Skeletal Muscle, Protein Metabolism, and Obesity

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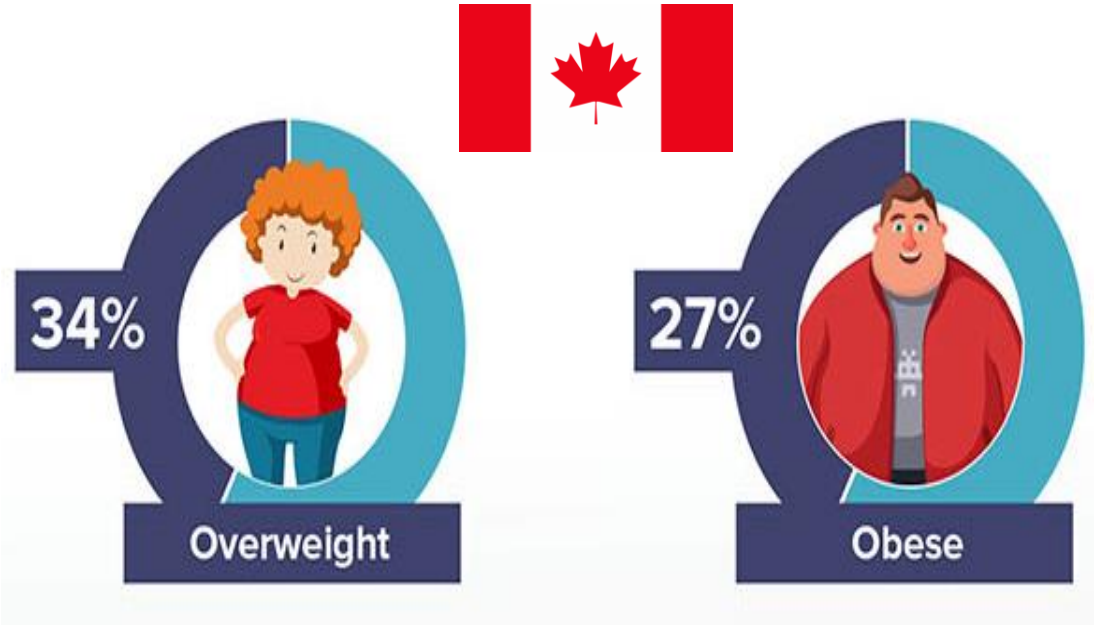
L'ASSOCIATION CANADIENNE des MEDECINS et CHIRURGIENS BARIATRIQUES

The CANADIAN ASSOCIATION of BARIATRIC PHYSICIANS and SURGEONS

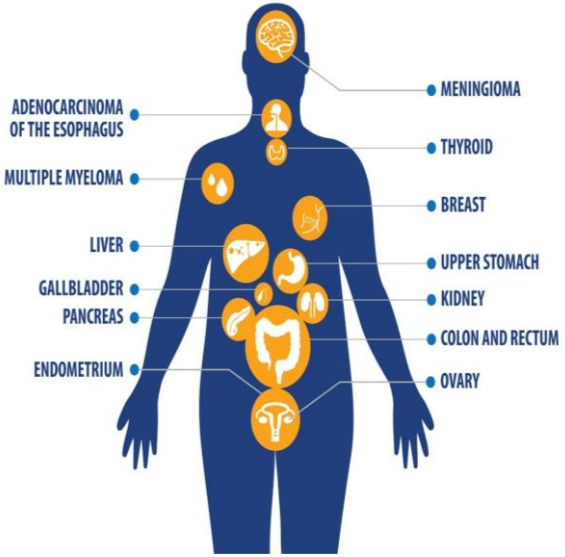
Obesity around the world



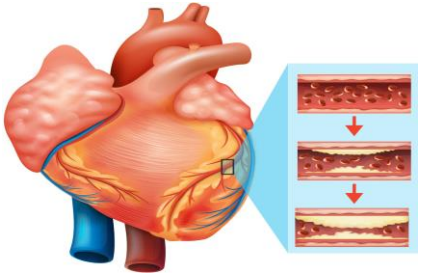
Statistics Canada (2016 & 2017)

