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NUTRACEUTICA A SOSTEGNO DEL MUSCOLO

Riccardo Calvani, PhD

Fondazione Policlinico Universitario Agostino Gemelli, IRCCS, Roma
Università Cattolica del Sacro Cuore, Roma

SIGG – Roma – 30-11-2018

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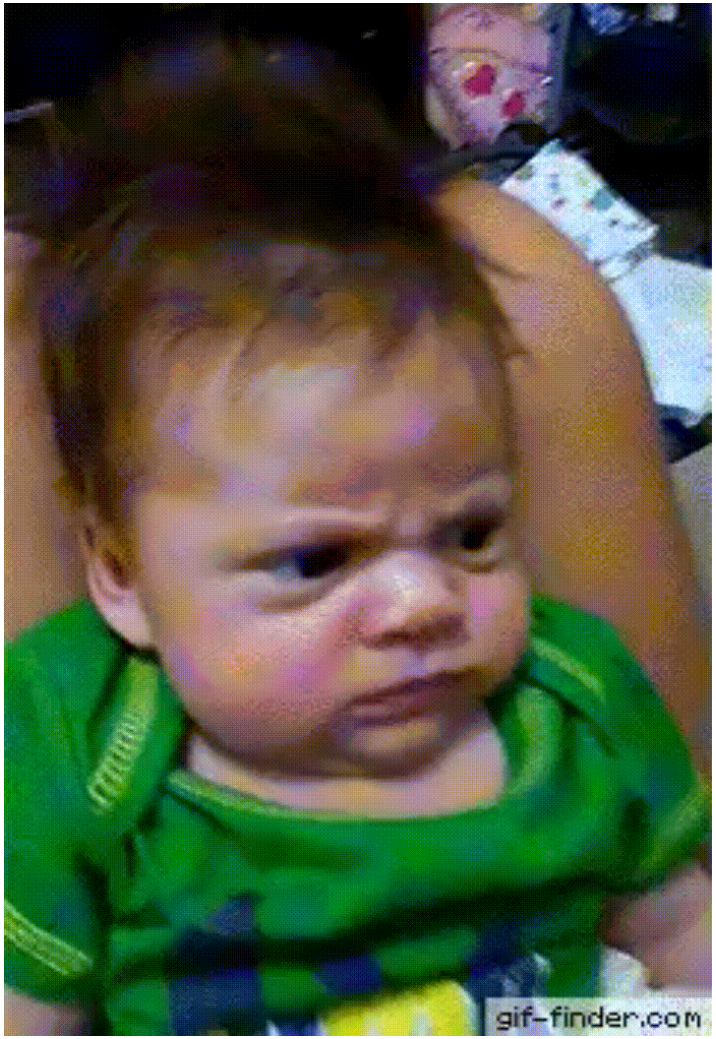

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Outline

- “Nutraceutici”, hallmarks of aging ed effetto Pachinko
- “Nutraceutici” e massa muscolare
- “Nutraceutici” e performance fisica
- “Nutraceutici” e muscolo – le nuove promesse

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- **“Nutraceutici”, hallmarks of aging ed effetto Pachinko**
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The Hallmarks of Aging

Carlos López-Otín,[1] Maria A. Blasco,[2] Linda Partridge,[3,4] Manuel Serrano,[5,*] and Guido Kroemer[6,7,8,9,10]

- Alterato funzionamento dei mitocondri
- Stress ossidativo
- Perturbazioni dell'omeostasi proteica
- Inefficienza dei meccanismi di controllo di qualità cellulari (es. autofagia, apoptosi)

- Infiammazione cronica ("Inflammaging")
- Alterazioni nei livelli ormonali circolanti
- Accorciamento dei telomeri (senescenza)
- Malnutritzione
- Disbiosi intestinale

Cell *153*, June 6, 2013

Pachinko model

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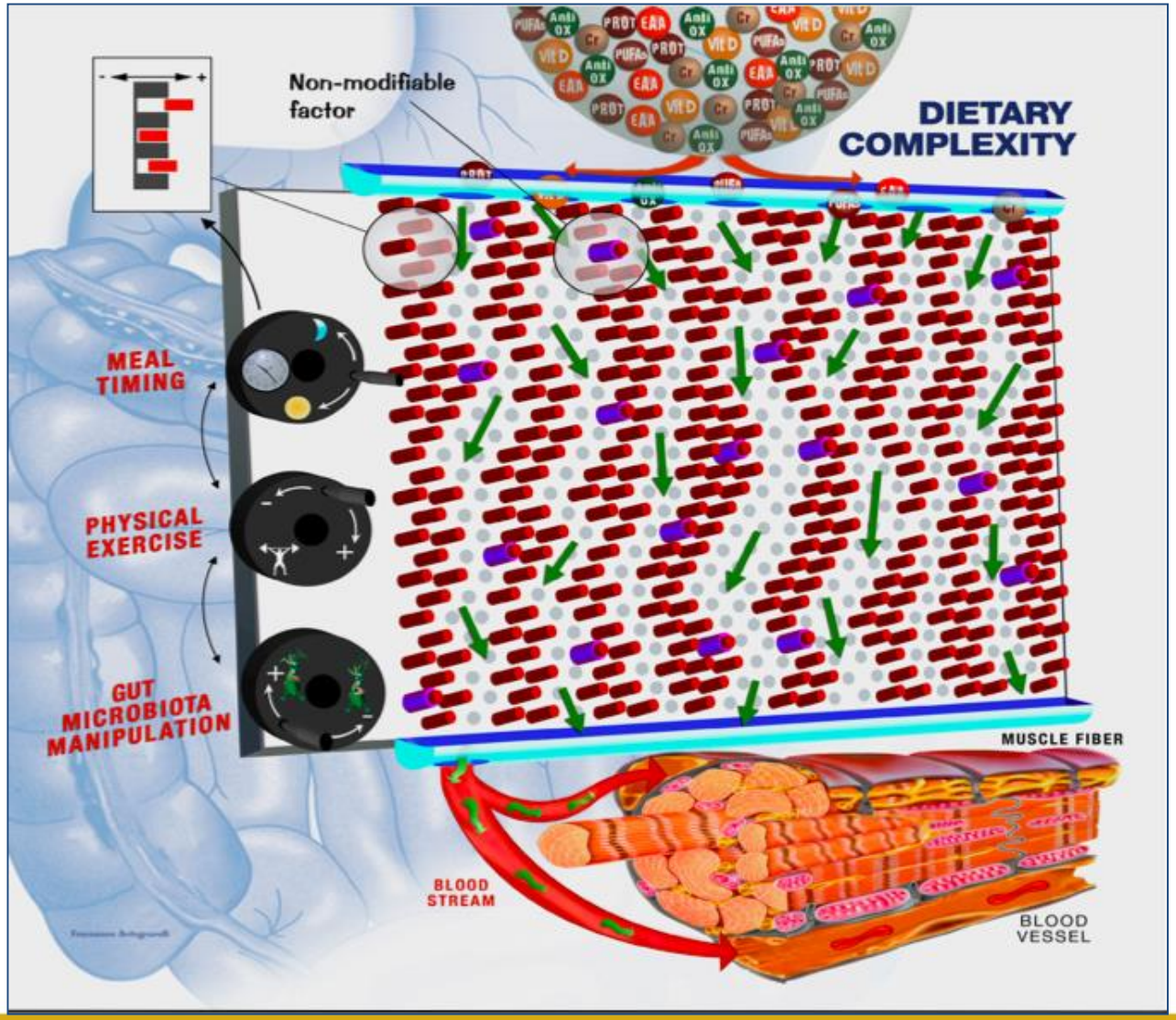
CURRENT NUTRITIONAL RECOMMENDATIONS AND NOVEL DIETARY STRATEGIES TO MANAGE SARCOPENIA

R. CALVANI[1], A. MICCHELI[2], F. LANDI[3], M. BOSSOLA[4], M. CESARI[5], C. LEEUWENBURGH[6], C.C. SIEBER[7], R. BERNABEI[3], E. MARZETTI[3]



The Journal of Frailty & Aging 03/2013; 2(1):38-53.

