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"It Must Be My Metabolism"

Nutrition to Maintain Muscle Mid-Life and Beyond

Live Leaner, Stronger and Longer

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The following relevant financial relationships have been disclosed by faculty, and all have been mitigated.

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Faculty have been asked to disclose discussion of unlabeled or unapproved use(s) of drugs or devices, as well as topics that are new and evolving, during the course of their presentations.

Learning Objectives

1. Dispel the myth of altered metabolism and weight gain with age
2. Define anabolic resistance as it relates to the aging body
3. Recognize the role muscle maintenance can play in health outcomes
4. Identify dietary strategies to help maintain muscle with aging, specifically the amount and timing of protein intake

”

I used to be thin and now, I’m not.

What happened?

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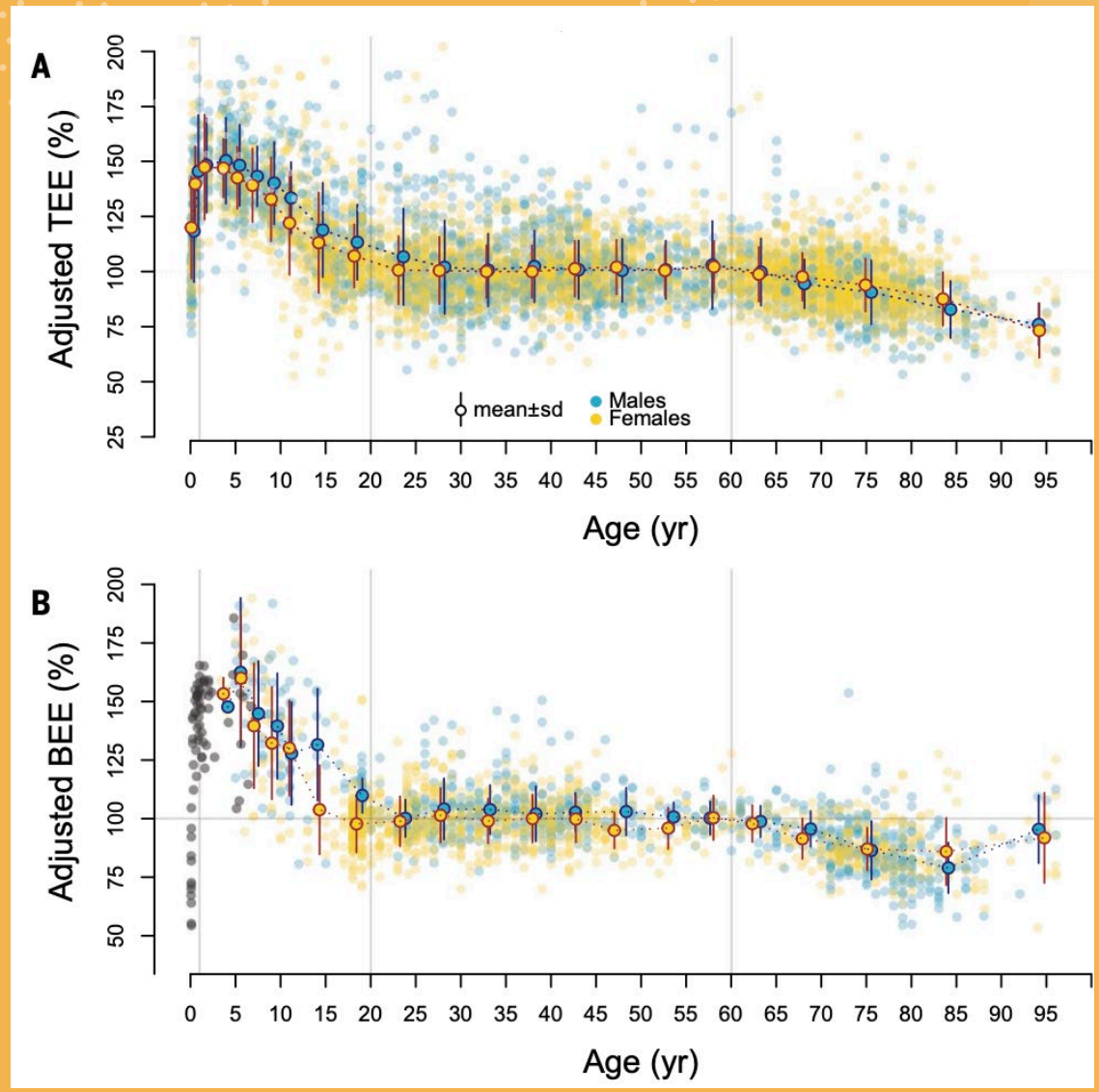
“It must be my metabolism”



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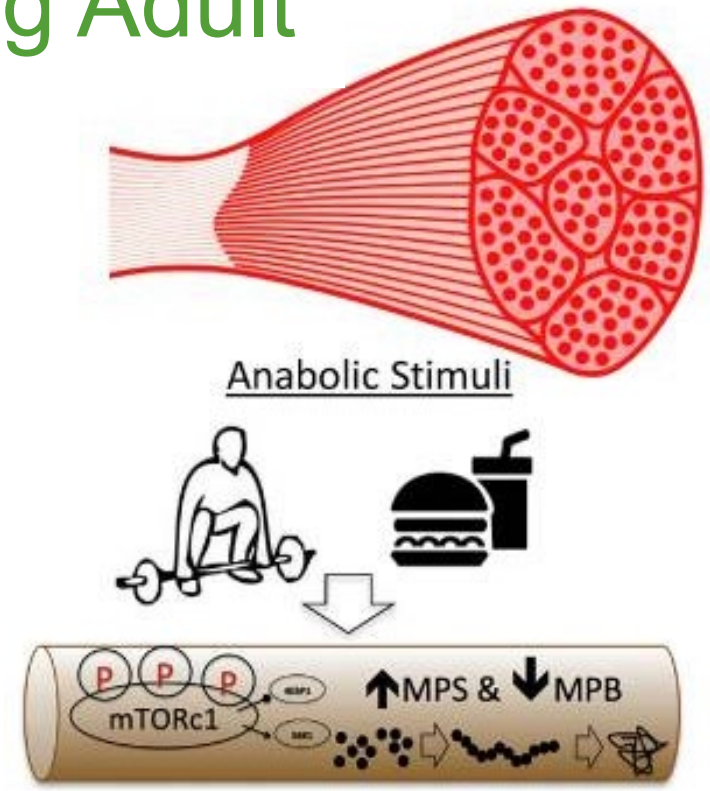
Pontzer et al. *Science*. 2021 Aug 13;373(6556):808-812.

