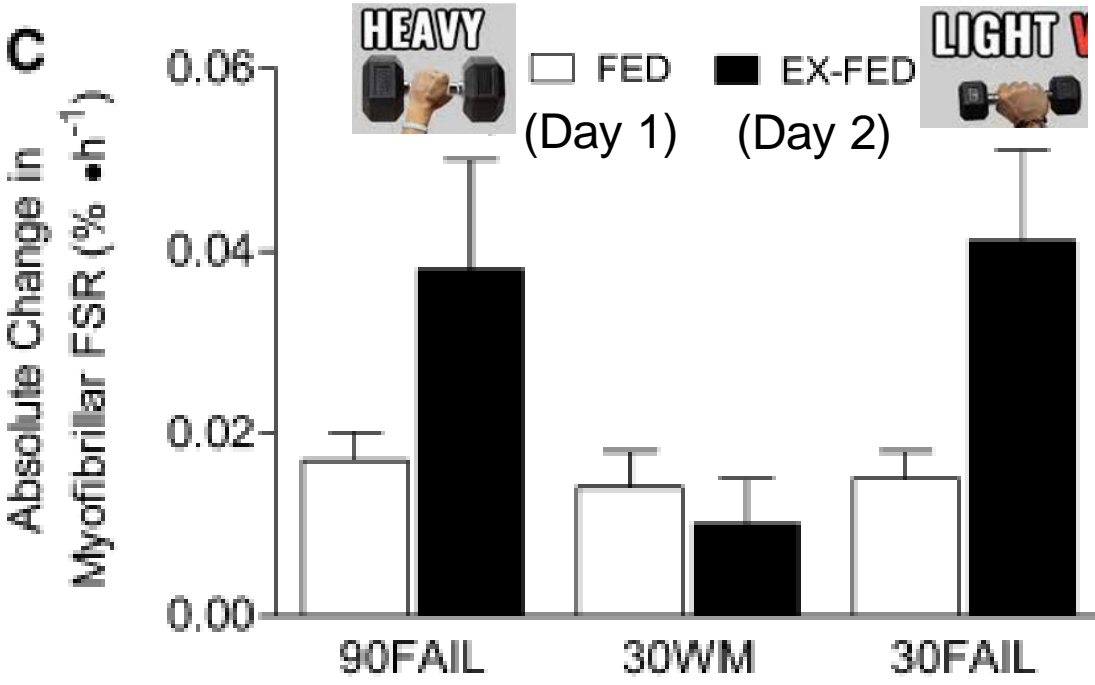


But do I have to lift heavy weights...?

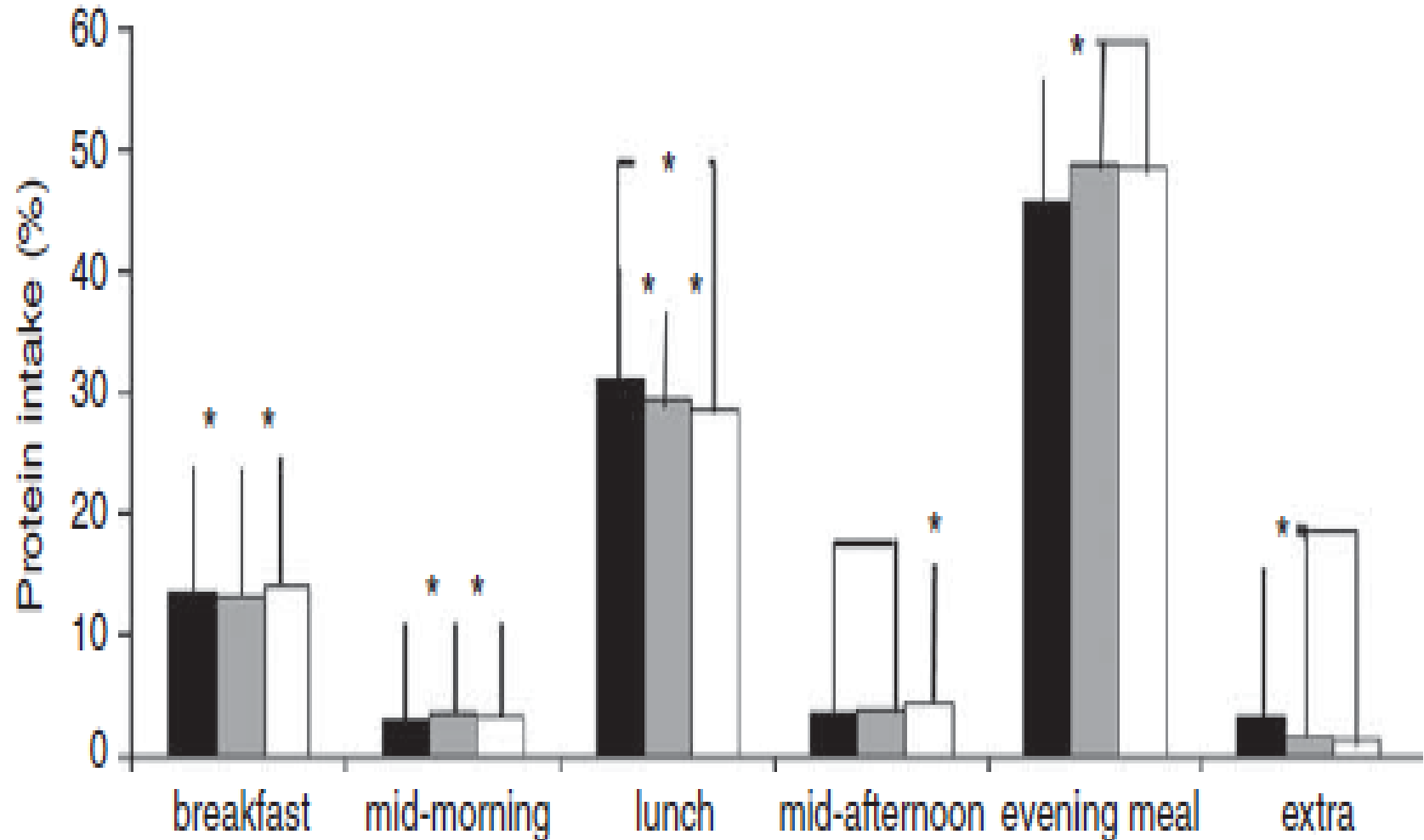
Rating of Perceived Exertion (RPE Scale)	
10	Maximal
9	Really, Really, Hard
8	Really Hard
7	
6	Hard
5	Challenging
4	Moderate
3	Easy
2	Really Easy
1	Rest