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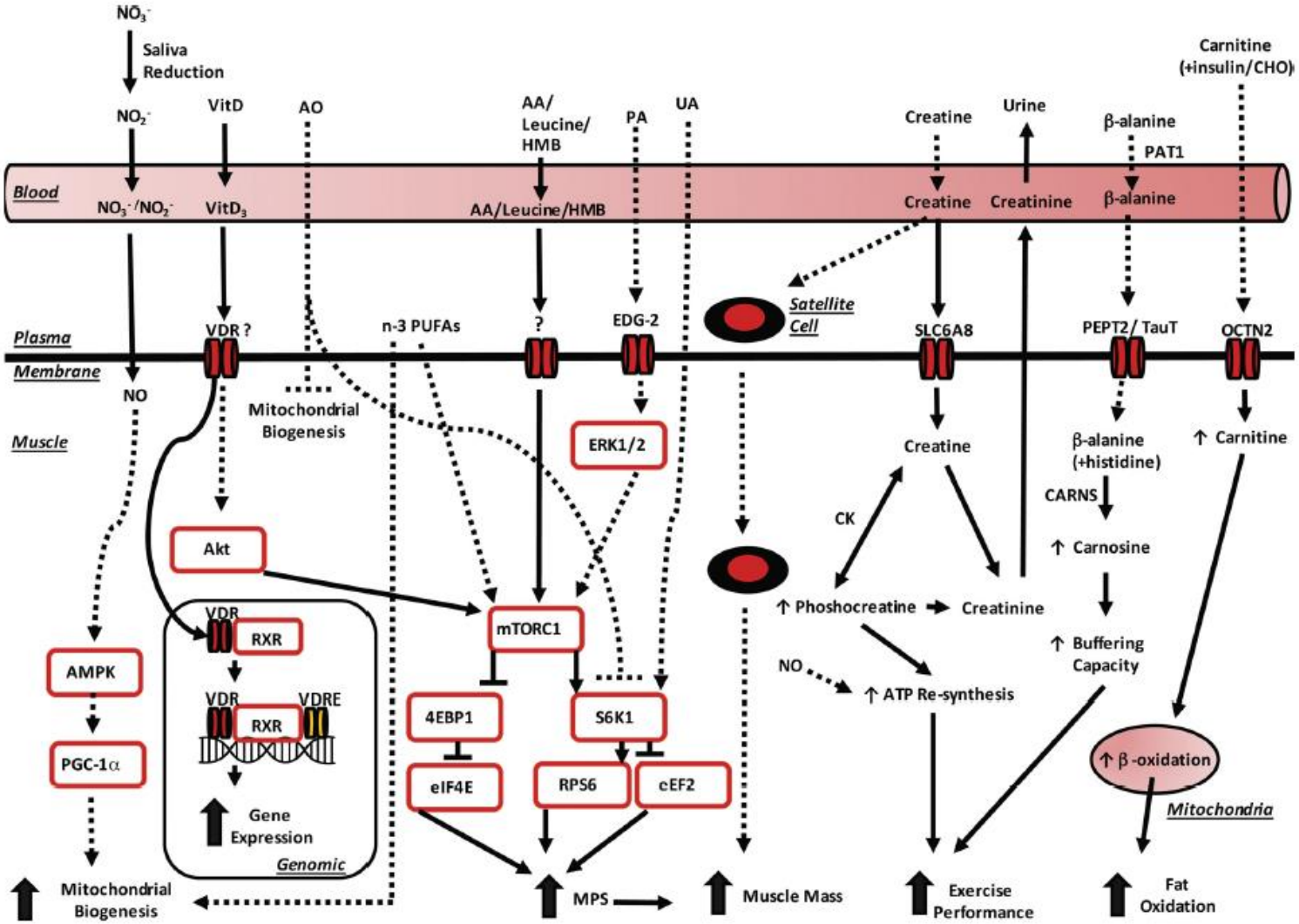
"Nutraceuticals" in relation to human skeletal muscle and exercise

Colleen S. Deane,[1,2,3] Daniel J. Wilkinson,[1] Bethan E. Phillips,[1] Kenneth Smith,[1] Timothy Etheridge,[3] and Philip J. Atherton[1]



Am J Physiol Endocrinol Metab 312: E282–E299, 2017.

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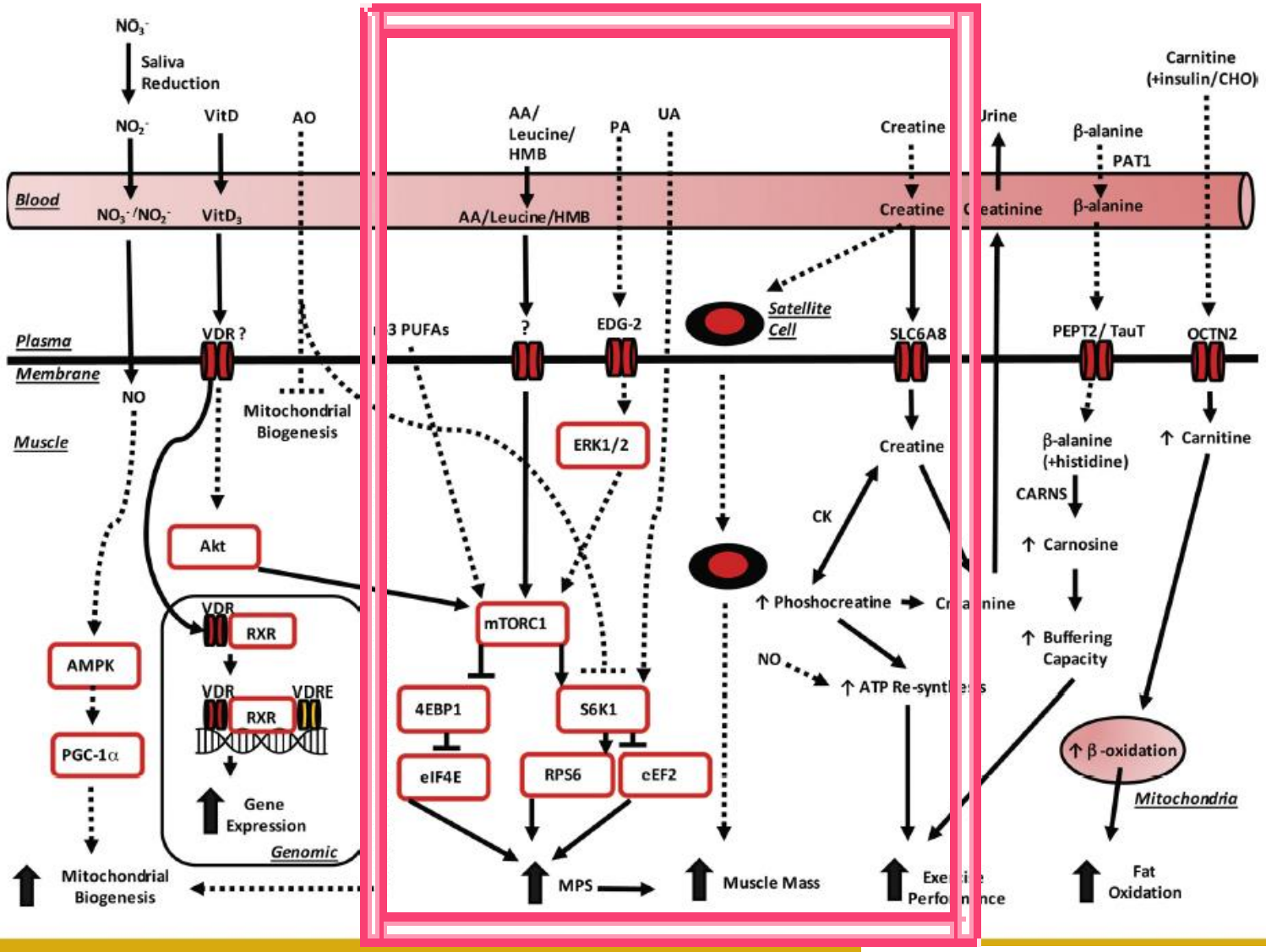

Am J Physiol Endocrinol Metab 312: E282–E299, 2017.