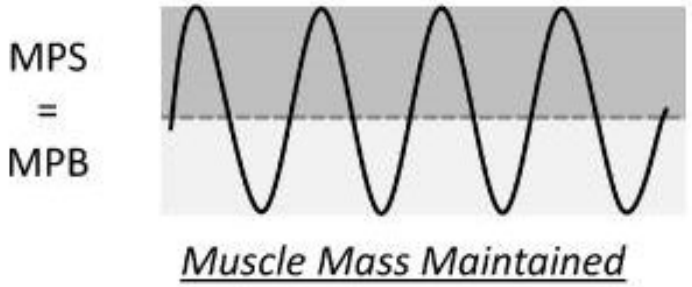
Lose Muscle Every Year Starting @ Age 30/40

- A little less than 1% per year starting in middle age on
- May lose 50% of muscle by 8-9th decade of life
- Due to imbalances of muscle protein synthesis (MPS) and breakdown (MPB)
- Our bodies do not respond the same to nutrition and exercise as they did when we were younger

Wilkinson et al. *Ageing Res Rev*. 2018;47:123-132.

Young Adult

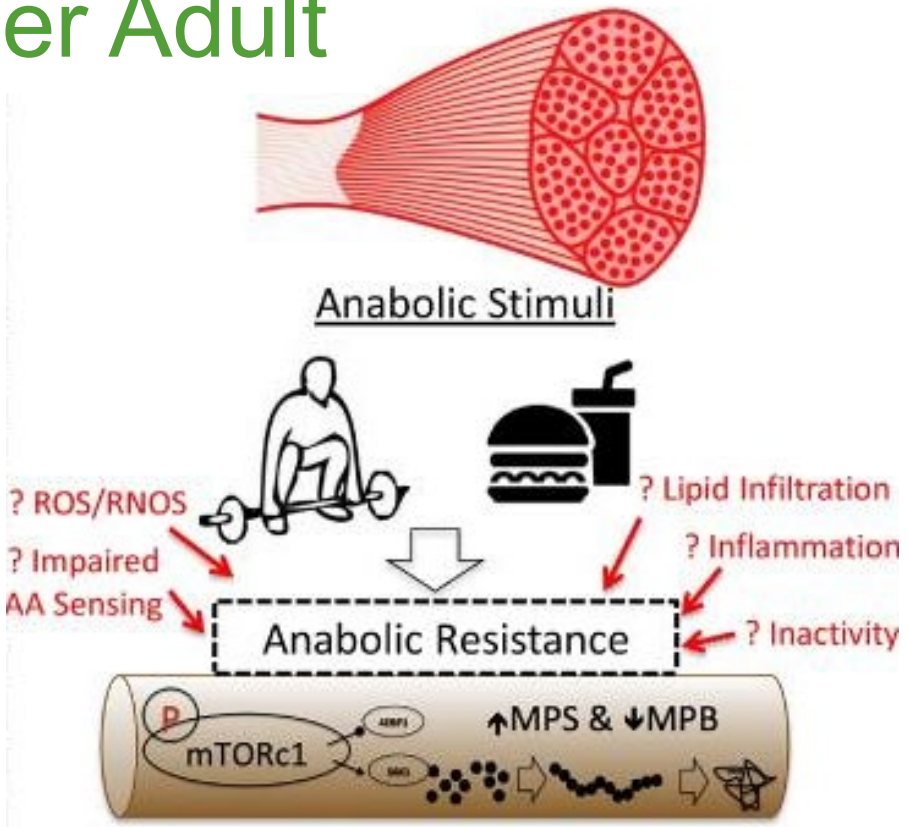


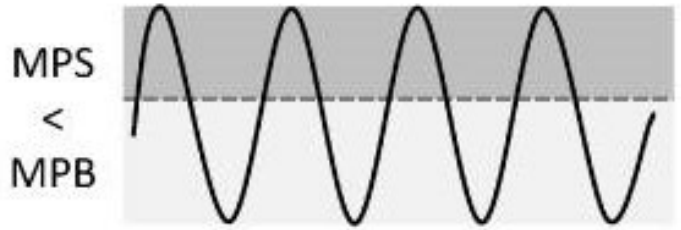


Muscle Mass Maintained

VS

Older Adult

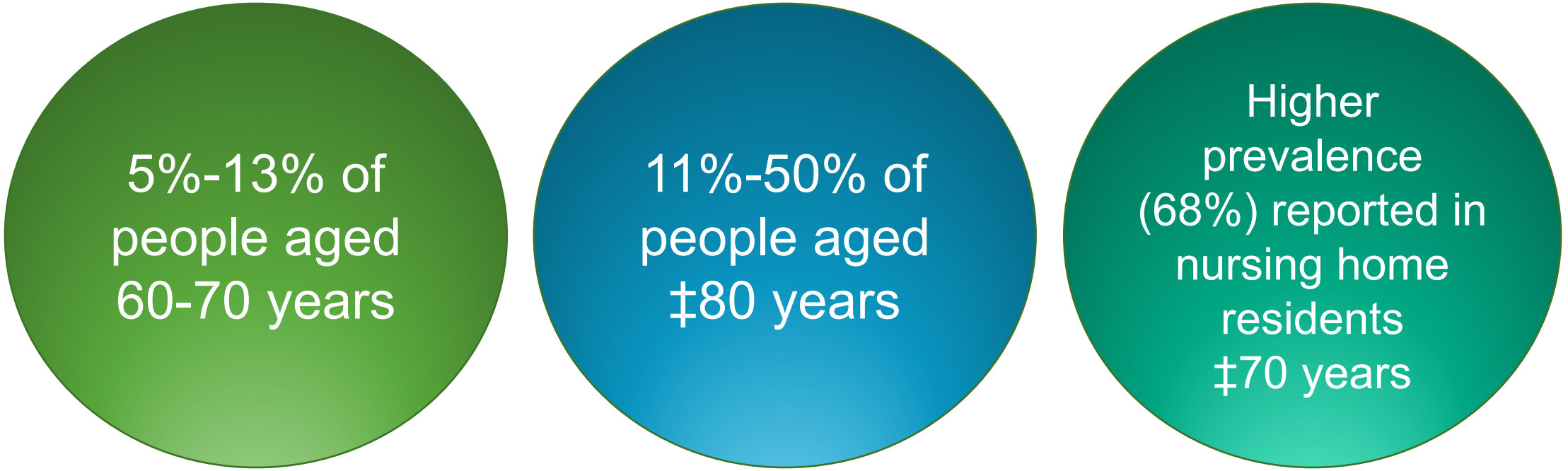




Muscle Atrophy

Wilkinson et al. *Ageing Res Rev*. 2018;47:123-132.

Sarcopenia



SARCOPENIA DOES NOT "JUST HAPPEN"

Rejuvenation Research. 2015;18(1): doi:10.1089/rej.2014.1623
Am J Clin Nutr. 2017;106:1078-1091.

Benefits of Diet and Exercise Over 50

Maintain muscle	Blood sugar control	Strength	Bone health
Blood pressure	Cognitive Function	Mood normalization	Mobility
Cancer (muscle or ↓ fat/ inflammation?)	Support Immune function	Gut health	Heart disease

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5830901/#
Rejuvenation Research. 2015;18(1): doi:10.1089/rej.2014.1623

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How to Overcome Anabolic Resistance: Diet

Protein Dose Response and Protein Timing

https://academic.oup.com/biomedgerontology/article/70/1/57/2947642

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	Group	Slope (%/h per g/kg)	Breakpoint (g/kg)	Goodness of Fit	Degrees of Freedom