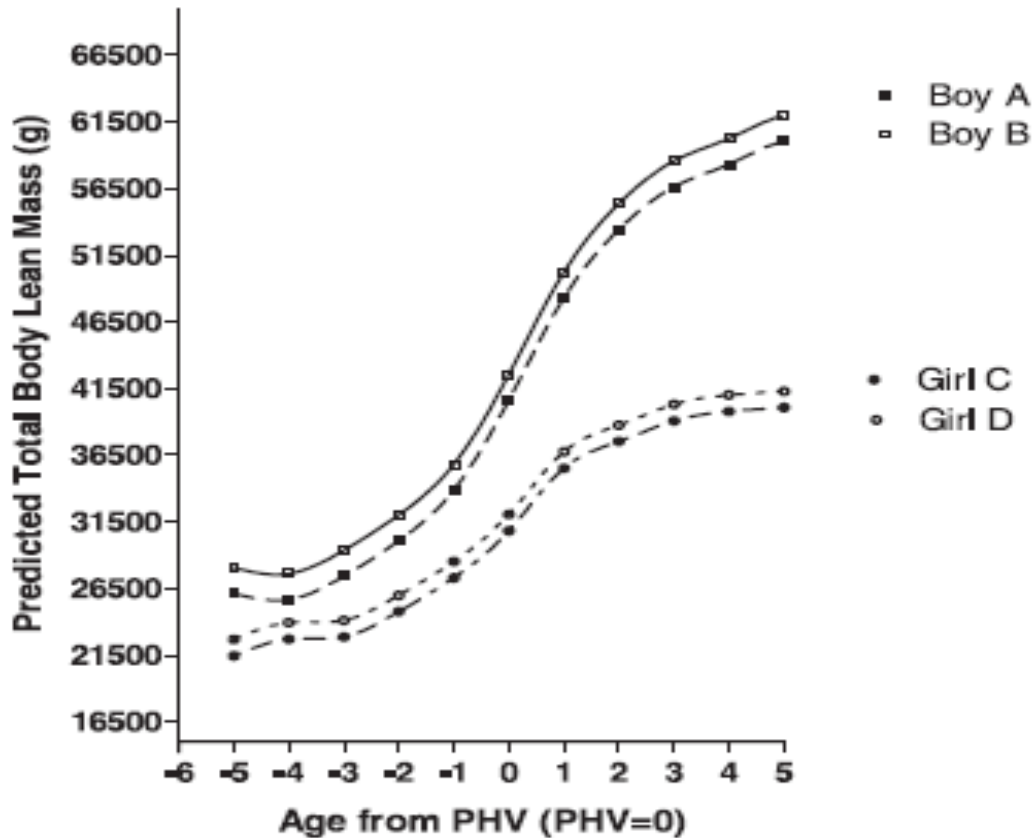
High effort (light and heavy) resistance exercise builds more muscle at breakfast...the next day!



Resistance exercise would make small protein meals (like breakfast) more efficient



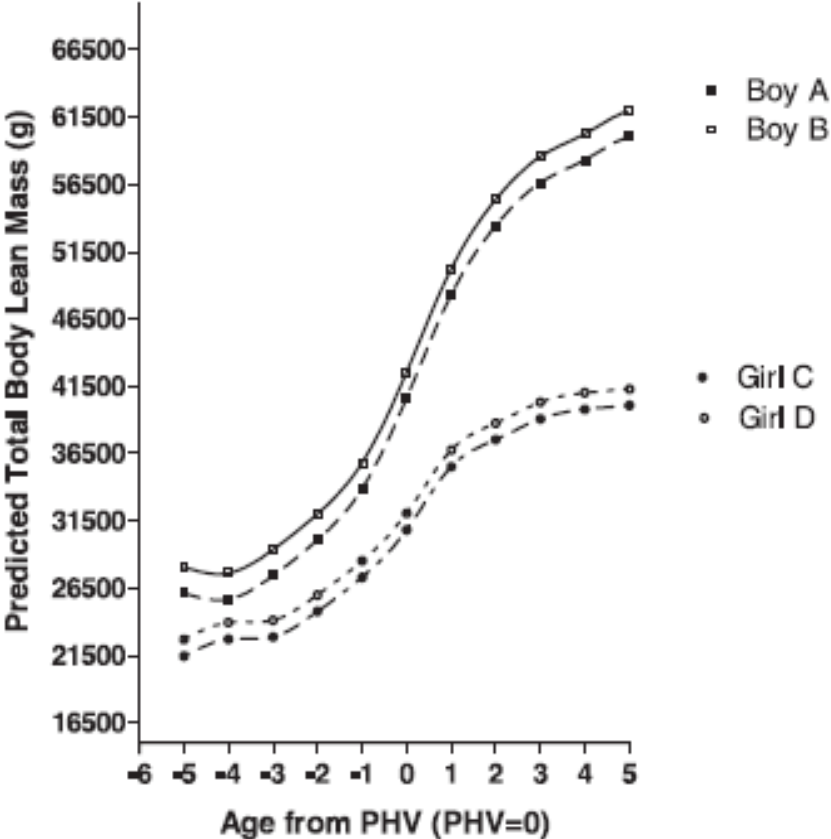
Active children have more lean body mass than their inactive peers



Baxter-Jones A, J. Appl. Physiol. 105:734, 2008.