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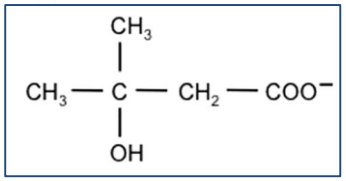
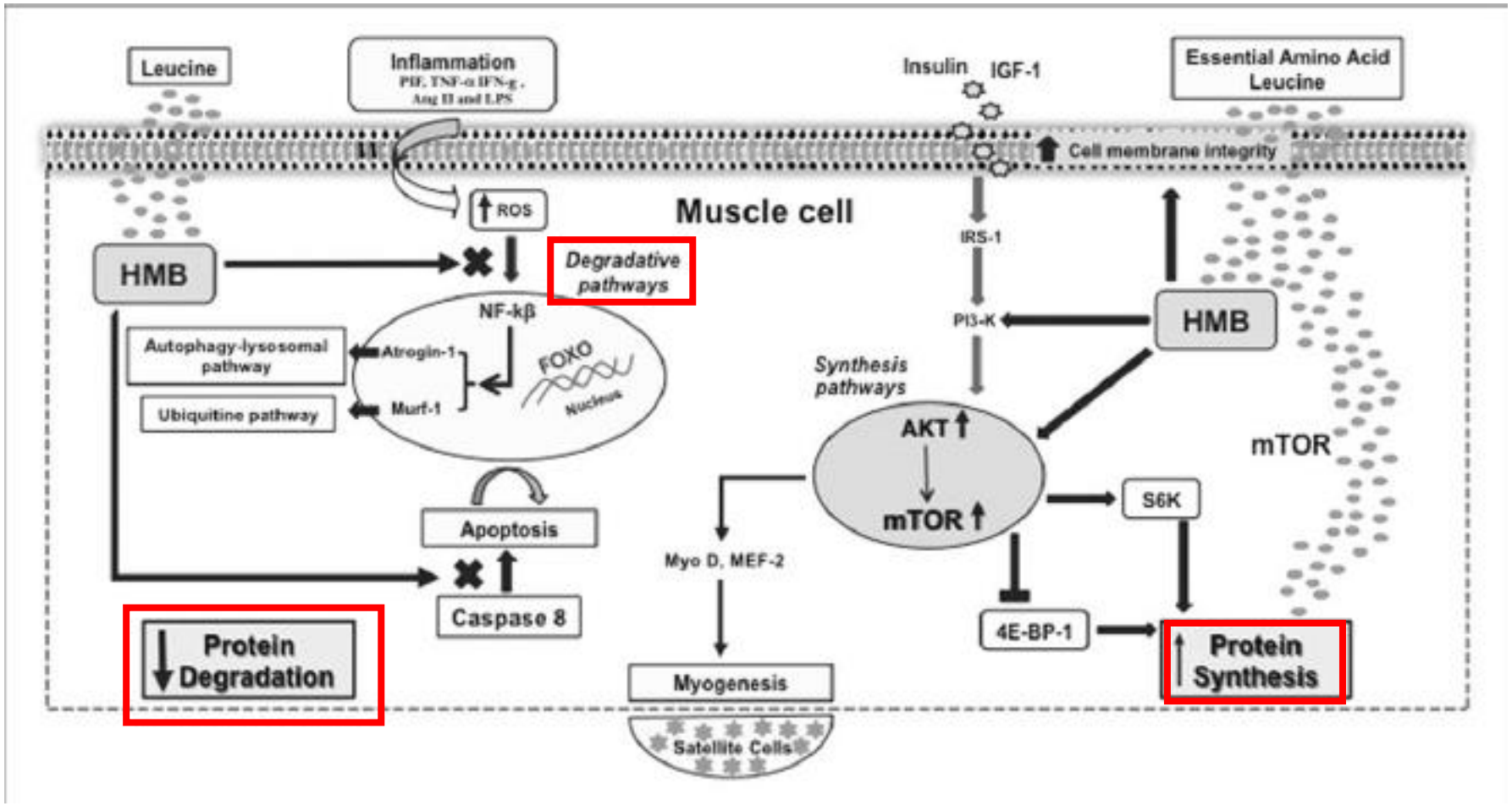
CURRENT OPINION

Beta-hydroxy-beta-methylbutyrate and sarcopenia: from biological plausibility to clinical evidence



Francesco Landi, Riccardo Calvani, Anna Picca, and Emanuele Marzetti



Curr Opin Clin Nutr Metab Care 2018, 21:000–000
DOI:10.1097/MCO.0000000000000524

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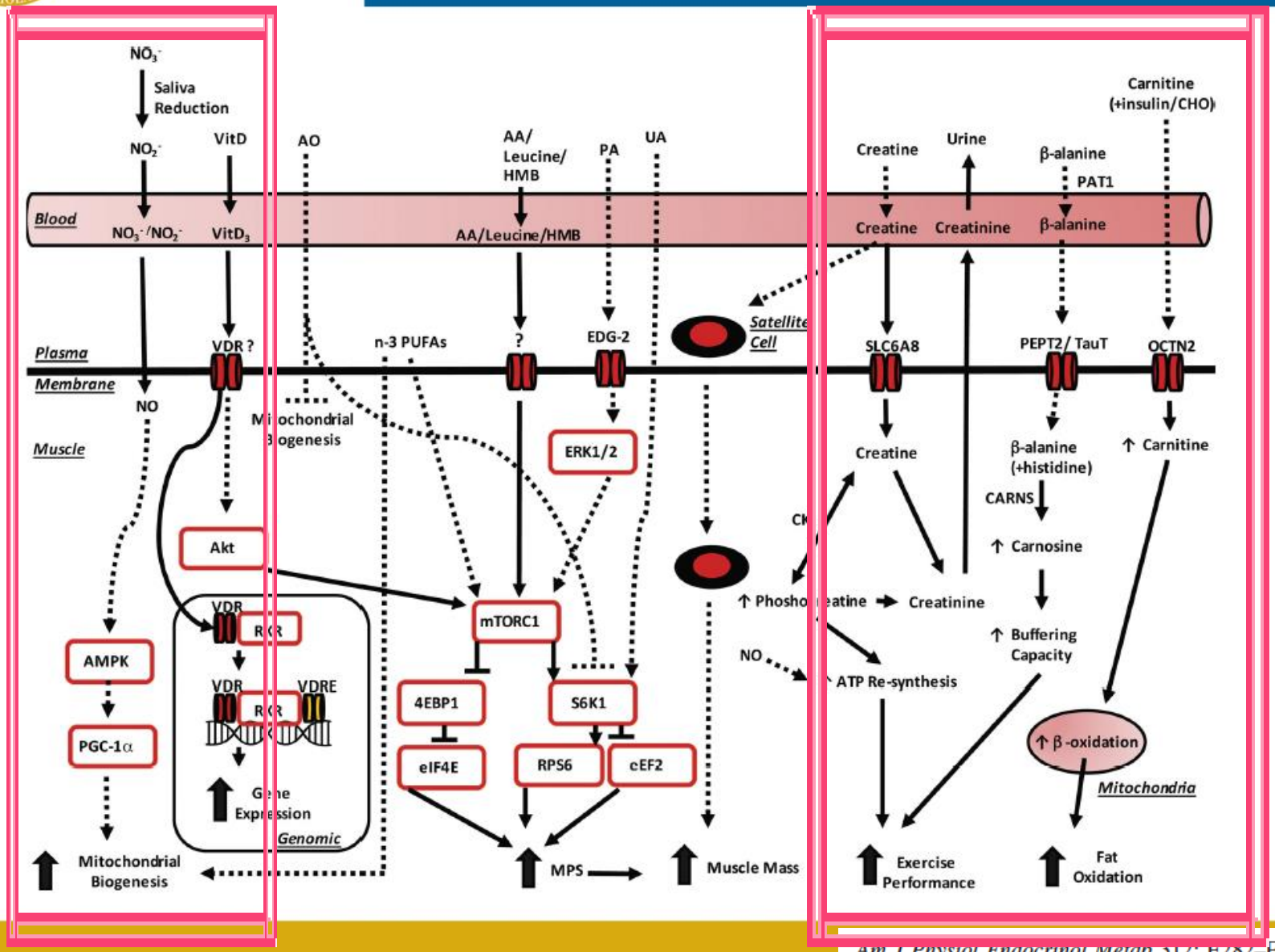

Am J Physiol Endocrinol Metab 312: E282–E299, 2017.