Health consequences of obesity

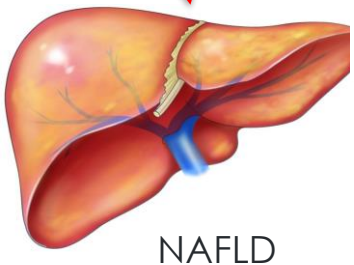
Insulin resistance and T2DM



Cancer

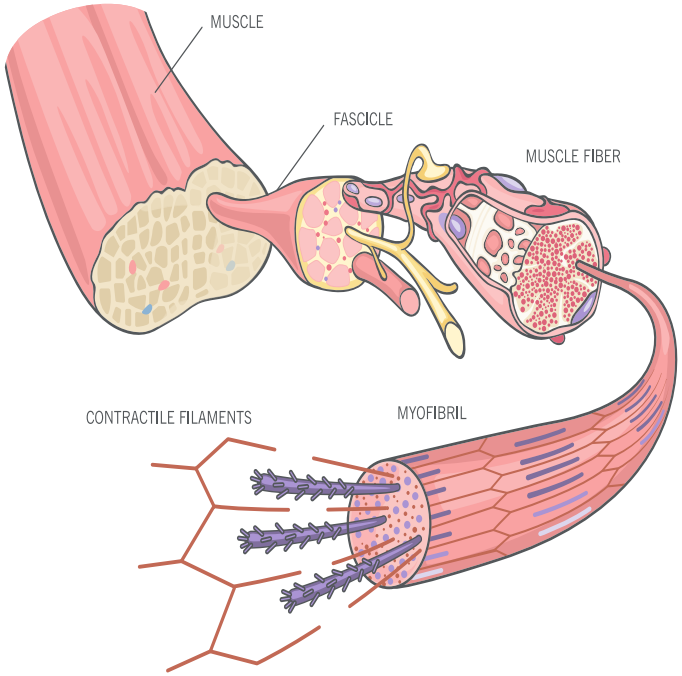


Cardiovascular disease



NAFLD

The importance of skeletal muscle



~40% total body mass

Critical roles in:

- Locomotion
- Basal metabolism
- Energy storage & nutrient deposition

Skeletal muscle mass is prognostic for ***mobility disability*** and ***chronic disease risk***, and is independent predictor of ***all-cause mortality***