Active children retain more protein to support the lean body growth

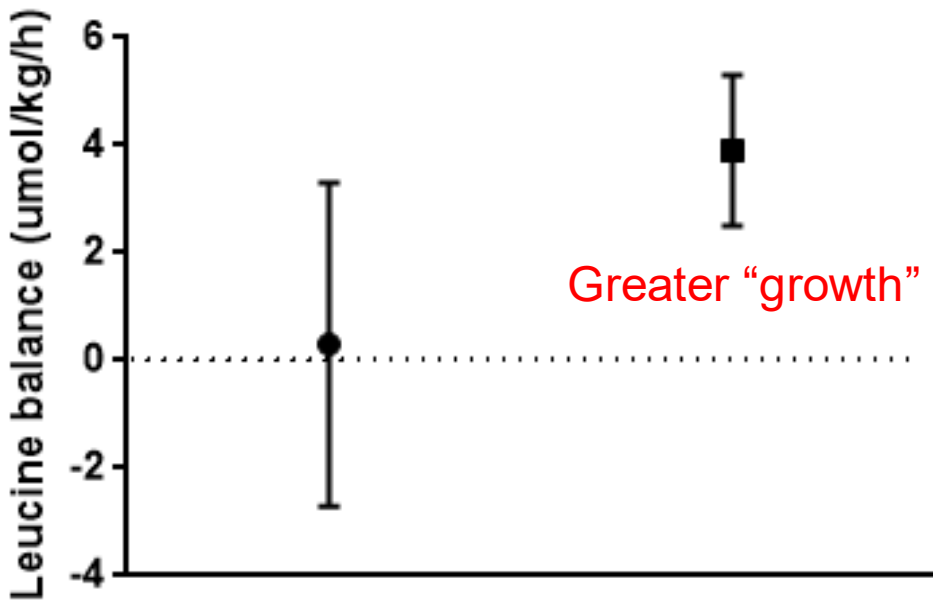


Baxter-Jones A, J. Appl. Physiol. 105:734, 2008.



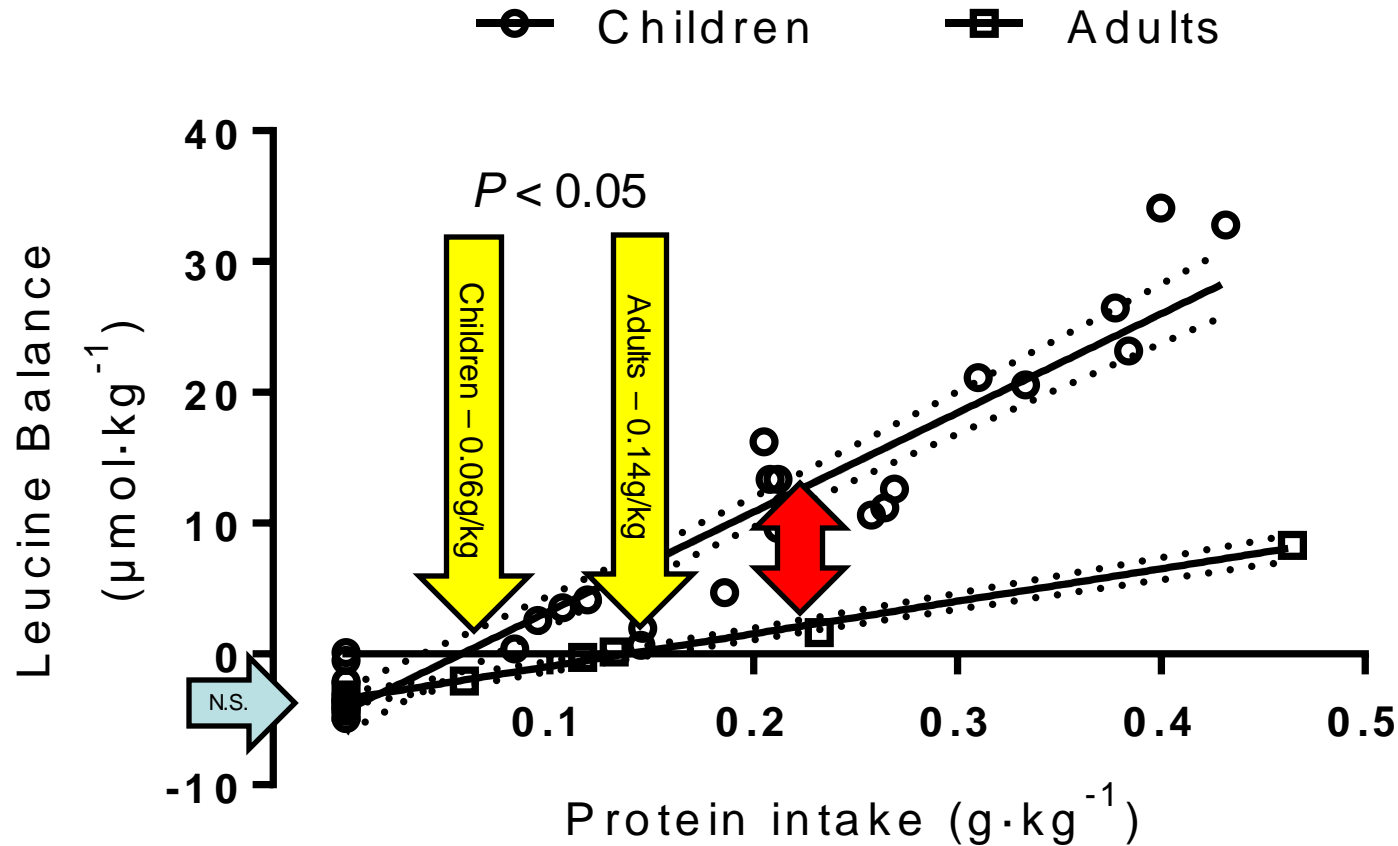
● Rested

■ Exercised



Adapted from:
 Volterman et al., *J. Nutr.* 147:807, 2017
 Beckett et al., *J. Clin. Endo. Metab.* 82:2445, 1997.