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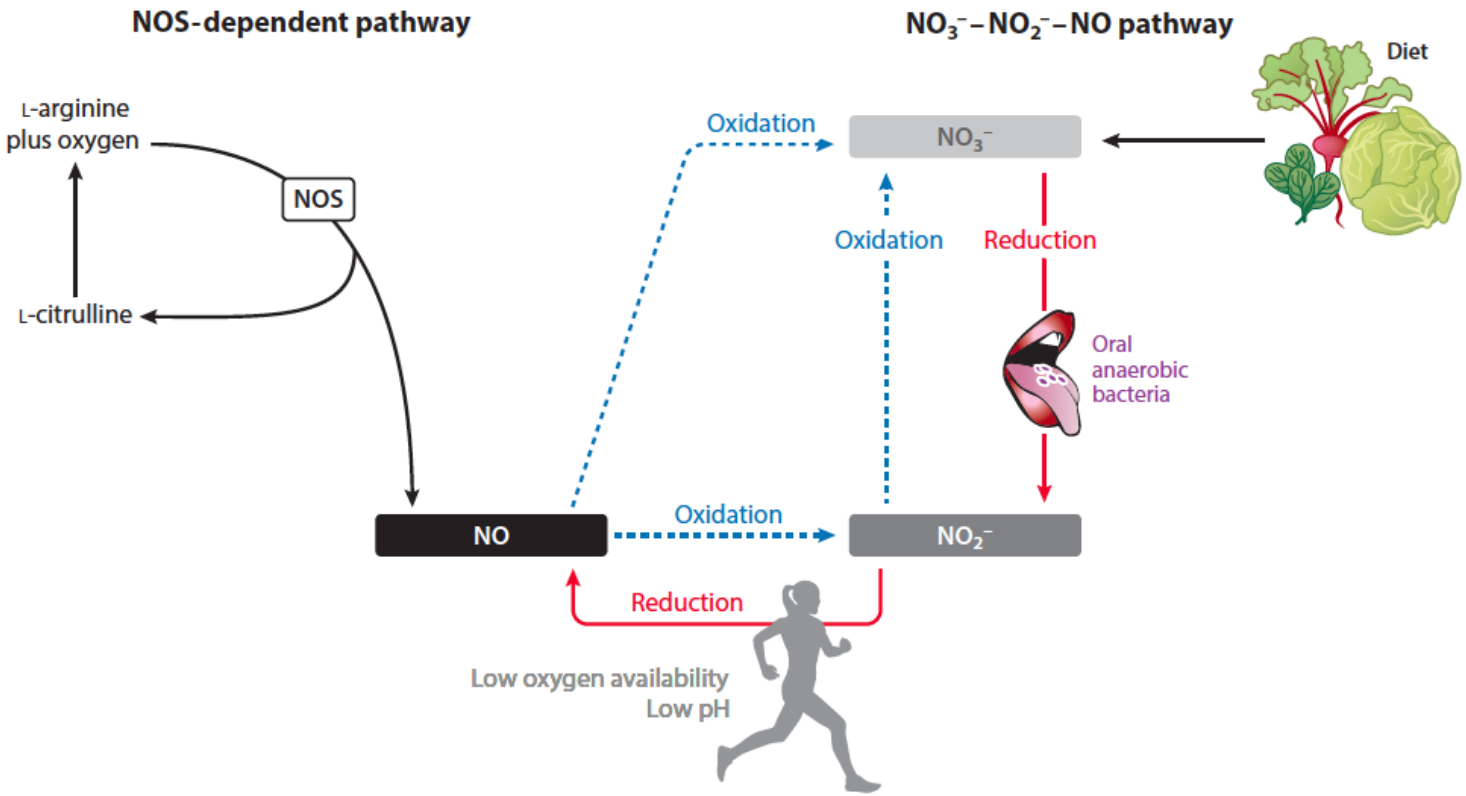
Dietary Nitrate and Physical Performance

Andrew M. Jones, Christopher Thompson, Lee J. Wylie, and Anni Vanhatalo



Annu. Rev. Nutr. 2018. 38:303–28

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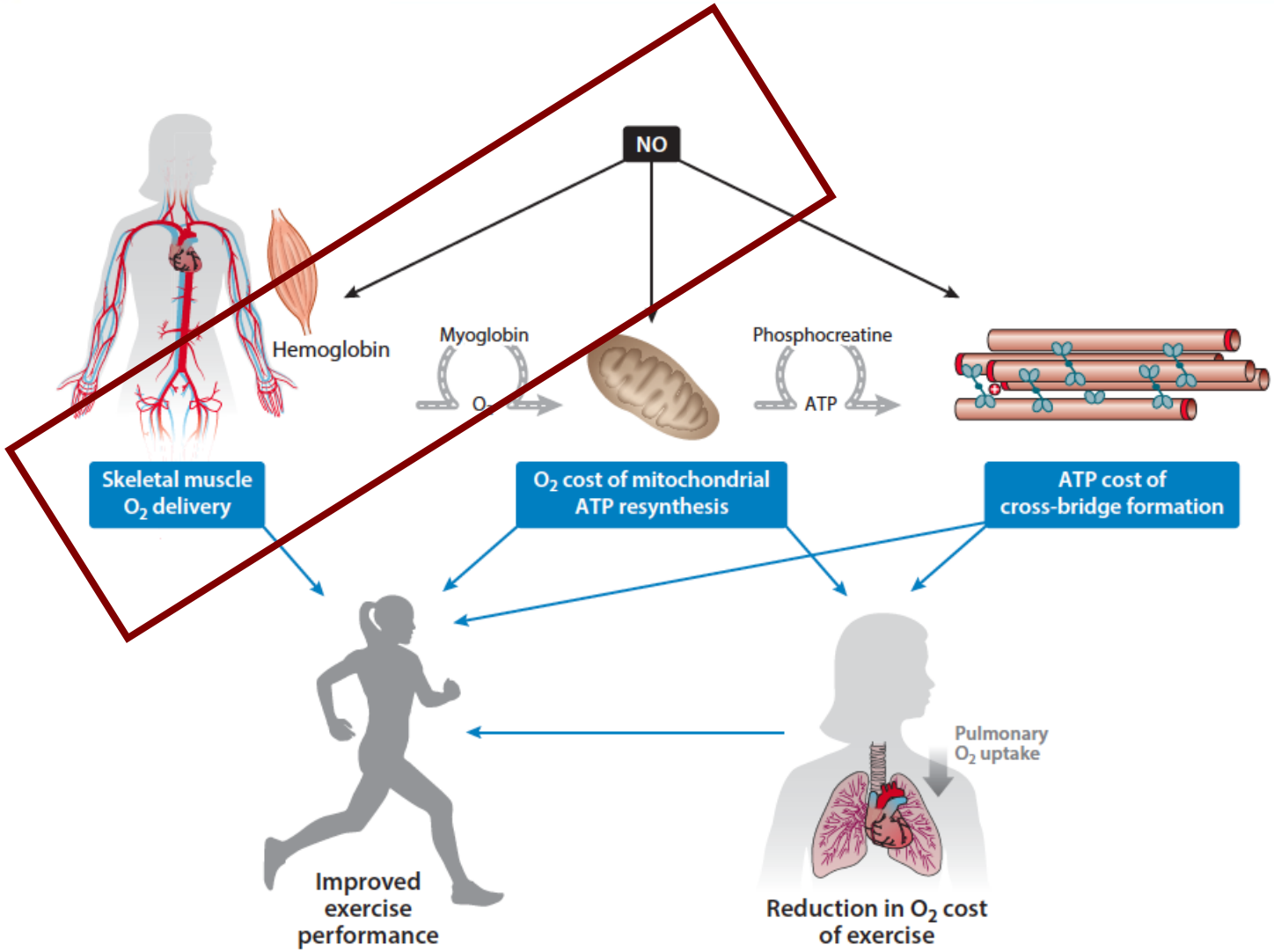

Annu. Rev. Nutr. 2018. 38:303–28

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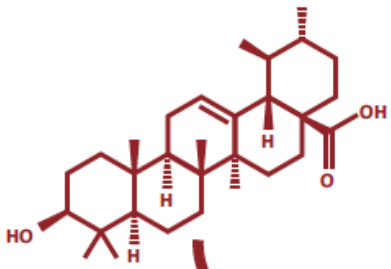
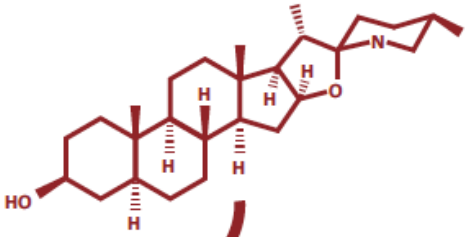
Acido Ursolico - Tomatidina