Protein/kg BM	Younger	0.12±0.06	0.24±0.6	r^2 = .49	93
	Older	0.07±0.03*	0.40±19†	r^2 = .40	48
Protein/kg LBM↑	Younger	0.12±0.08	0.25±0.13	r^2 = .39	49
	Older	0.05±0.02*	0.61±0.28*	r^2 = .41	48

- Biphase Linear Regression Model Characteristics
- *Notes:* Mean ± 95% CI. BM = body mass; LBM = lean body mass; Slope = slope of the first line segment of the biphase linear regression. ↑LBM available for N = 43 older and N = 44 younger men.
- *Different from younger men, $P < .01$.
- †Trend for a difference between younger and older men, $P = .055$.

https://academic.oup.com/biomedgerontology/article/70/1/57/2947642

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What Can Be Done?

MUSCLE PROTEIN STIMULUS (MPS)

Younger men @ 0.24 g/kg

Older men @ 0.40 g/kg

(0.25 and 0.60 g/kg lean body mass in younger and older)

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Protein Timing

0.4 g/kg/bw

25 g women

30 g for men

Each meal starting at breakfast

(2 g of leucine)

https://www.ncbi.nlm.nih.gov/entrez/eutils/elink.fcgi?dbfrom=pubmed&retmode=ref&cmd=prlinks&id=19057193
Exerc Sport Sci Rev. 2013; 41(4):216-223. doi:10.1097/JES.0b013e3182a4e699.

Protein needs per meal

Younger vs Older

lbs	kg	Protein/kg/meal 0.24	Protein/kg/meal 0.40
110	50.0	12.0	20.0
120	54.5	13.1	21.8
130	59.1	14.2	23.6
140	63.6	15.3	25.5
150	68.2	16.4	27.3
160	72.7	17.5	29.1
170	77.3	18.5	30.9
180	81.8	19.6	32.7
190	86.4	20.7	34.5
200	90.9	21.8	36.4
210	95.5	22.9	38.2
220	100.0	24.0	40.0