Children are relatively more sensitive to dietary amino acids after exercise than adults



Adult data adapted from:

Volterman et al., *J. Nutr.* 147:807, 2017

Moore et al., *Am. J. Clin. Nutr.* 89:161, 2009.

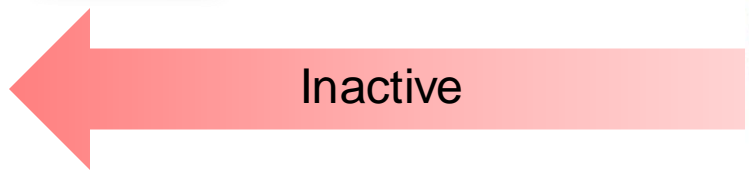
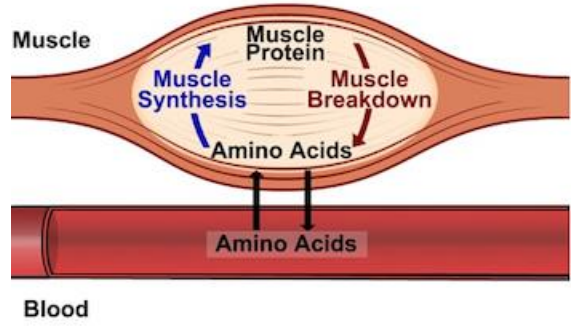
Levenhagen et al., *Med. Sci. Sports Exerc.* 34:828, 2002.

What I've told you (the good news)...

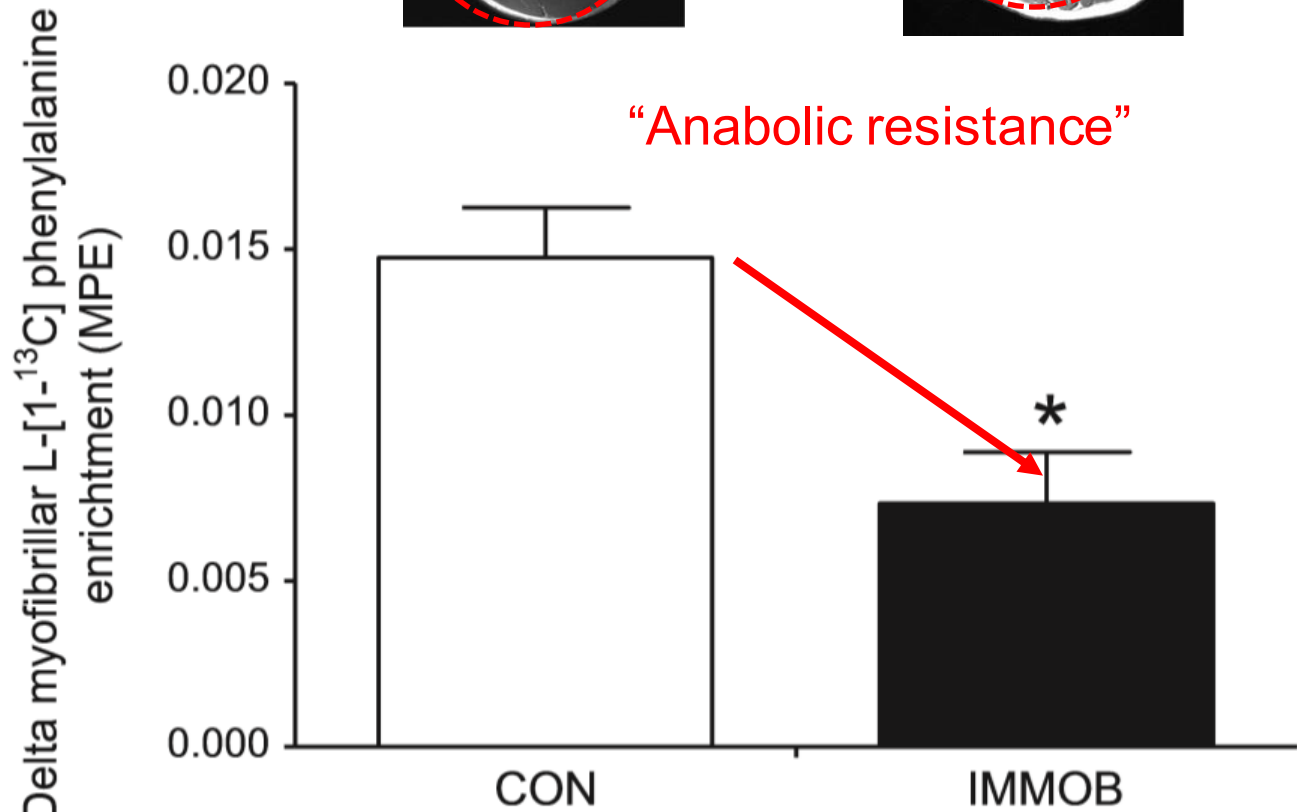
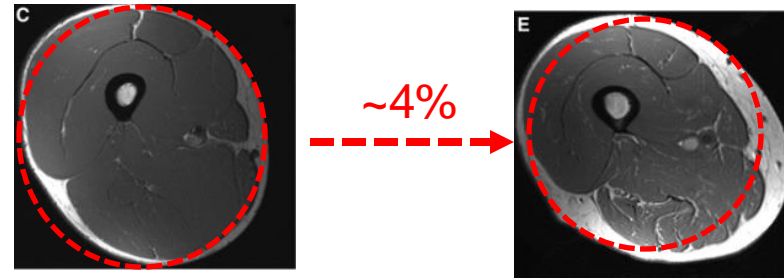
- Eating builds muscle
- Being active increases muscle building
- “You're more of what you just ate”