Ursolic acid

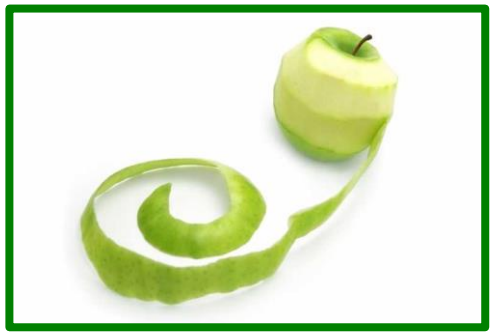
Young adult muscle

Aging



Tomatidine

ATF4-dependent gene expression in skeletal muscle fibers



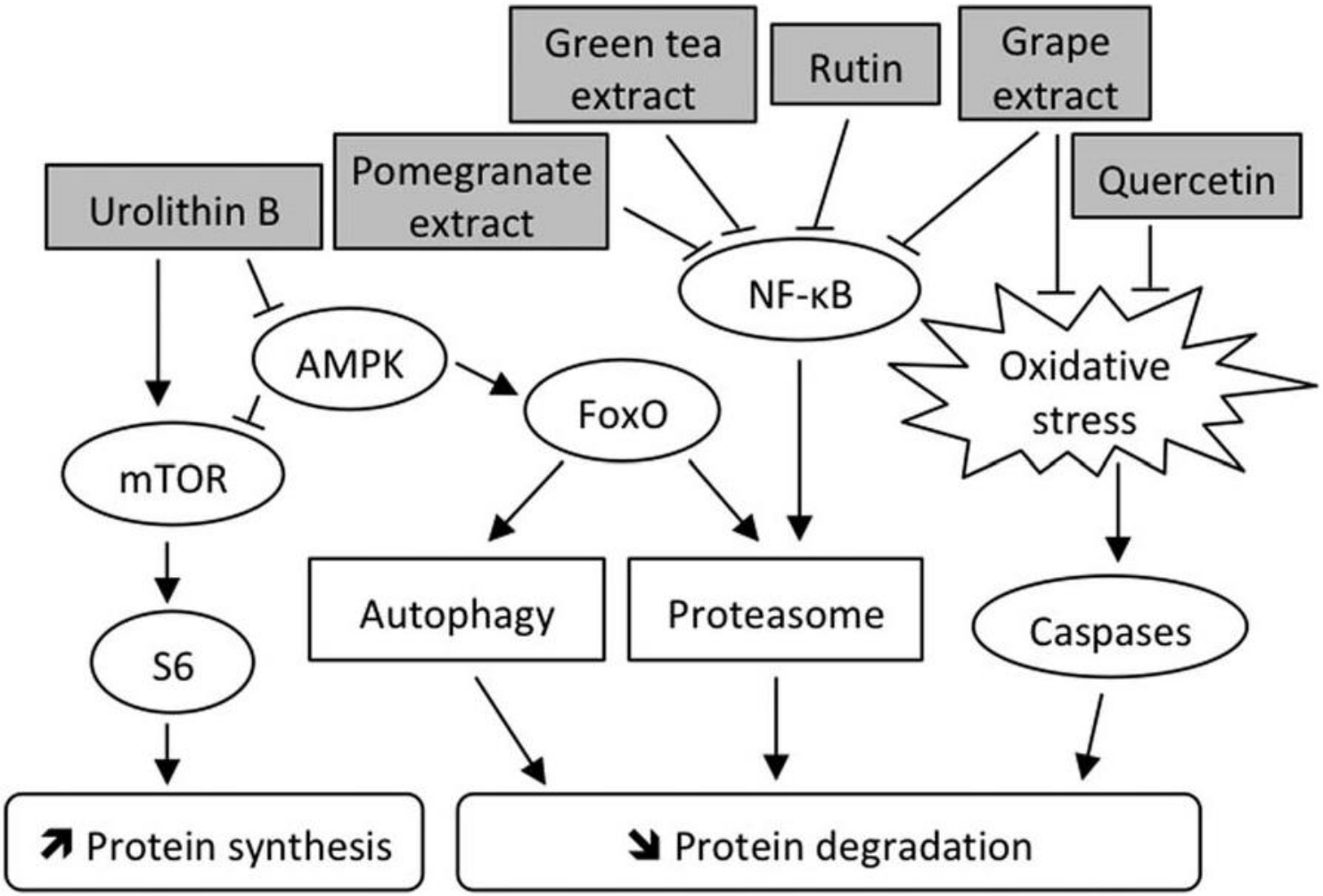
Reduced muscle protein synthesis

Age-related muscle weakness and atrophy

Trends in Endocrinology & Metabolism, Month Year, Vol. xx, No. yy http://dx.doi.org/10.1016/j.tem.2016.06.010

Using polyphenol derivatives to prevent muscle wasting

Marc Francaux and Louise Deldicque



Curr Opin Clin Nutr Metab Care 2018, 21:159–163

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Using polyphenol derivatives to prevent muscle wasting

Marc Francaux and Louise Deldicque

Table 1. Original articles dealing with the effects of polyphenols on muscle wasting between January 2016 and August 2017

Reference	Polyphenol type or extract	Model	Main result
Gil da Costa *et al.* [8▪▪]	Rutin, curcumin	HPV16-transgenic mice	Rutin totally preserved muscle mass, whereas curcumin limited the loss during cancer cachexia
Mukai *et al.* [14▪▪]	Quercetin	Sciatic nerve section in mice	Prevention of disuse muscle atrophy by targeting mitochondria
Rodriguez *et al.* [12▪]	Pomegranate extract rich in ellagitannins	TNFα injection in mice	Relative protection against an acute inflammation, likely via urolithin A
Rodriguez *et al.* [13▪]	Urolithin B	Sciatic nerve section in mice	Reduction of muscle atrophy by favorably regulating muscle protein balance

Curr Opin Clin Nutr Metab Care 2018, 21:159–163

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Curr Opin Clin Nutr Metab Care 2018, 21:159–163

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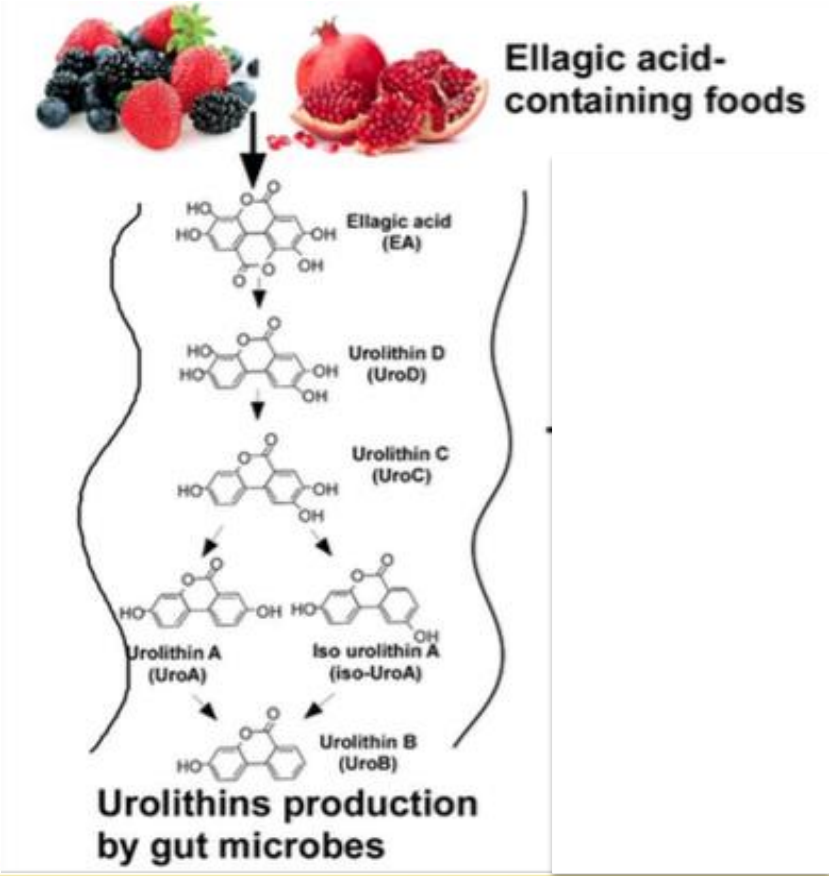
Urolithin A induces mitophagy and prolongs lifespan in *C. elegans* and increases muscle function in rodents

nature medicine

Dongryeol Ryu[1,5], Laurent Mouchiroud[1,5], Pénélope A Andreux[1,2,5], Elena Katsyuba[1], Norman Moullan[1], Amandine A Nicolet-dit-Félix[1], Evan G Williams[1], Pooja Jha[1], Giuseppe Lo Sasso[1], Damien Huzard[3], Patrick Aebischer[4], Carmen Sandi[3], Chris Rinsch[2] & Johan Auwerx[1]