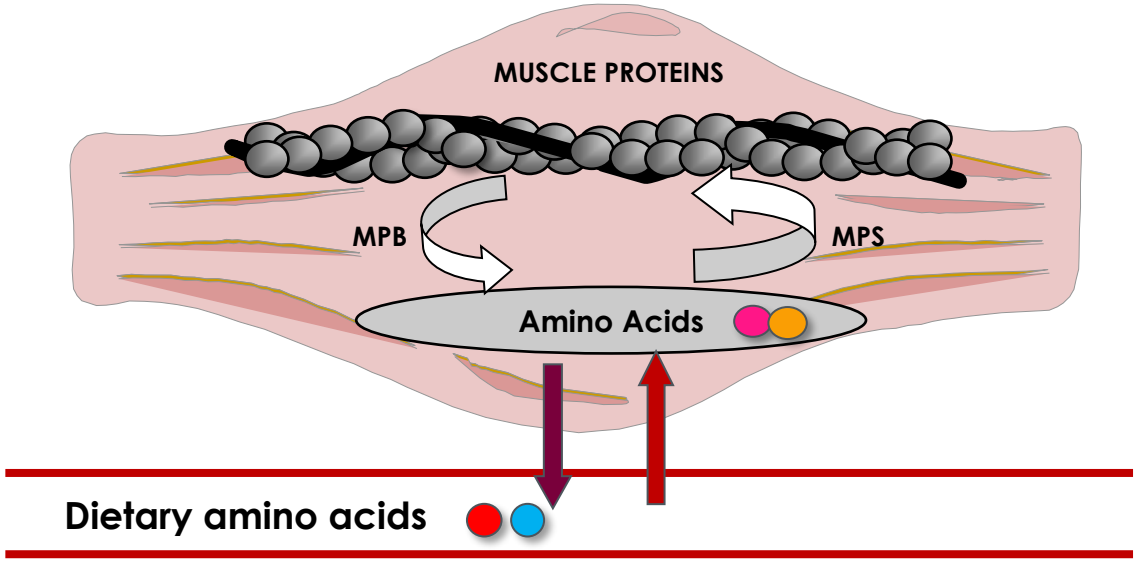
What am I going to talk about today

1. Regulation of skeletal muscle mass under normal conditions

2. How obesity influences one's ability to regulate skeletal muscle mass

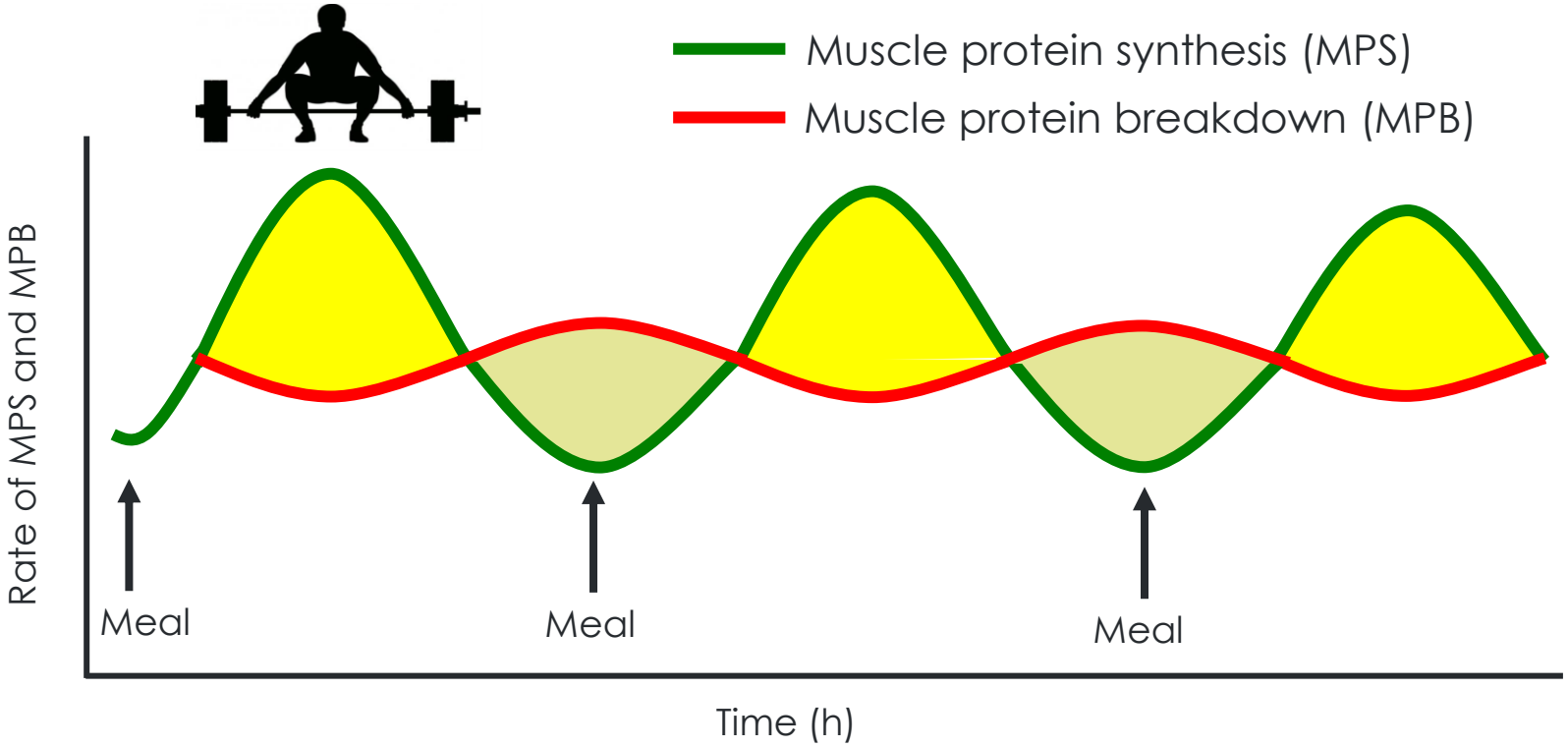
3. How exercise and protein nutrition can influence skeletal muscle muscle mass in individuals with obesity