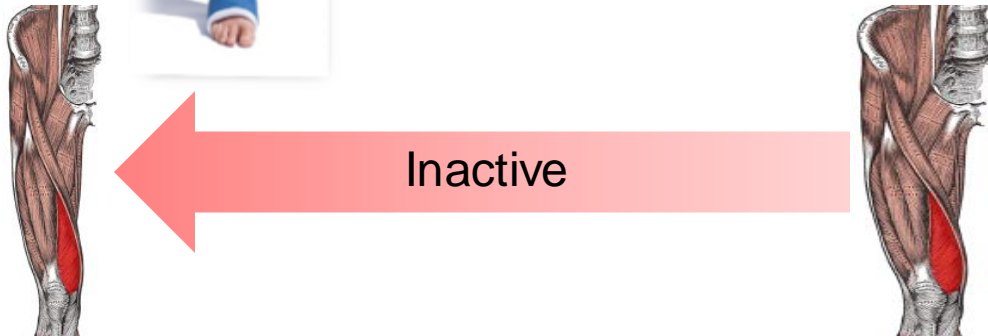
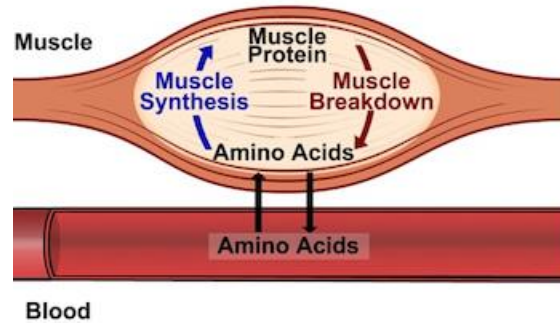
Muscle wastes with inactivity (the bad news)



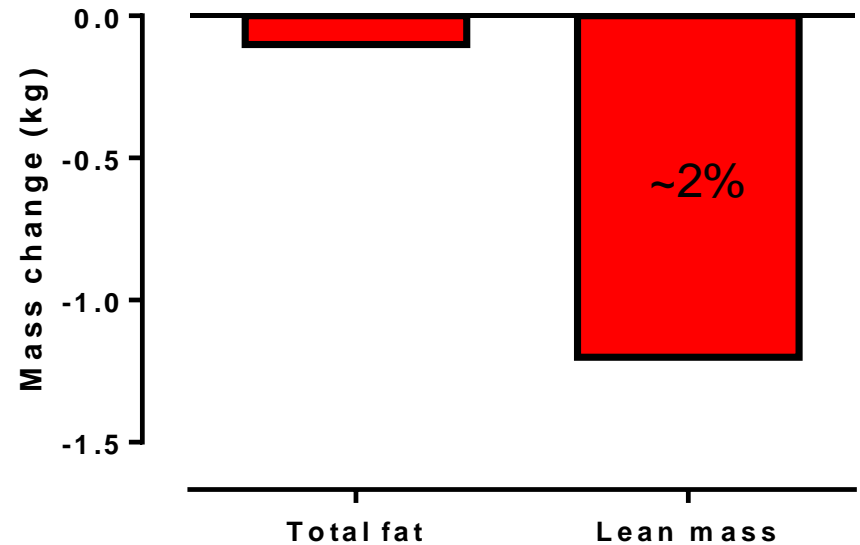
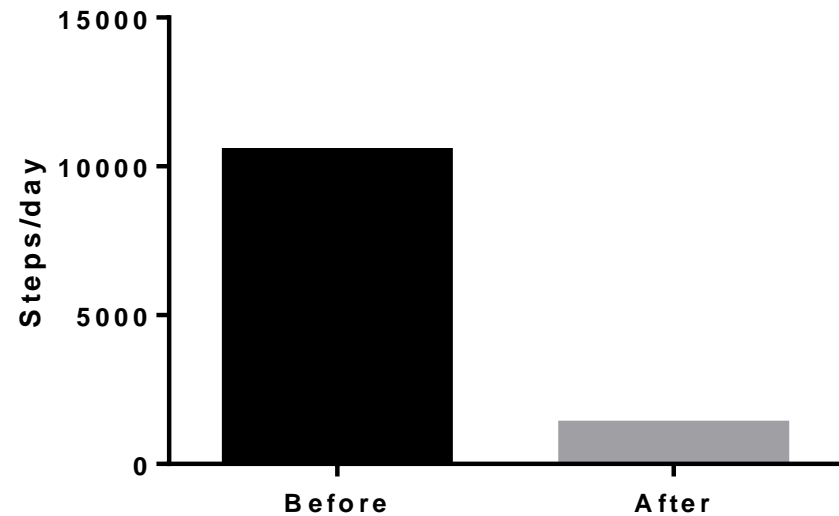
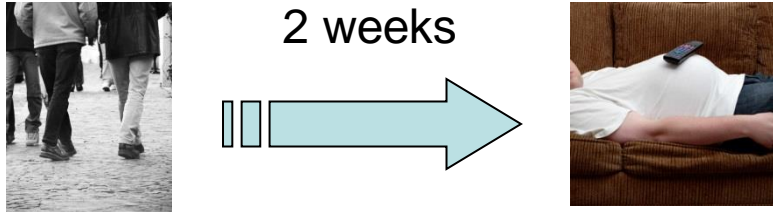
Complete inactivity impairs the muscle's ability to use dietary protein to rebuild