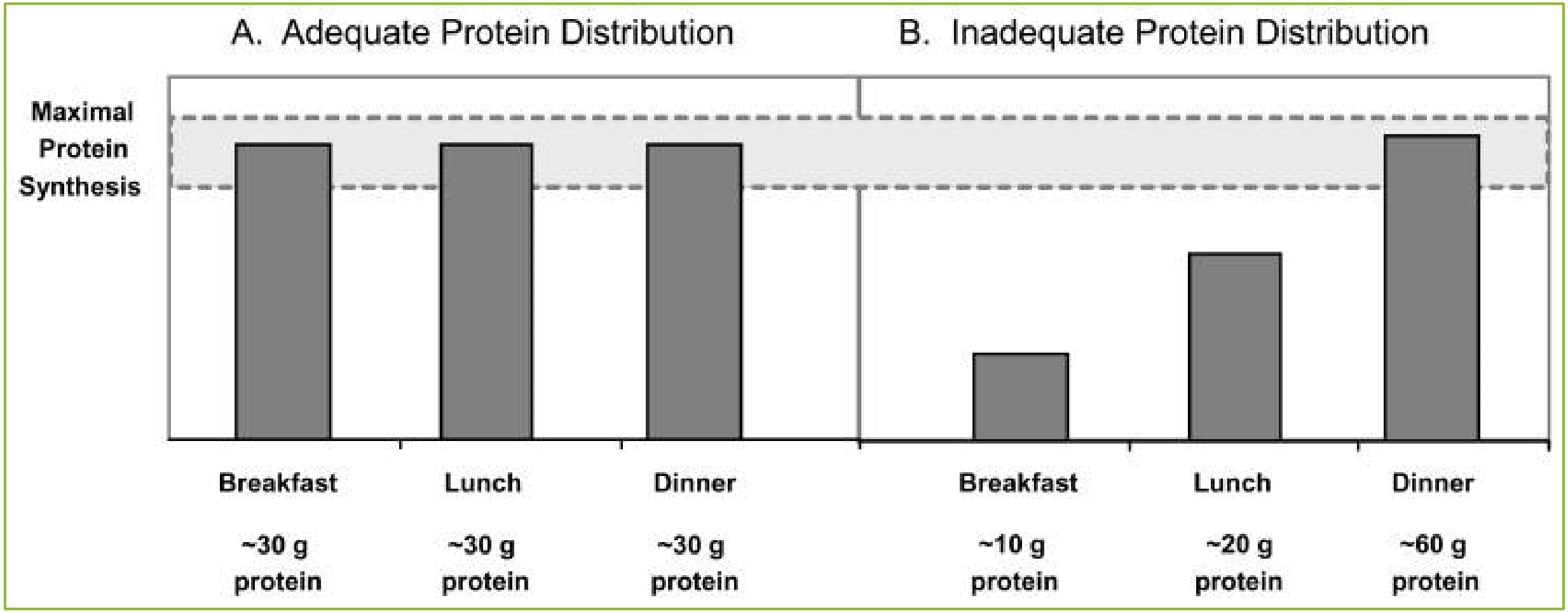
This Is NOT a HIGH Protein Diet

Current recommendations established by the Institute of Medicine at 0.8 g/km/day with no attention to timing

The recommendations were and based on short-duration nitrogen balance studies in young adults

“Minimal daily average dietary intake level that meets the nutritional requirements of nearly all healthy individuals,” does not promote optimal health or protect elders from sarcopenic muscle loss”

Curr Opin Clin Nutr Metab Care. 2009;12(1):86-90.



Curr Opin Clin Nutr Metab Care. 2009;12(1):86-90. doi:10.1097/MCO.0b013e32831cef8b. PMID: 19057193; PMCID: PMC2760315.

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Common Breakfast Choices

- Croissant
- Bagel with cream cheese
- Donut
- Bowl of oatmeal with cran-raisins and brown sugar
- Fiber cereal with milk, OJ
- A small container of yogurt (+ fruit)

Breakfast Reset

BEFORE

5.3 oz Greek Yogurt:
15 grams protein
No fiber

RESET

1 cup of Greek yogurt: 20 g protein
1 oz of nuts: 7 g protein + 2 g fiber
½ cup berries: 3 g fiber
TOTAL: 27 g of protein and 5 g fiber

Food	Serving Size	Protein Content (grams)
Dairy		
Milk, skim 0% fat	1 cup	8
Milk, 1%, 2%, whole	1 cup	8
Yogurt, plain & flavored	8 oz	10
Yogurt, plain & flavored Greek	8 oz	24
Kiefer yogurt drink	1 cup	8
Cottage cheese	1 cup	28
Cheese	1 oz	4-7
Goat milk	8 oz	8
Ricotta cheese	¼ cup	7
Plant-based protein		
Soy milk	1 cup	7
Almond milk	1 cup	1
Oat milk	1 cup	3
Pea-protein milk	1 cup	8
Nuts	1 oz	4-6
Peanuts	1 oz	7
Nut butter (almond, peanut)	2 tbsp	6-8
Pumpkin seeds	1 oz	5
Veggie burger	1 patty	10-12 (depending on brand)
Hemp seeds	2 tbsp	7
Edamame (shelled)	½ cup	13
Beans, black and pinto	½ cup	6
Baked beans	1/3 cup	7
Chickpeas	½ cup	7
Tofu, firm	½ cup	10
Tempeh	½ cup	15

Seafood		
White Fish	4 oz	28
Salmon	4 oz	23
Shrimp/prawns	3 oz	12
Tuna, chunk light in water	3 oz	20
Shellfish: clams, crab, imitation fish, lobster, scallops	3 oz	21
Sardines	1 can	26
Fish, smoked (herring, lox)	1 oz	7
Oysters	6	7
Meat		
Beef, ground (85% lean)	4 oz	21
Beef Jerky	1 oz	7
Chicken breast	4 oz	36
Egg	1	6
Egg whites	2	8
Ham, sliced	3 oz	18
Ham, deli slices	3 slices	12
Hot dog	1	7
Lamb rack	3 oz	25
Pork chop	3 oz	21
Pork loin	3 oz	21
Steak: filet, porterhouse, sirloin, strip, T-bone	4 oz	32
Turkey burger	4 oz	30
Turkey breast	4 oz	21
Turkey, deli sliced	3 slices	7
Veal cutlet, lean	3 oz	30
Sausage	3 oz	21
Bacon, pork	2 slices	7
Bacon, turkey	3 slices	7

High protein Grains		
Quinoa	1/2 cup	4
Wild Rice	1/2 cup	3
Pasta	1/2 cup	4
Chickpea pasta	1/2 cup	7
Lentil pasta	1/2 cup	6.5
Soba noodles	1/2 cup	3

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Leucine-Rich Foods

Food	Leucine Content
Cod (1 fillet)	3.8 g
Salmon (1/2 fillet)	3.1 g
Beef (steak, 4 oz)	3.0 g
Whey protein isolate (30 g, 1 serv.)	3.0 g
Chicken breast (medium)	2.8 g
Tofu (1 cup, extra firm)	2.8 g
Tuna (1 can)	2.7 g
Pork (4 oz loin)	2.6 g
Beef (4 oz, ground)	2.4 g
Tempeh (1 cup, cooked)	2.4 g
Tilapia (4 oz.)	2.3 g
Duck (4 oz, skin eaten)	2.2 g
Turkey (4 oz.)	2.0 g
Lamb (4 oz, ground)	2.0 g
Yogurt (6 oz, Greek, low-fat)	1.7 g
Shrimp (3 oz., 12-20 small pieces)	1.7 g
Ham (4 oz.)	1.5 g