Muscle protein turnover



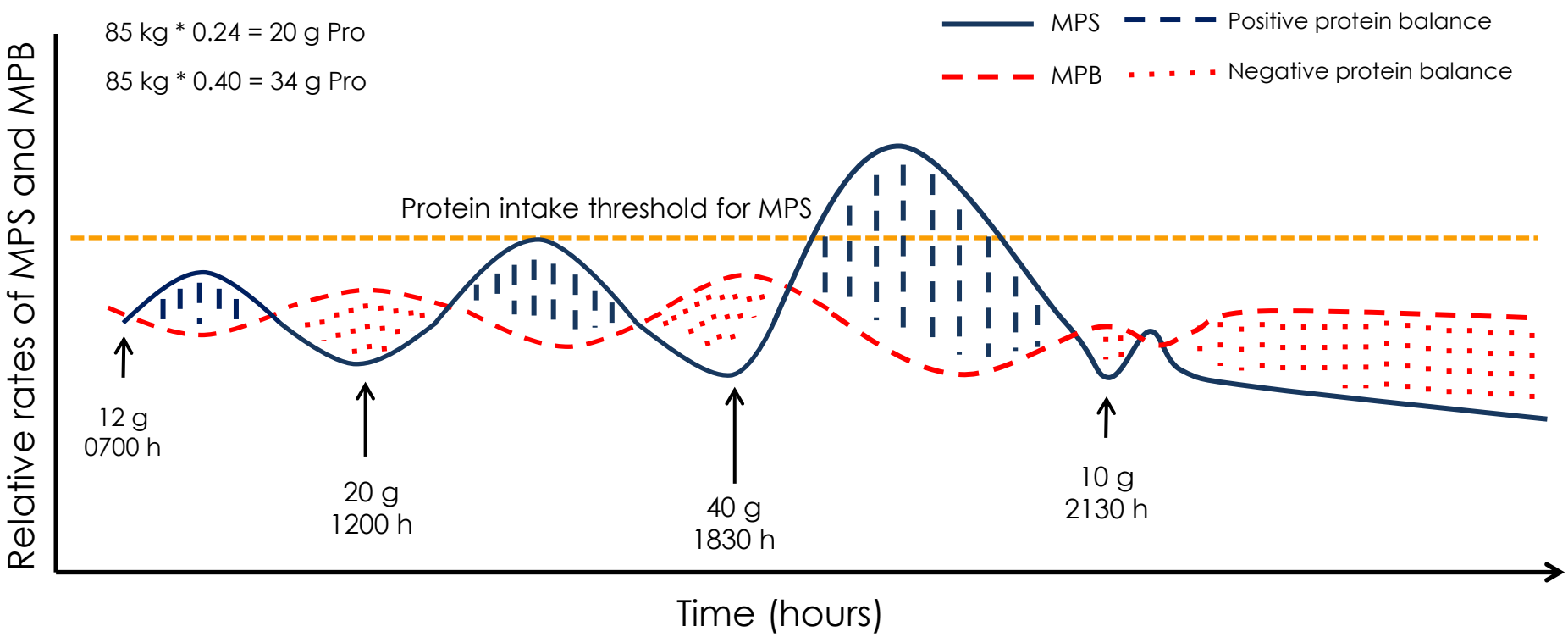
Credit: Dr. Chris McGlory

Muscle protein synthesis and muscle protein breakdown



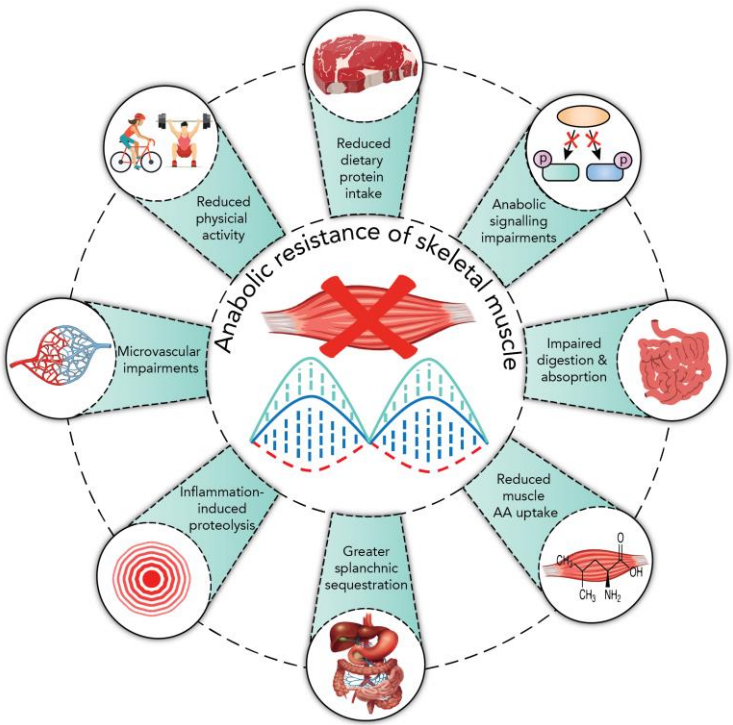
Credit: Dr. Leigh Breen

Anabolic resistance of skeletal muscle

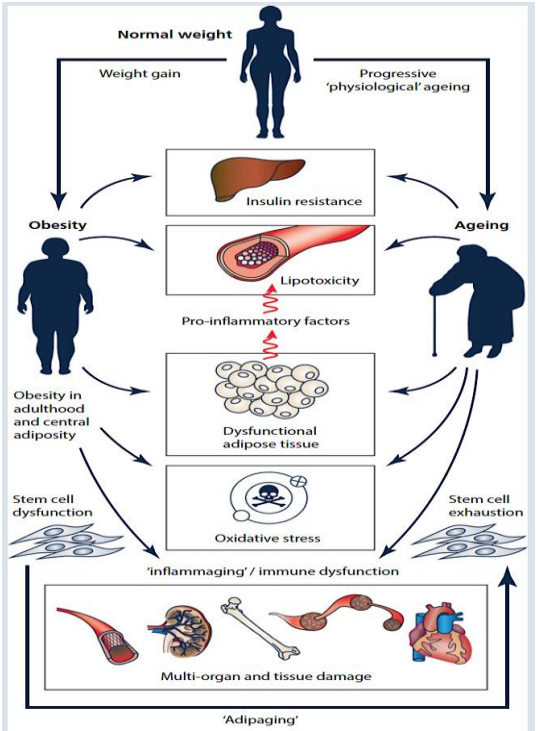