Muscle wastes with inactivity (the bad news)



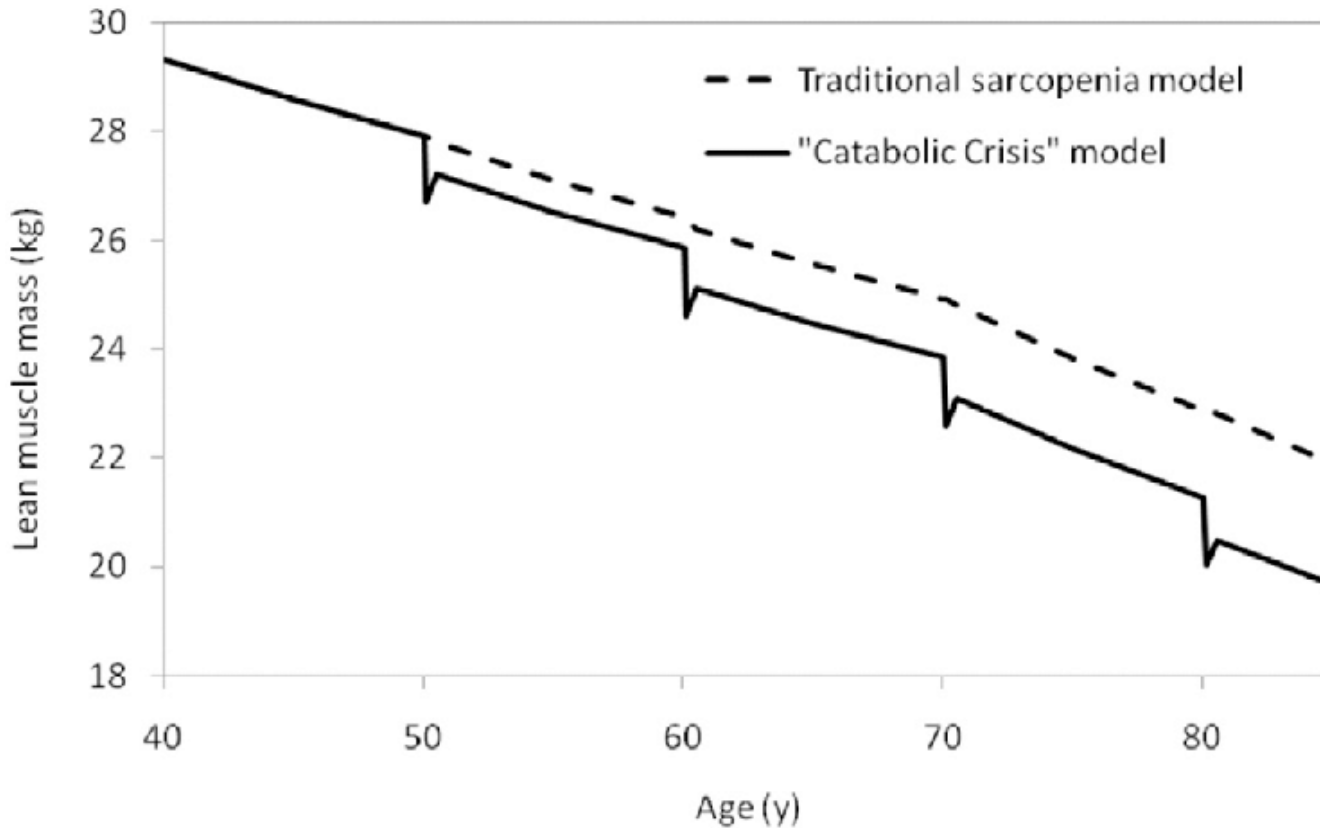
'Benign' inactivity (reduced daily step count) reduces muscle mass in as little as 2 weeks



Target 10,000 steps per day to maintain muscle mass and 'anabolic sensitivity'



Muscle loss with aging/inactivity is harder to 'gain back'