Food	Leucine Content
Cottage cheese (1/2 cup)	1.4 g
Parmesan cheese (1 oz.)	1.1 g
Pork sausage (1 link)	1.0 g
Yogurt (6 oz, plain, low-fat)	0.9 g
Milk (1 cup)	0.8 g
1 egg (cooked)	0.5 g
Asiago cheese (1 oz.)	0.7 g
Split peas (1/2 cup)	0.6 g
Lentils (1/2 cup)	0.6 g
Beans (black, kidney 1/2 cup)	0.6 g
Mozzarella cheese (1 oz.)	0.6 g
Nut butter (2 tbsp)	0.5 g
Mixed nuts (1/4 cup)	0.5 g
Sunflower butter (2 tbsp)	0.4 g
Chickpeas (1/2 cup)	0.4 g
Feta cheese (1 oz.)	0.4 g
1 Egg white (cooked)	0.3 g

* estimates, numbers may vary based on reference

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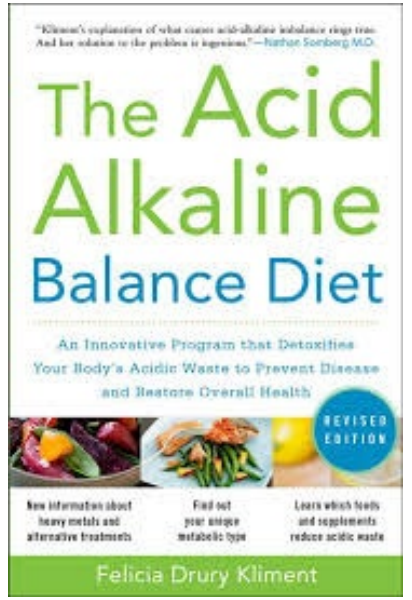
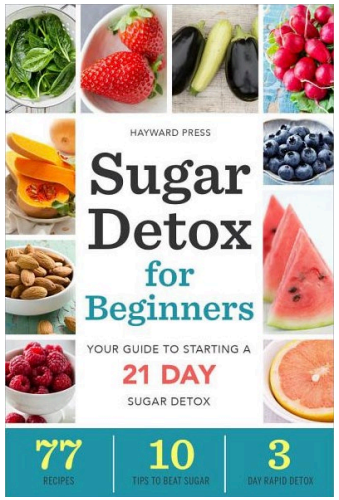
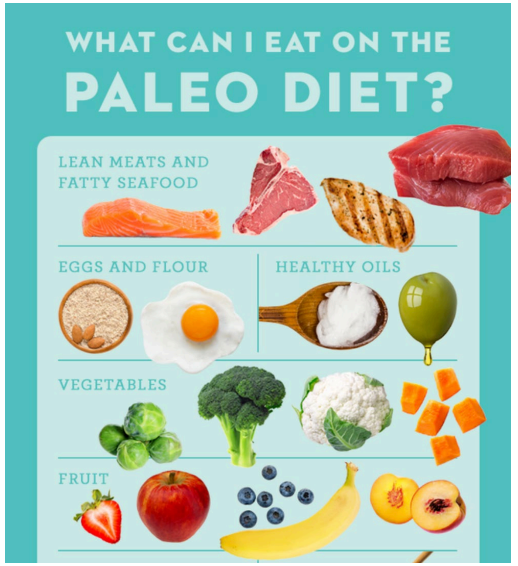
Serving Size

Some Popular Diets Du Jour







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Intermittent Fasting or Time-Restricted Eating

Controlled for calories

Both groups lost weight

Secondary outcomes

- Loss of lean mass typically accounts for 30% of weight loss
- In this study, lean mass accounted for 65% of weight loss
- Amount of lean mass lost also correlated with weight regain

GOAL: FAT LOSS NOT WEIGHT LOSS or Muscle Retention/Gain

JAMA Internal Medicine Published online September 28, 2020

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Fiber

Typical American Eats <16 g/day

Goal: 24 plus

Fiber

- ✓ Fruits
- ✓ Vegetables
- ✓ Whole grains
- ✓ Nuts and Seeds

Fiber

- Helps us feel full
- Nutrient rich foods
- Helps with digestion/stools
- Stabilize blood sugar
- Lower cholesterol
- Helps the microbiome

“…healthy lifestyle, that is, age-appropriate physical exercise and (elderly) tailored diet, including pro and prebiotics ... can contribute to reduce inflamm-aging and age-related pathologies. These last strategies are totally doable and should be pursued at population level.”

“Human aging is characterized by a chronic, low-grade inflammation, and this phenomenon has been termed as "inflamm-aging.”

J Gerontol A Biol Sci Med Sci. 2014;69 Suppl 1:S4-9. doi:10.1093/gerona/glu057. PMID: 24833586.