Oikawa, S.Y., et al. (2019) Frontiers in Nutrition

Aging and obesity: two sides of the same coin?



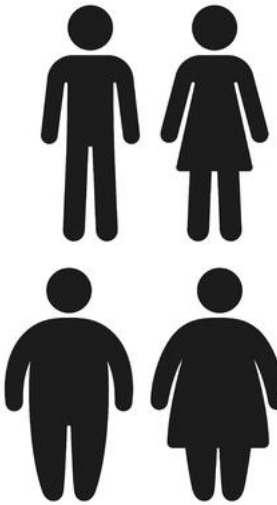
McKendry, J. et al. 2021. *Comprehensive Physiology*



Perez et al. 2016. The *Journal of Physiology*

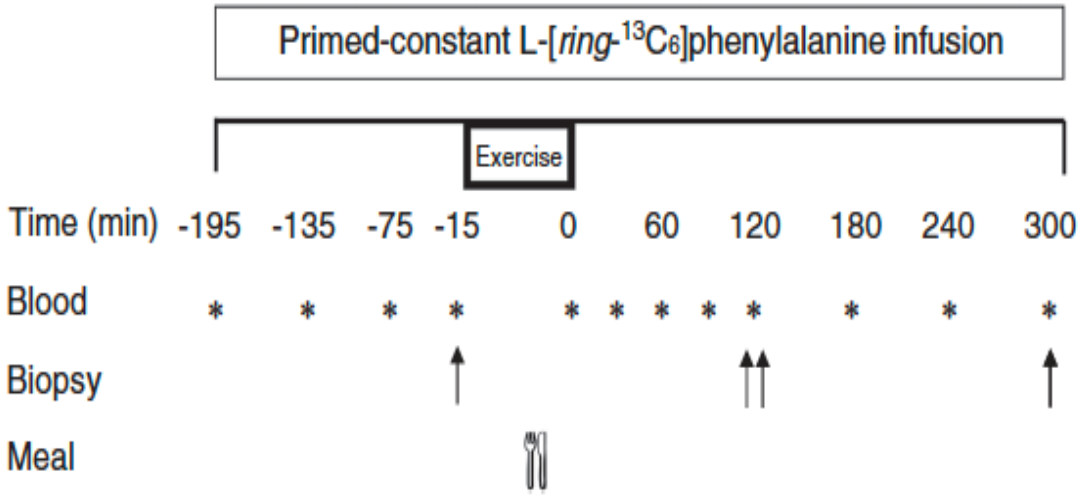
How does obesity influence Skeletal muscle mass regulation?