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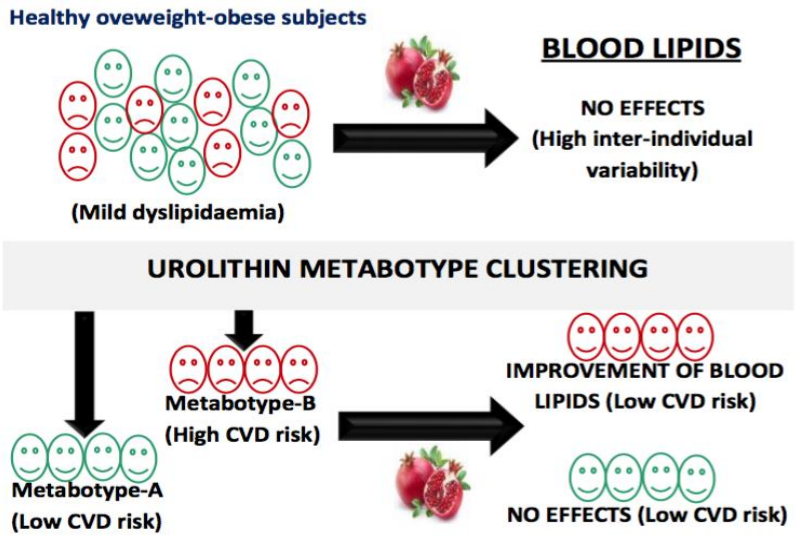
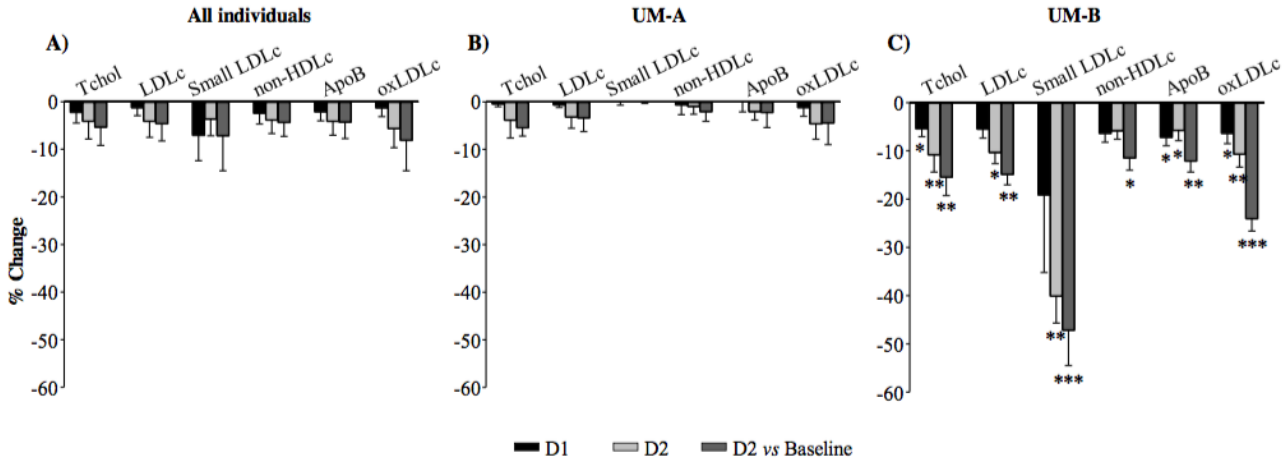
Clustering according to urolithin metabotype explains the interindividual variability in the improvement of cardiovascular risk biomarkers in overweight-obese individuals consuming pomegranate: A randomised clinical trial

*Antonio González-Sarrías[a], Rocío García-Villalba[a], María Romo-Vaquero[a], Cesarettin Alasalvar[b], Asim Örem[c], Pilar Zafrilla[d], Francisco A. Tomás-Barberán[a], María V. Selma[a], and Juan Carlos Espín[a]**

Molecular Nutrition & Food Research 10.1002/mnfr.201600830.





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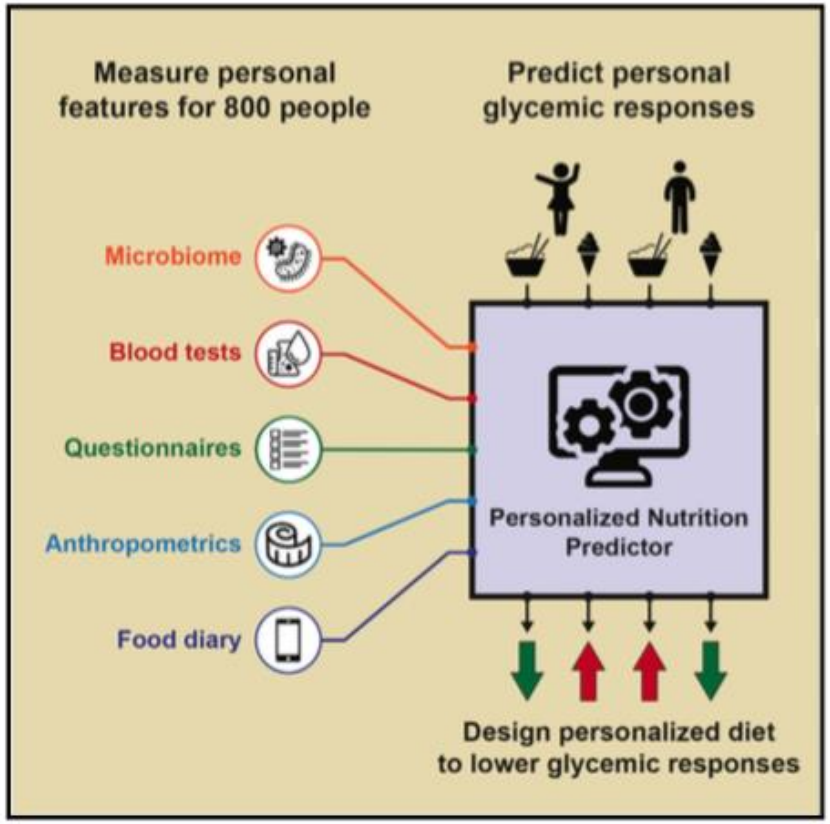
Cell

Personalized Nutrition by Prediction of Glycemic Responses

Graphical Abstract



Authors

David Zeevi, Tal Korem, Niv Zmora, ..., Zamir Halpern, Eran Elinav, Eran Segal

Correspondence

eran.elinav@weizmann.ac.il (E.E.), eran.segal@weizmann.ac.il (E.S.)

In Brief

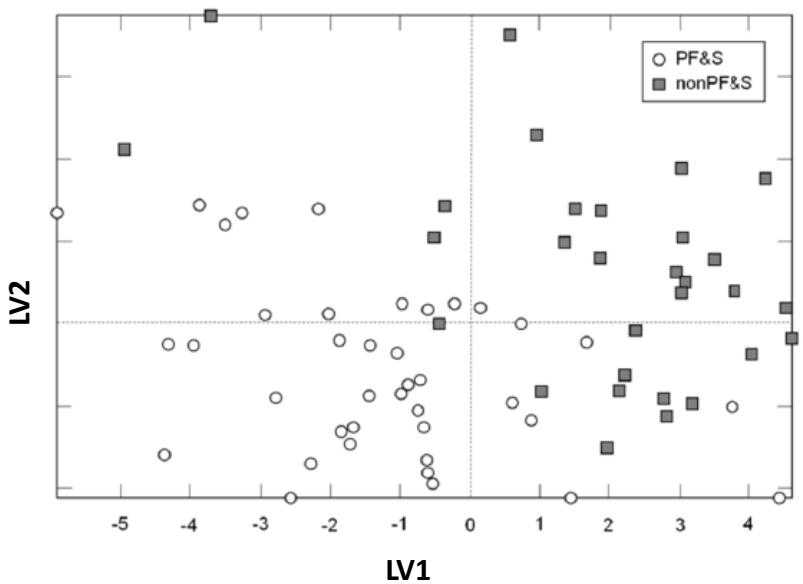
People eating identical meals present high variability in post-meal blood glucose response. Personalized diets created with the help of an accurate predictor of blood glucose response that integrates parameters such as dietary habits, physical activity, and gut microbiota may successfully lower post-meal blood glucose and its long-term metabolic consequences.