Pre- and Probiotics, Fiber, and the Gut Microbiome

Gut microbiota composition is associated with biological age

Also, gut microbial diversity inversely correlates with biological age, but not with chronological age

Gerontology. 2018;64(6):513-520. doi:10.1159/000490615

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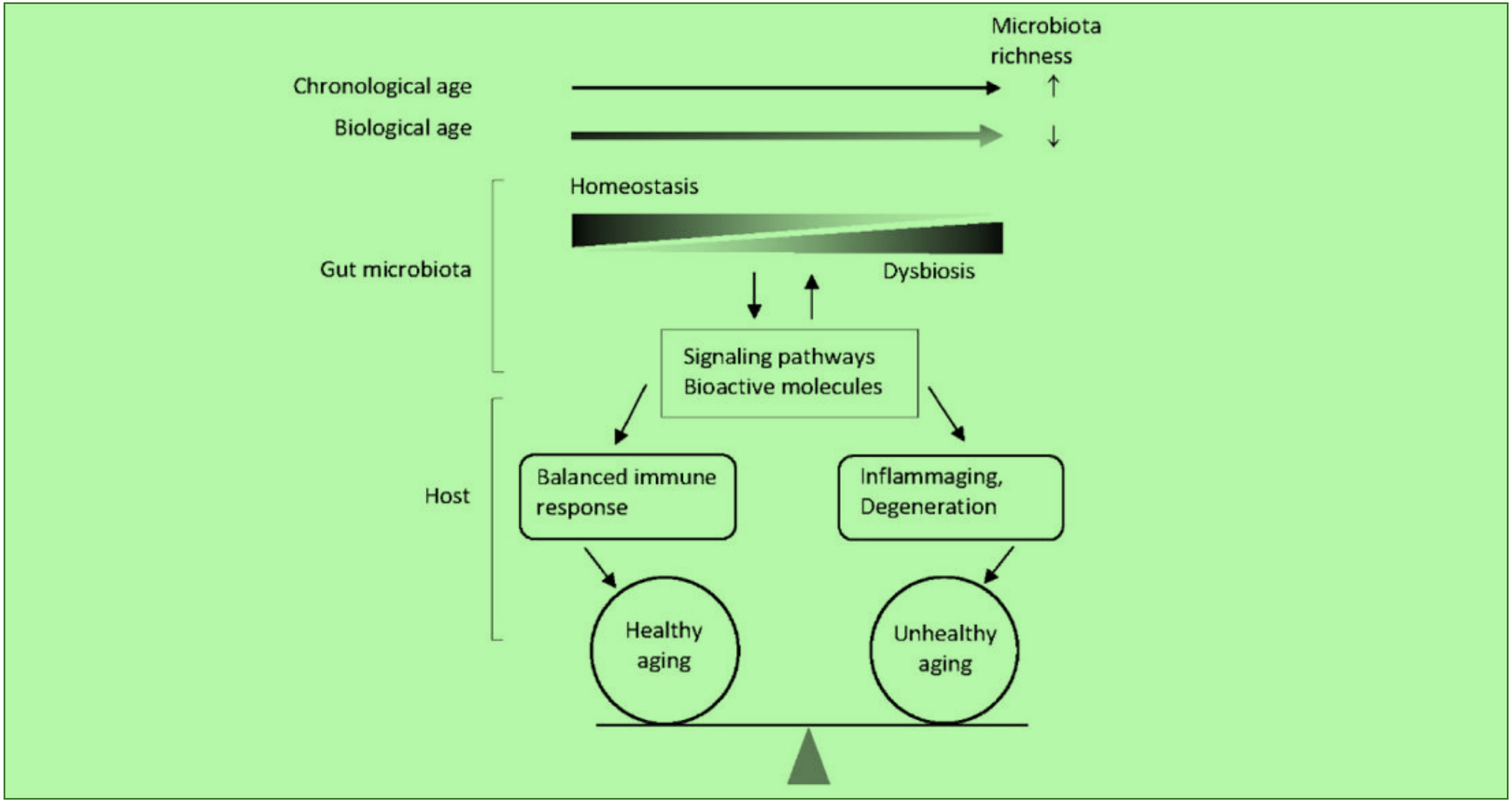

Gerontology. 2018;64(6):513-520. doi:10.1159/000490615

Pre- and Probiotics

Prebiotics feed microbes

Plant fibers:

- Apples
- Artichokes
- Asparagus
- Banana
- Barley
- Berries
- Chicory
- Dandelion greens
- Flaxseed
- Garlic
- Beans and peas
- Green vegetables
- Oats
- Onions
- Tomatoes
- Soybeans
- Wheat

Probiotics add living microbes to our system

- Yogurt
- Kefir
- Sauerkraut
- Kombucha
- Kimchi
- Some aged cheeses

https://www.webmd.com/digestive-disorders/prebiotics-overview

Fiber

Food	Fiber (g)	Food	Fiber (g)
Cabbage, red (raw) 1 cup	1.5	Iceberg or kale (raw) lettuce, 1 cup	0.5
Asparagus, (cooked) ½ cup	2.8	Cauliflower (cooked) ½ cup	1.0
Brussel sprouts (cooked) ½ cup	3.8	Spinach (cooked) ½ cup	1.6
Apple	2.8	Melon, cantaloupe 1 cup	1.1
Mango ½ small	2.9	Grapes, 15 small	0.5
Black beans ½ cup	6.1	Chic peas	4.3
Whole wheat bread	1.5	White Bread	0.6
Cheerios 1 ¼ cup	2.5	Rice Krispies 1 cup	0.3
Flaxseed 1 tbsp	3.3	Sunflower seeds 1 tbsp	0.5

Compare

BEFORE

Turkey sandwich on white bread: 1.6 g fiber

With mayo: 0 fiber

And small bag of pretzels: 1 g fiber

TOTAL FIBER: 2.6 g fiber

RESET

Turkey sandwich on whole wheat: 3 g fiber

¼ avocado: 2.3 g fiber

Apple: 2.8 g fiber

TOTAL FIBER: 8.1 g fiber

Fruit and Vegetable Intake

- **Reduced mortality**
- **Hypertension**
- **Stroke**
- **Cancer**
- **Osteoporosis**
- **Cognitive function**
- **Coronary heart disease**

"may be a risk reduction factor for inflammation with specific regard to fruit and vegetable intake **VARIETY,** rather than **QUANTIY"**

Maturitas. 2013;75(4):305-312. doi:10.1016/j.maturitas.2013.05.005.

Fruit and Vegetable Intake

- Folate
- Potassium
- Vitamin K
- Vitamin C
- Magnesium
- Phytonutrients

Maturitas. 2013;75(4):305-312. doi:10.1016/j.maturitas.2013.05.005.