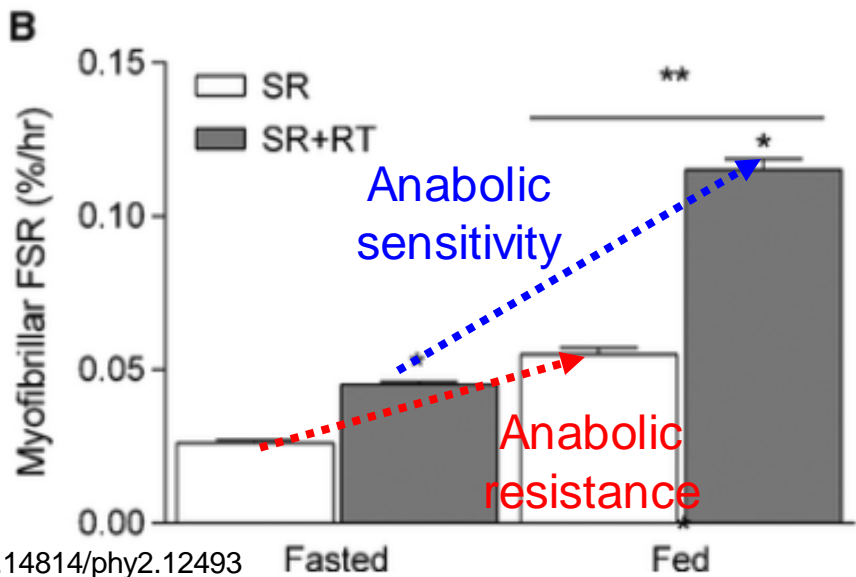
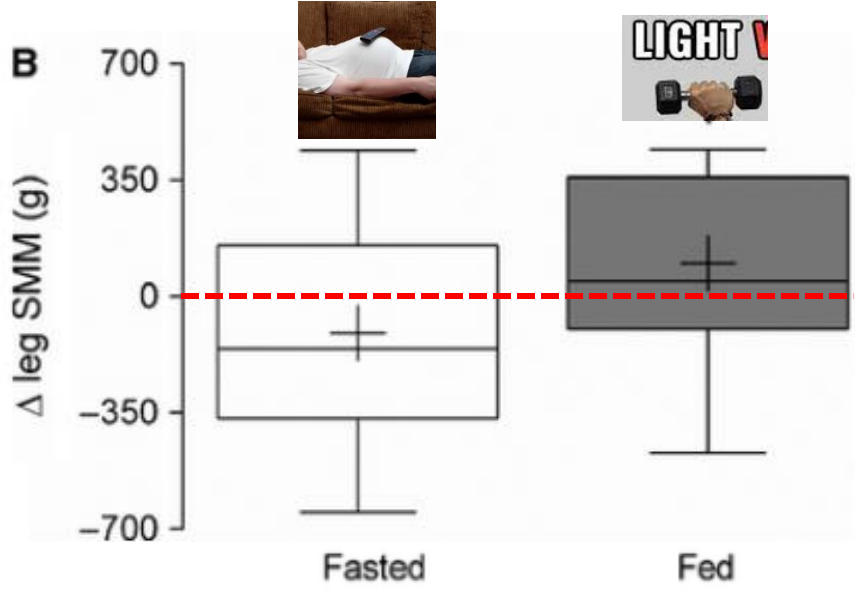
English & Paddon-Jones, Curr. Opin. Clin. Nutr. Metab. Care 13:34, 2010.



Low load, high effort exercise mitigates muscle loss during step reduction in older adults

~1500 steps/day (2 weeks)

6 exercise sessions





Does breaking up sitting time improve dietary protein efficiency?

Breakfast



Lunch



Prolonged sitting
(8h)