Obesity and muscle protein synthesis in young



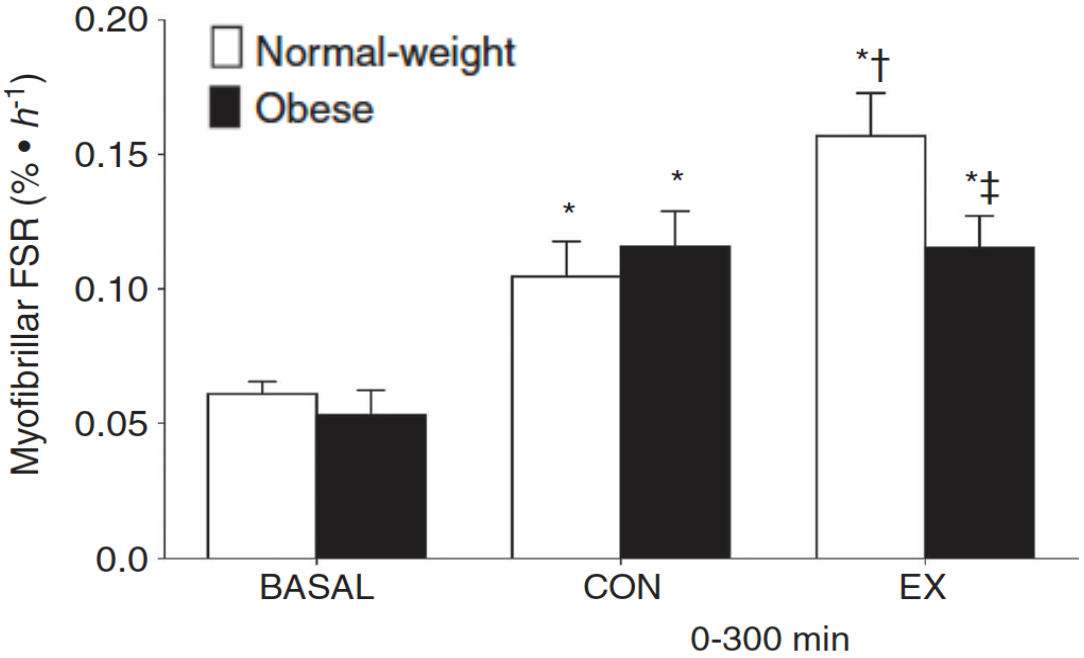
n = 9
BMI = 21.9

n = 9
BMI = 35.7



Beals, J.W. et al. 2018. *The Journal of Physiology.*

Obesity impairs muscle protein synthesis in young



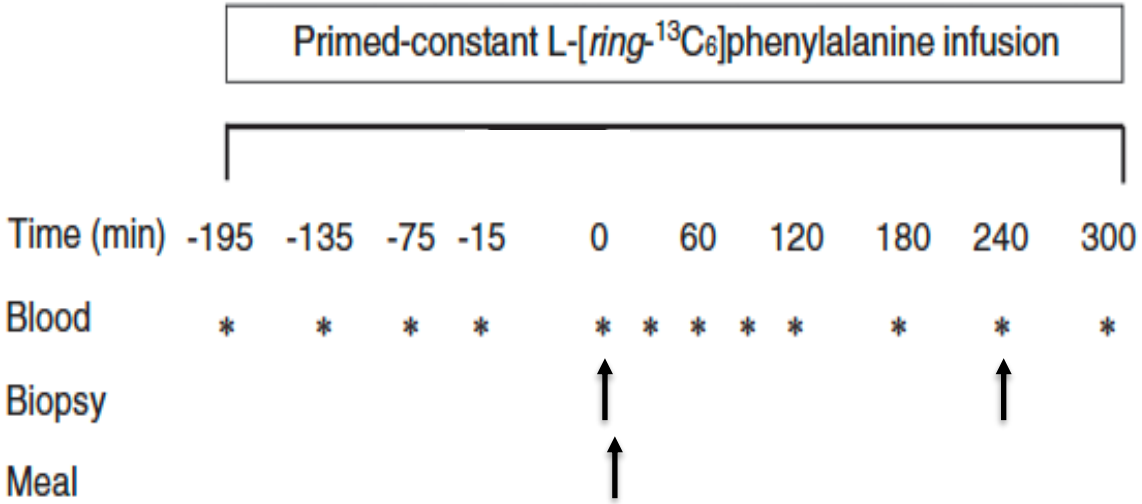
Beals, J.W. et al. 2018. *The Journal of Physiology.*