66,719 women from the Nurses' Health Study (1984–2014) and 42,016 men from the Health Professionals Follow-up Study (1986–2014)

CONCLUSIONS: Higher intakes of fruit and vegetables were associated with lower mortality; the risk reduction plateaued at ≈5 servings of fruit and vegetables per day.

These findings support current dietary recommendations to increase intake of fruits and vegetables, but not fruit juices and potatoes.

*** 2 servings of fruit * 3 servings of vegetables**

Circulation. 2021;143:1642–1654. DOI:10.1161/CIRCULATIONAHA.120.048996

“Higher serum carotenoid levels predict improved muscle strength and bone density among older adults. Fruit and vegetable consumption has also been found to improve physical function and walking speed while reducing walking disability and frailty among elders”

Maturitas. 2013;75(4):305-312. doi:10.1016/j.maturitas.2013.05.005.

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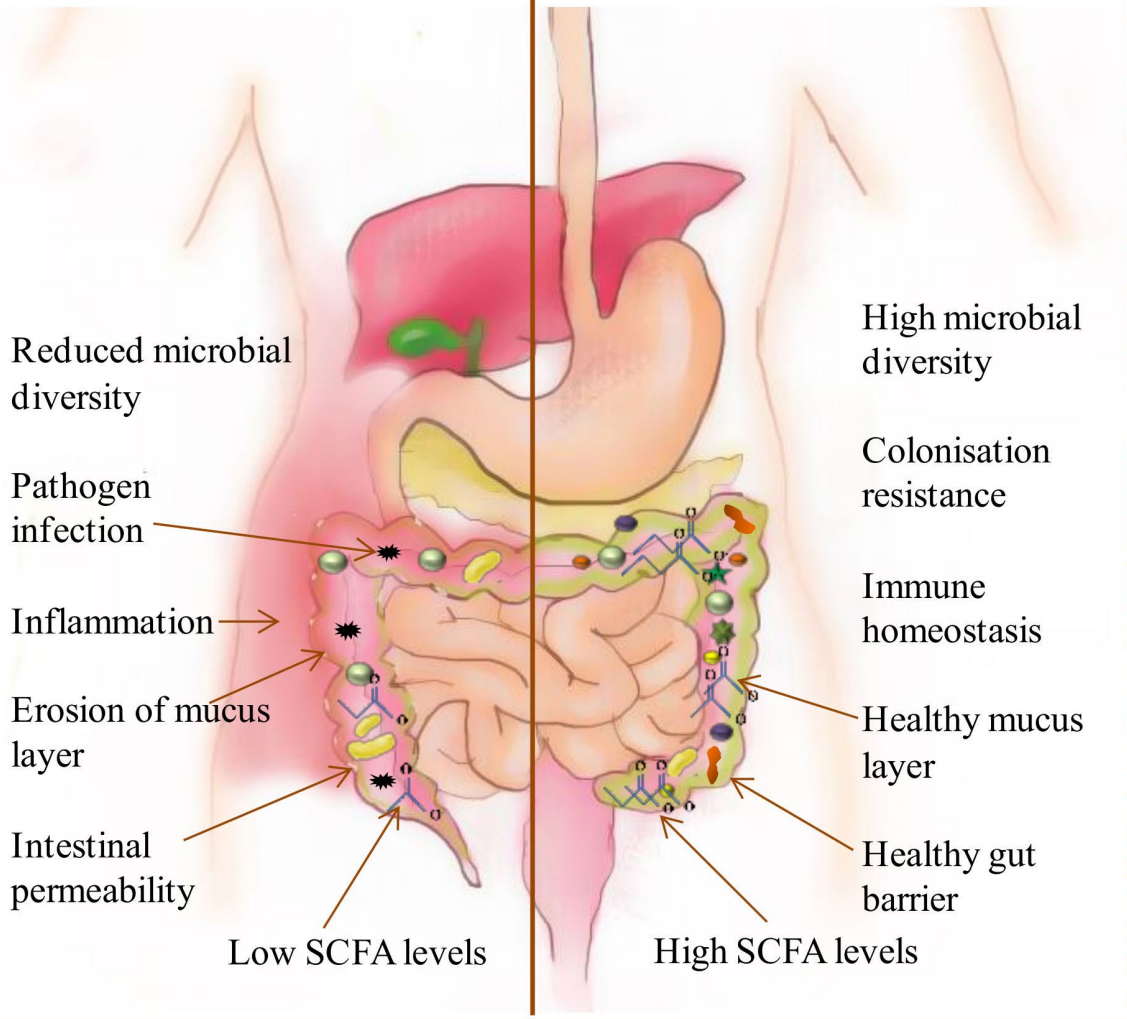
Additional Areas of Concern

- Folate and brain health
- B-12, lack of intrinsic factor
- Fats—role in inflammation and healthy mitochondria
- Vitamin D
- Calcium

Poor Quality Diet	Consequences	Healthy Diet
Predominant foods ▪Animal-derived protein (meat & processed meat) ▪Saturated fats ▪Refined grains ▪Sugar ▪Salt ▪Alcohol ▪Corn-derived fructose		Predominant foods ▪Fruits ▪Vegetables ▪Fibre ▪Plant-derived protein ▪MUFAs ▪n-3 PUFAs

Nutrients 2019;11,923; doi:10.3390/nu11040923

Normal Weight Obesity

- Underdiagnosed and understudied
- Normal body mass index but a high body fat mass
- Estimated 30 million Americans fall into this category
- Increased risk for cardiometabolic morbidity and mortality
- Changes in body composition, inflammation, oxidative stress greater compared to normal weight lean individuals (challenge, standards of body fat cutoffs not yet consistent)

*Int J Obes. 2021;*45:2141-2155. https://doi.org/10.1038/s41366-021-00858-7

Exercise Plus Food

Strength Training Stimulus PLUS Protein-Timing MAXIMIZES Muscle Retention

J Nutr Health Aging. 2000;4(3):143-55. PMID: 10936901

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“Remarkably, physical activity and exercise are well-established countermeasures against muscle aging, and have been shown to attenuate age-related decreases in muscle mass, strength, and regenerative capacity, and slow or prevent impairments in muscle metabolism.”