Cell *163*, 1079–1094, November 19, 2015

A Distinct Pattern of Circulating Amino Acids Characterizes Older Persons with Physical Frailty and Sarcopenia: Results from the BIOSPHERE Study

Riccardo Calvani [1,2], Anna Picca [1,2,*], Federico Marini [3], Alessandra Biancolillo [3], Jacopo Gervasoni [1,2], Silvia Persichilli [1,2], Aniello Primiano [2], Hélio José Coelho-Junior [2,4], Maurizio Bossola [1,2], Andrea Urbani [1,2], Francesco Landi [1,2], Roberto Bernabei [1,2] and Emanuele Marzetti [1]

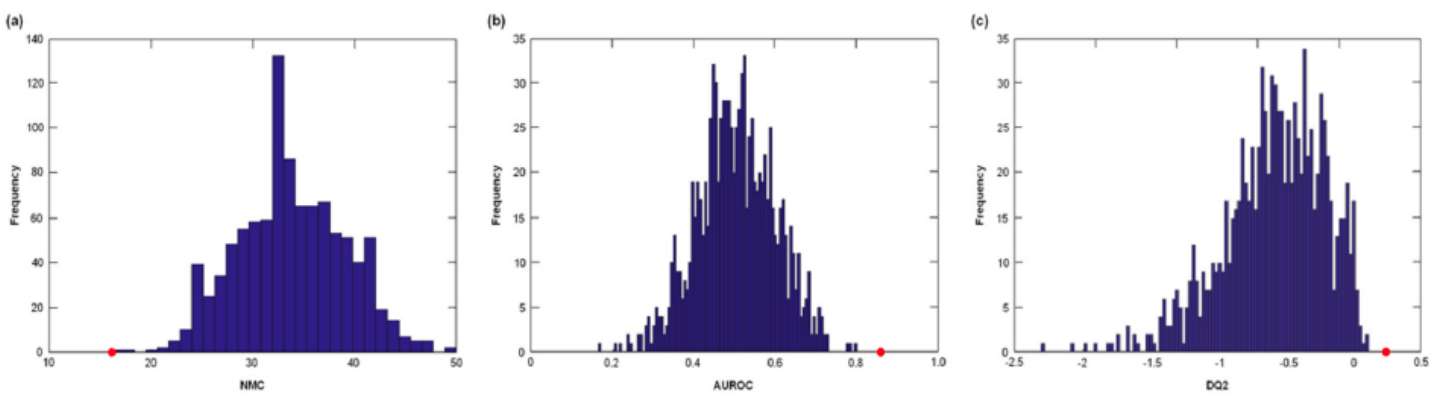
Nutrients 2018, *10*, 1691; doi:10.3390/nu10111691



% Correct classifications:

Controls:	78.5±6%
PF&S:	75.1± 4.6%
Total:	76.6± 3.9%

	PF&S (n = 38)	nonPF&S (n = 30)	VIP	RP
α-aminobutyric acid (μmol/L)	20.0 ± 4.9	22.3 ± 5.7	2.2	8.0
Asparagine (μmol/L)	91.0 ± 12.6	77.8 ± 13.4	3.4	2.0
Aspartic Acid (μmol/L)	24.6 ± 5.4	17.0 ± 4.0	5.8	2.6
Citrulline (μmol/L)	44.8 ± 12.1	36.8 ± 11.5	2.1	2.8
Ethanolamine (μmol/L)	10.3 ± 1.7	9.0 ± 2.2	1.7	9.9
Glutamic acid (μmol/L)	71.7 ± 16.6	54.3 ± 21.2	2.3	8.5
Methionine (μmol/L)	22.6 ± 2.8	23.4 ± 5.7	1.3	6.3
Sarcosine (μmol/L)	1.9 ± 0.6	1.5 ± 0.5	1.4	8.0
Taurine (μmol/L)	220.1 ± 36.5	189.5 ± 47.2	1.8	6.7



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Conclusioni

- Singolo nutraceutico "magic bullet" per il muscolo
  → estremamente difficile

- Necessari studi sull'uomo più lunghi e con metodologie standardizzate

- Critico lo studio della biodisponibilità dei nutraceutici/integratori e dei fattori che la influenzano
  → profili "omici" e modelli predittivi

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Grazie per l’attenzione

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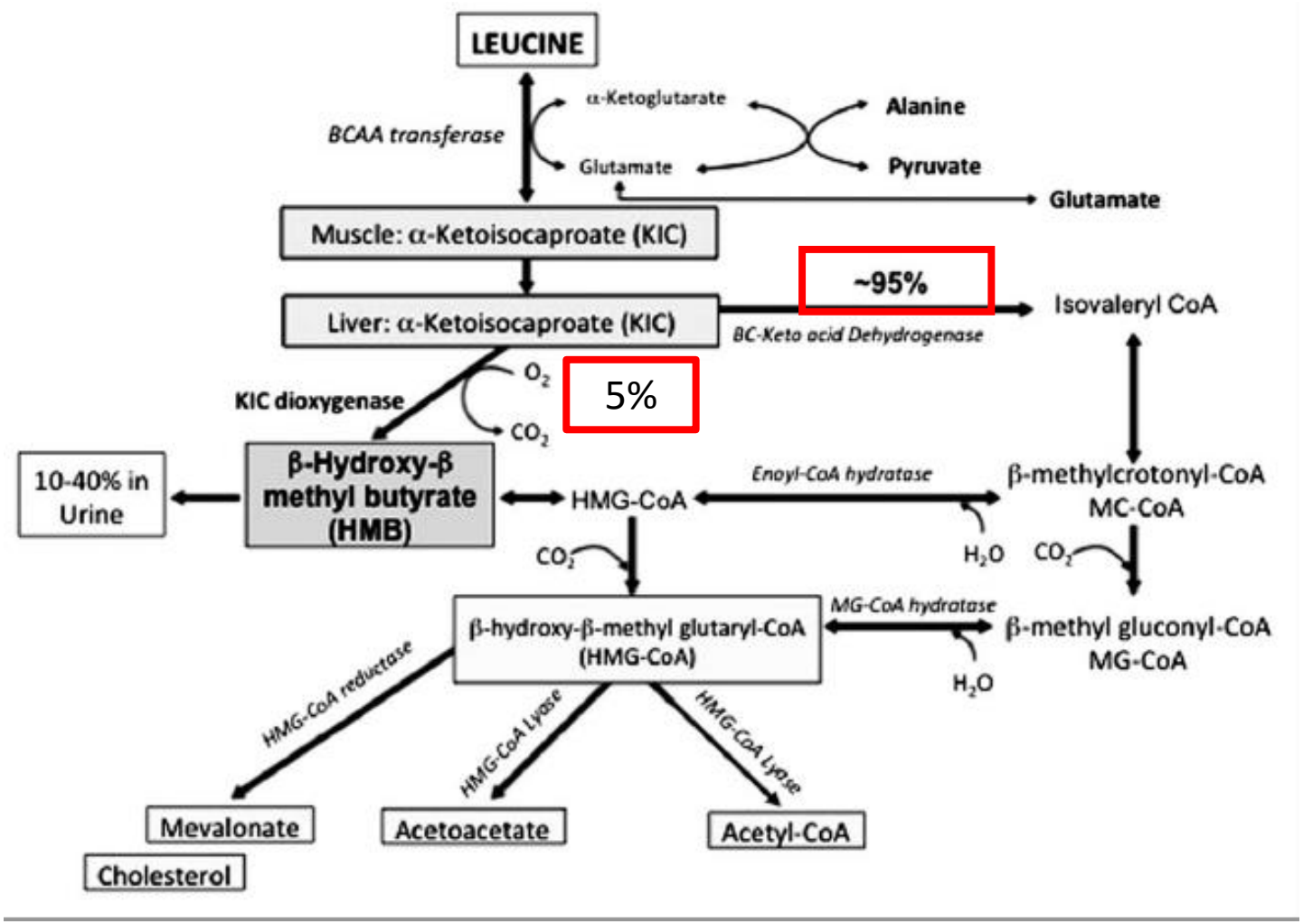
CURRENT OPINION

Beta-hydroxy-beta-methylbutyrate and sarcopenia: from biological plausibility to clinical evidence

Francesco Landi, Riccardo Calvani, Anna Picca, and Emanuele Marzetti



Curr Opin Clin Nutr Metab Care 2018, 21:000–000
DOI:10.1097/MCO.0000000000000524

Beta-hydroxy-beta-methylbutyrate and sarcopenia: from biological plausibility to clinical evidence

Francesco Landi, Riccardo Calvani, Anna Picca, and Emanuele Marzetti

- 3g/d HMB
- = 60g leucine/d
- = >600g of high-quality protein sources (eggs, dairy and meat) daily

=

=

Curr Opin Clin Nutr Metab Care 2018, 21:000–000
DOI:10.1097/MCO.0000000000000524

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HMB: evidenze cliniche

Anziani malnutriti (Ospedale e comunità)