Obesity and age-related anabolic resistance

Young Lean
n = 18
BMI = 23.3

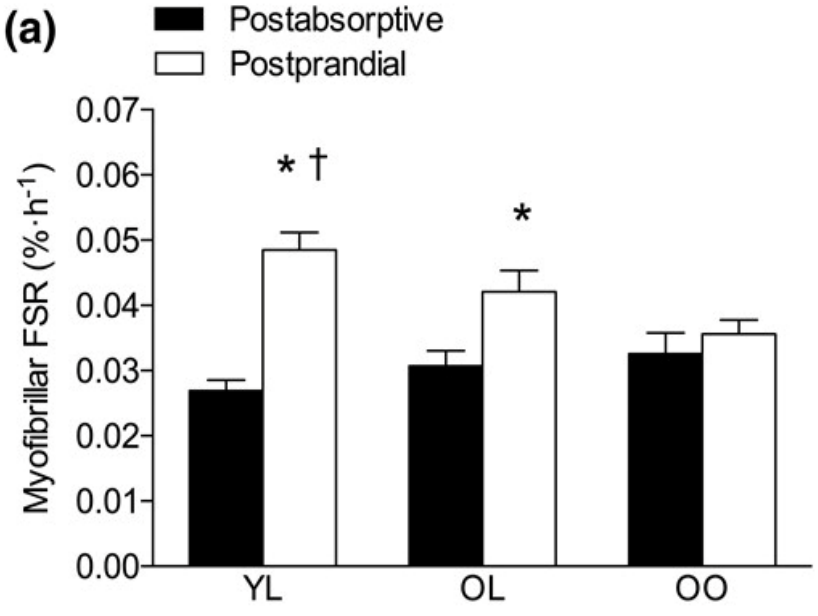
Older Lean
n = 10
BMI = 22.7

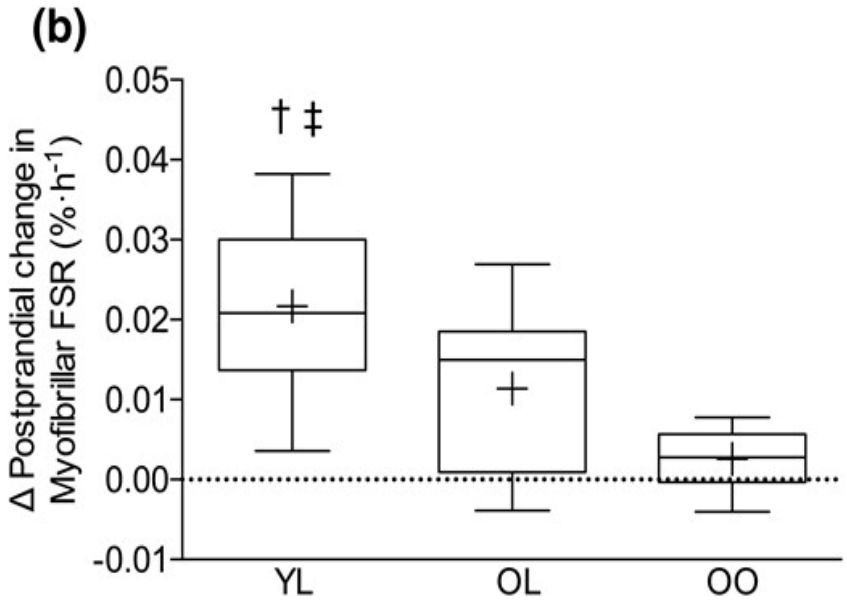
Older Obese
n = 7
BMI = 32.9



Smeuninx et al. (2017) *JCEM*

Obesity exacerbates age-related anabolic resistance

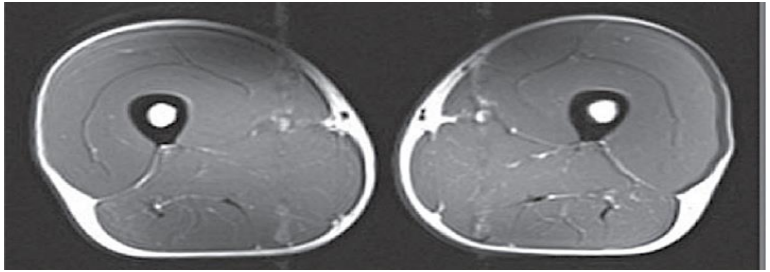


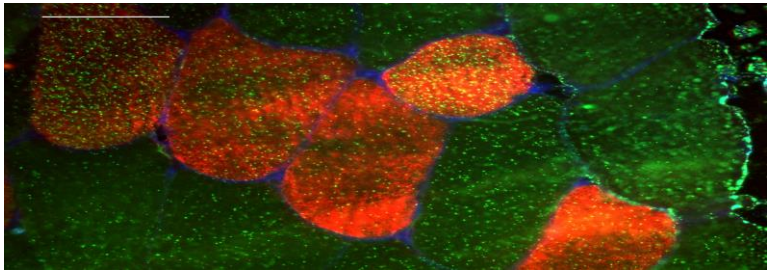


Smeuninx et al. (2017) *JCEM*

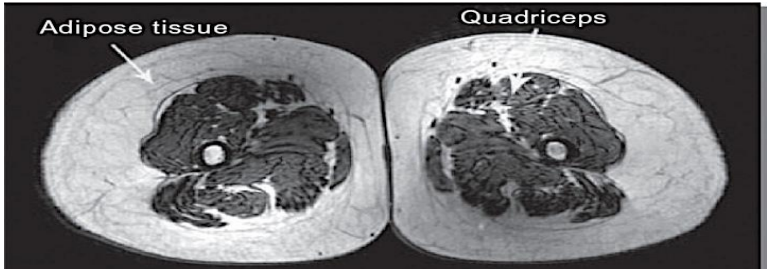
Obesity exacerbates age-related anabolic resistance