Cold Spring Harb Perspect Med. 2018;8:a029785

Physical Activity Plan

Cardiovascular/aerobic: moderate to vigorous

Strength/resistance training: 3 x a week, major muscle groups, at least one set of 10-15 repetitions

Balance training; more days than not (or balance activity, ie, dancing, tai chi, yoga)

Flexibility; range of motion

Supervised sessions or creation of a plan is helpful, especially as chronic conditions and therapeutic activities may need to be integrated

DOI: 10.1161/CIRCULATIONAHA.107.185650

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> Notably, the training-induced changes in muscle mass and nervous system function leads to an **improved functional capacity** during activities of daily living.

Scand J Med Sci Sports. 2010:20:49-64 doi: 10.1111/j.1600-0838.2009.01084.x

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Key Takeaways

1

Metabolism does not significantly change by age 50

2

Loss of muscle mass is a little less than 1% per year after age 40

3

Anabolic resistance occurs with age

4

25-30 g of protein is needed at every meal to overcome anabolic resistance

Key Takeaways (Cont'd)

5

Fiber is helpful to keep microbiome healthy; aim for 6-8 g per meal and 2+ per snack

6

Fruits and vegetables help in many ways to reduce mortality and risk/severity of chronic diseases

7

B-12, calcium, vitamin D, folate, and fats are all areas of concern

8

Strength/ resistance training is essential to maximize muscle and function

Finally…

What you do now will determine your vitality ten years from now!

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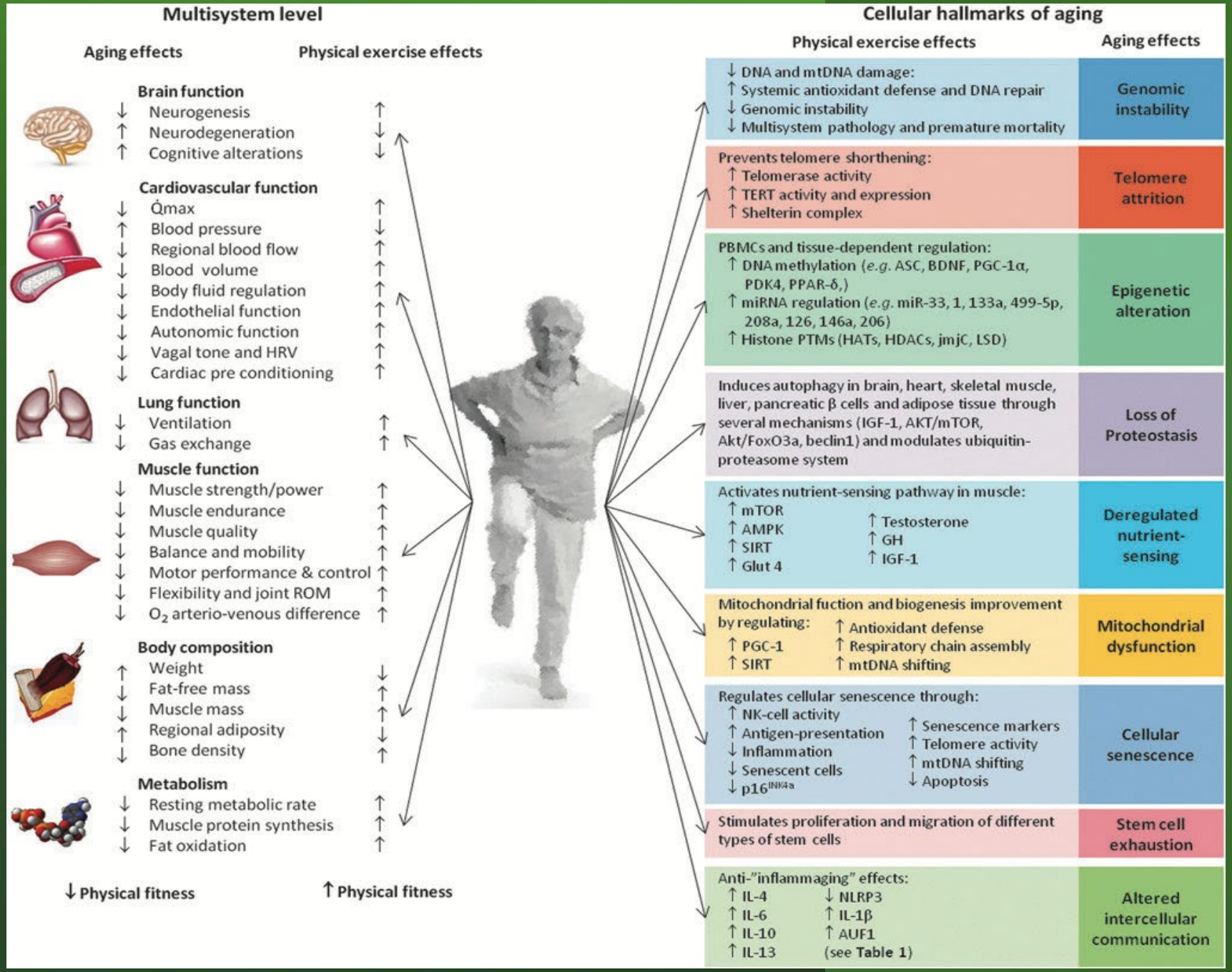
Thank you.
Questions?

HeidiSkolnik.com
Twitter: @HeidiSkolnik
Instagram: @HeidiSkolnik

“Regular exercise has multi-system anti-aging effects.”



REJUVENATION RESEARCH. 2015:18,1.
DOI:10.1089/rej.2014.1623