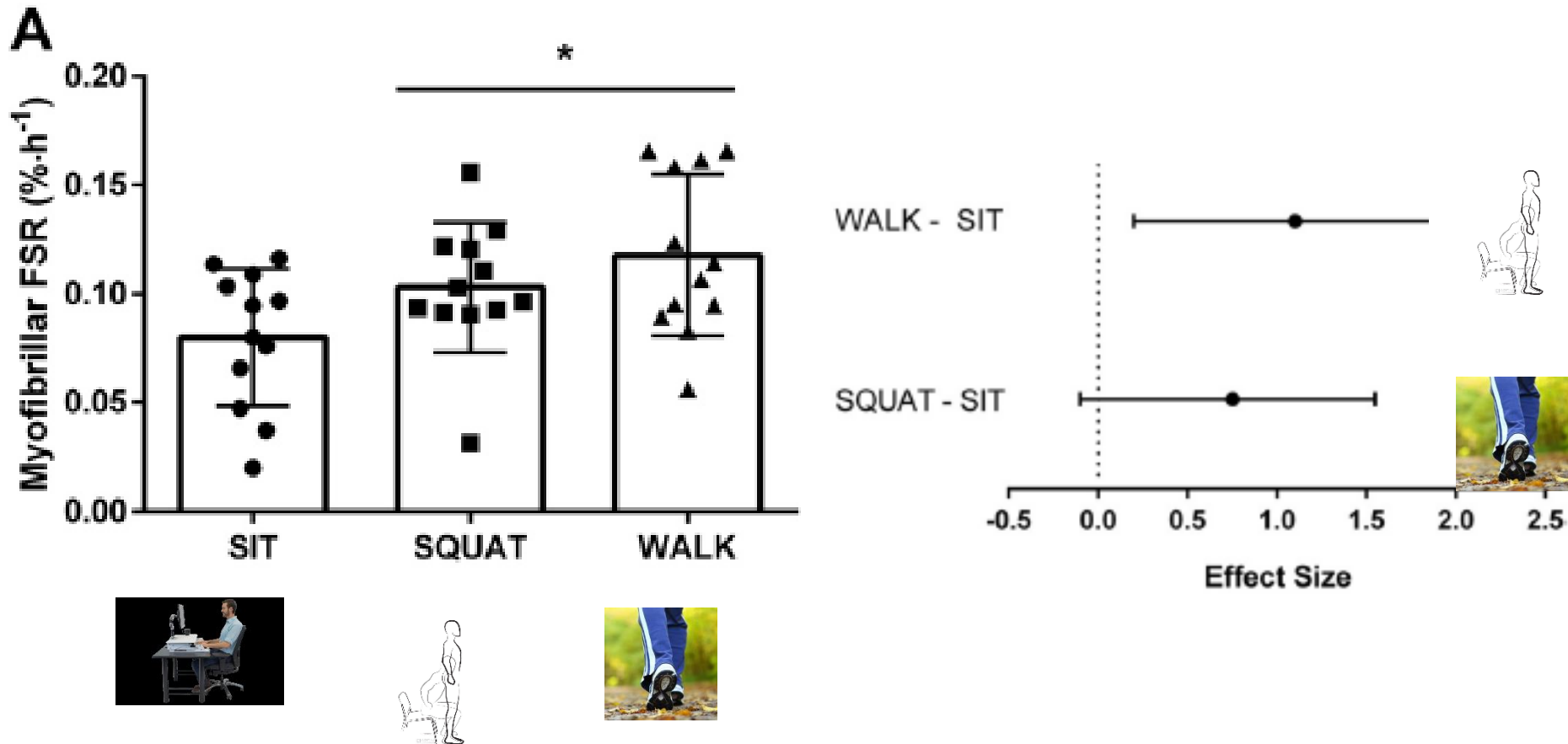


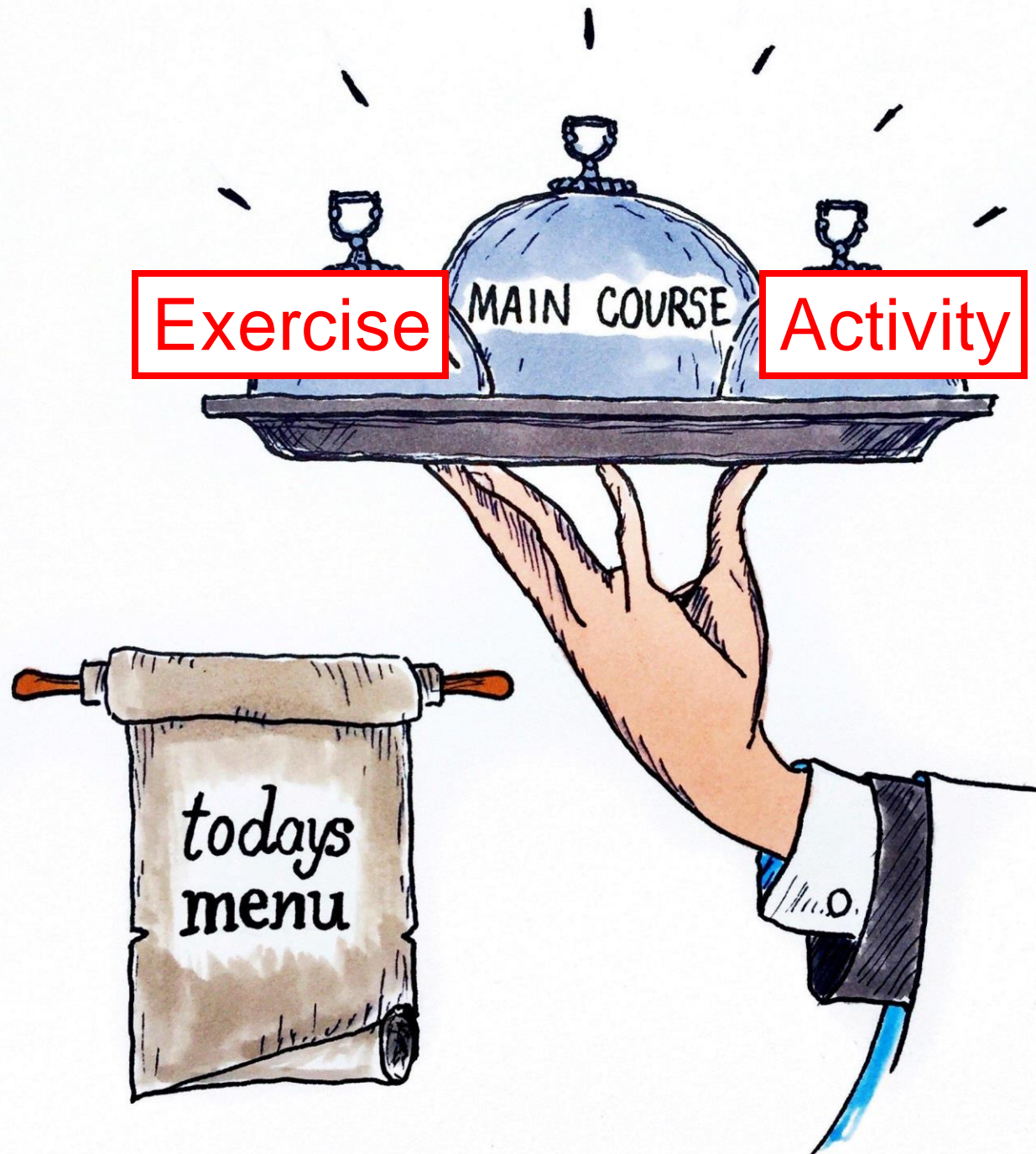
Activity break squats
(15 repetitions)



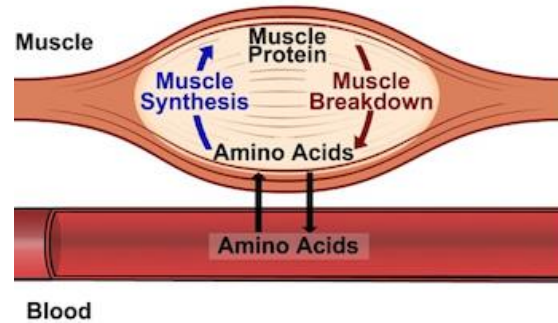
Activity break walking
(2 min)

YES! Breaking up sedentary time with activity “snacks” improves dietary protein efficiency





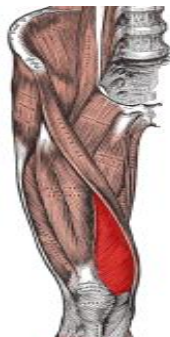
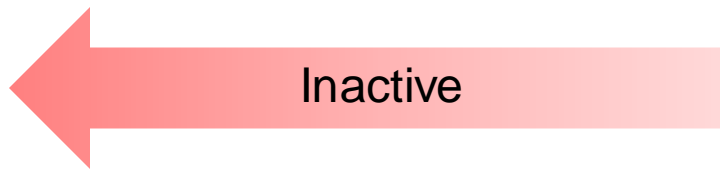
Eating builds muscle



“You are what you ate”

“Less of what you ate”

“More of what you ate”



10,000 steps/day
“Activity snacks”
Resistance exercise