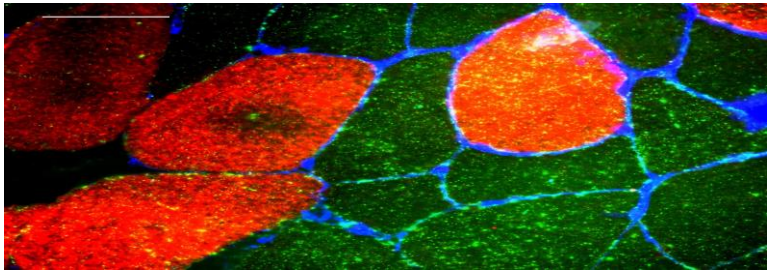
Young Lean





Older Obese





Wroblewski et al. (2011) *Phys Sportsmed*
Smeuninx et al. (2017*) JCEM*

How exercise and protein nutrition influence skeletal muscle muscle mass in individuals with obesity?

For weight loss…..why Protein?

1. Satiety
2. Thermic effect
3. Poor substrate for lipogenesis
4. Preserves muscle mass (and may increase fat mass loss)
5. Nutrient-density

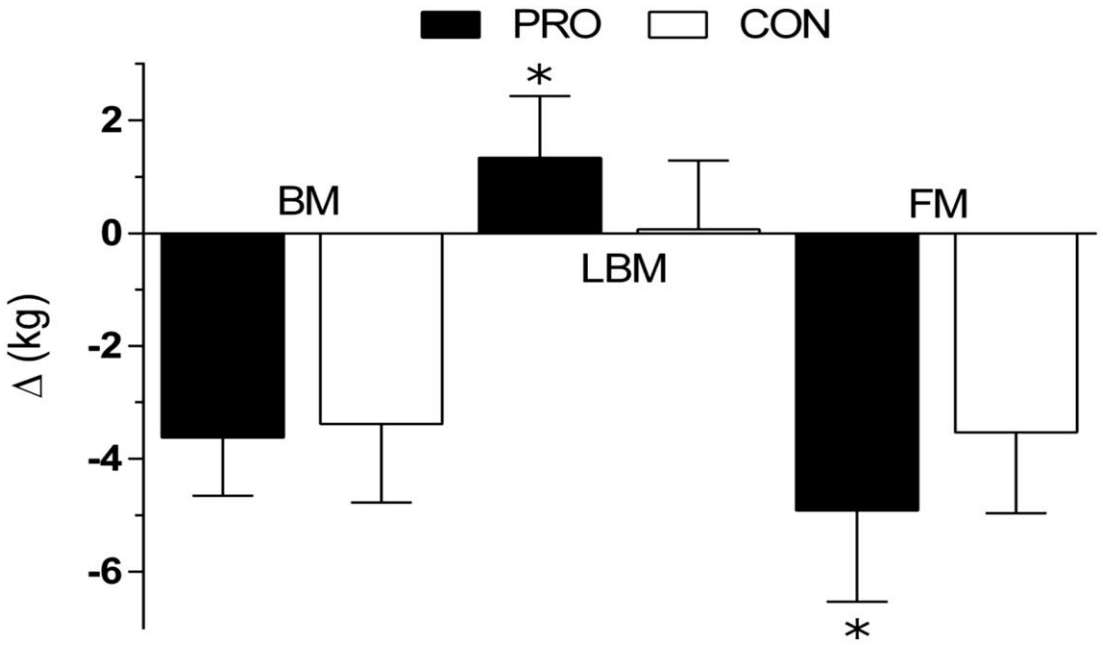
Higher compared with lower dietary protein during an energy deficit combined with intense exercise promotes greater lean mass gain and fat mass loss: a randomized trial[1,2]

*Thomas M Longland, Sara Y Oikawa, Cameron J Mitchell, Michaela C Devries, and Stuart M Phillips**

- Young men (n=20/group)
- 40% reduction/d in estimated E needs for 28d
- Exercising 6d/week
- PROTEIN: 1.2 vs. 2.4 g protein/kg/d

Longland, T.M., et al. 2016. Am J Clin Nutr.

Increased muscle mass and loss of fat mass is possible



Longland, T.M., et al. 2016. Am J Clin Nutr.

Summary

1. Obesity is widely prevalent and has severe health consequences
2. Skeletal muscle is extremely important for maintaining health
3. Muscle mass is regulated by MPS and MPB
4. Obesity impairs the anabolic response to feeding and exercise
5. Exercise and protein are important for maintaining muscle

Protein Metabolism Research Lab

Thank you for listening!

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