- Miglioramento dell'**handgrip strength** (Deutz, 2016)
- Aumentata forza e qualità muscolare **in soggetti sarcopenici** (Cramer, 2016)

Fratturati di femore

- Mantenimento **massa muscolare** (Malafarina, 2017)

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HMB: limitazioni

- **Pochi studi**
- **Metodologie eterogenee**
- **Possibili interazioni tra HMB e altri nutrienti e con l'attività fisica**

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Stephen L. DeFelice, M.D.
Chairman
The Foundation for Innovation in Medicine

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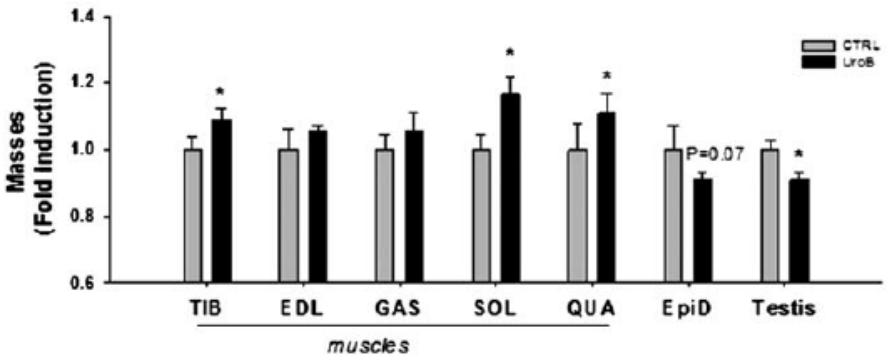
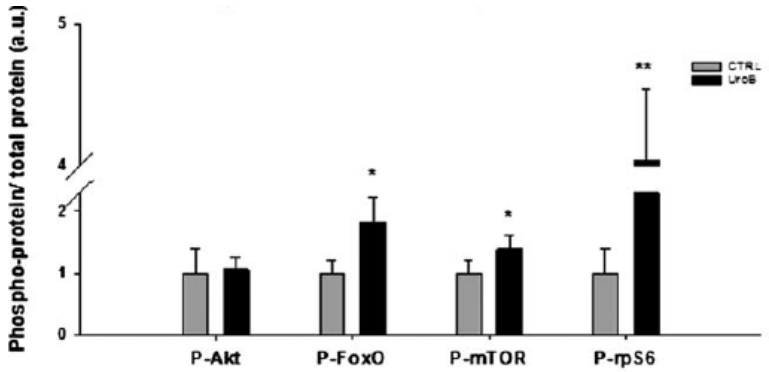
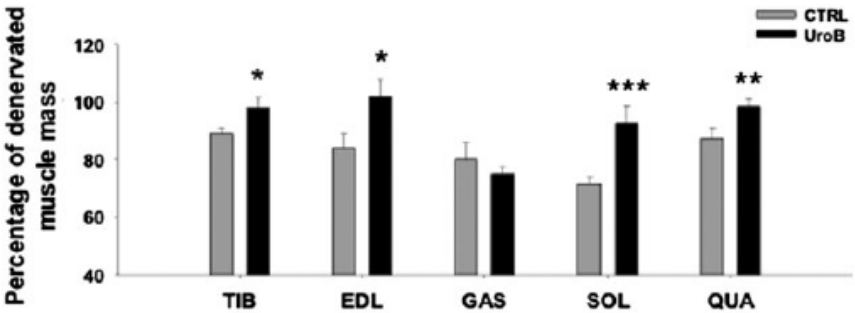
Urolithin B, a newly identified regulator of skeletal muscle mass

Julie Rodriguez[1,2], Nicolas Pierre[1], Damien Naslain[1], Françoise Bontemps[3], Daneel Ferreira[4], Fabian Priem[2], Louise Deldicque[1] & Marc Francaux[1*]







Journal of Cachexia, Sarcopenia and Muscle 2017; **8**: 583–59

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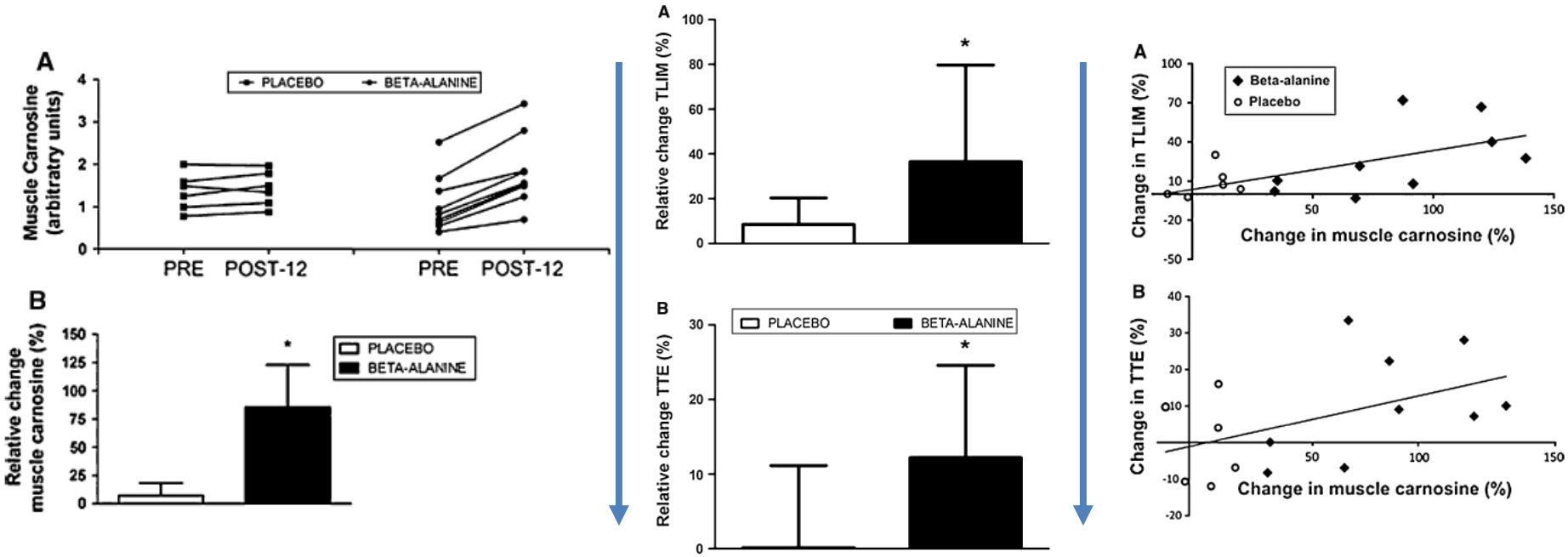
Beta-alanine (Carnosyn™) supplementation in elderly subjects (60–80 years): effects on muscle carnosine content and physical capacity

Serena del Favero · Hamilton Roschel · Marina Y. Solis · Ana P. Hayashi · Guilherme G. Artioli · Maria Concepción Otaduy · Fabiana B. Benatti · Roger C. Harris · John A. Wise · Cláudia C. Leite · Rosa M. Pereira · Ana L. de Sá-Pinto · Antonio Herbert Lancha-Junior · Bruno Gualano



Amino Acids (2012) 43:49–56
DOI 10.1007/s00726-011-1190-x

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Alpha-lipoic acid preserves skeletal muscle mass in type 2 diabetic OLETF rats

Oak-Kee Hong[1], Jang-Won Son[2], Hyuk-Sang Kwon[3], Seong-Su Lee[2], Sung-Rae Kim[2] and Soon Jib Yoo[2*]

Hong *et al. Nutrition & Metabolism* (2018) 15:66

APIGENIN INHIBITS SCIATIC NERVE DENERVATION–INDUCED MUSCLE ATROPHY

WON HEE CHOI, PhD, YOUNG JIN JANG, PhD, HYO JEONG SON, MS, JIYUN AHN, PhD, CHANG HWA JUNG, PhD, and TAE YOUL HA, PhD

Muscle Nerve 58: 314–318, 2018

Coffee consumption promotes skeletal muscle hypertrophy and myoblast differentiation

Young Jin Jang,[a] Hyo Jeong Son,[a] Ji-Sun Kim,[a,b] Chang Hwa Jung,[a,c] Jiyun Ahn,[a,c] Jinyoung Hur[a,c] and Tae Youl Ha *[a,c]

Food Funct., 2018, **9**, 1102

Acido Fosfatidico

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CURRENT NUTRITIONAL RECOMMENDATIONS AND NOVEL DIETARY STRATEGIES TO MANAGE SARCOPENIA

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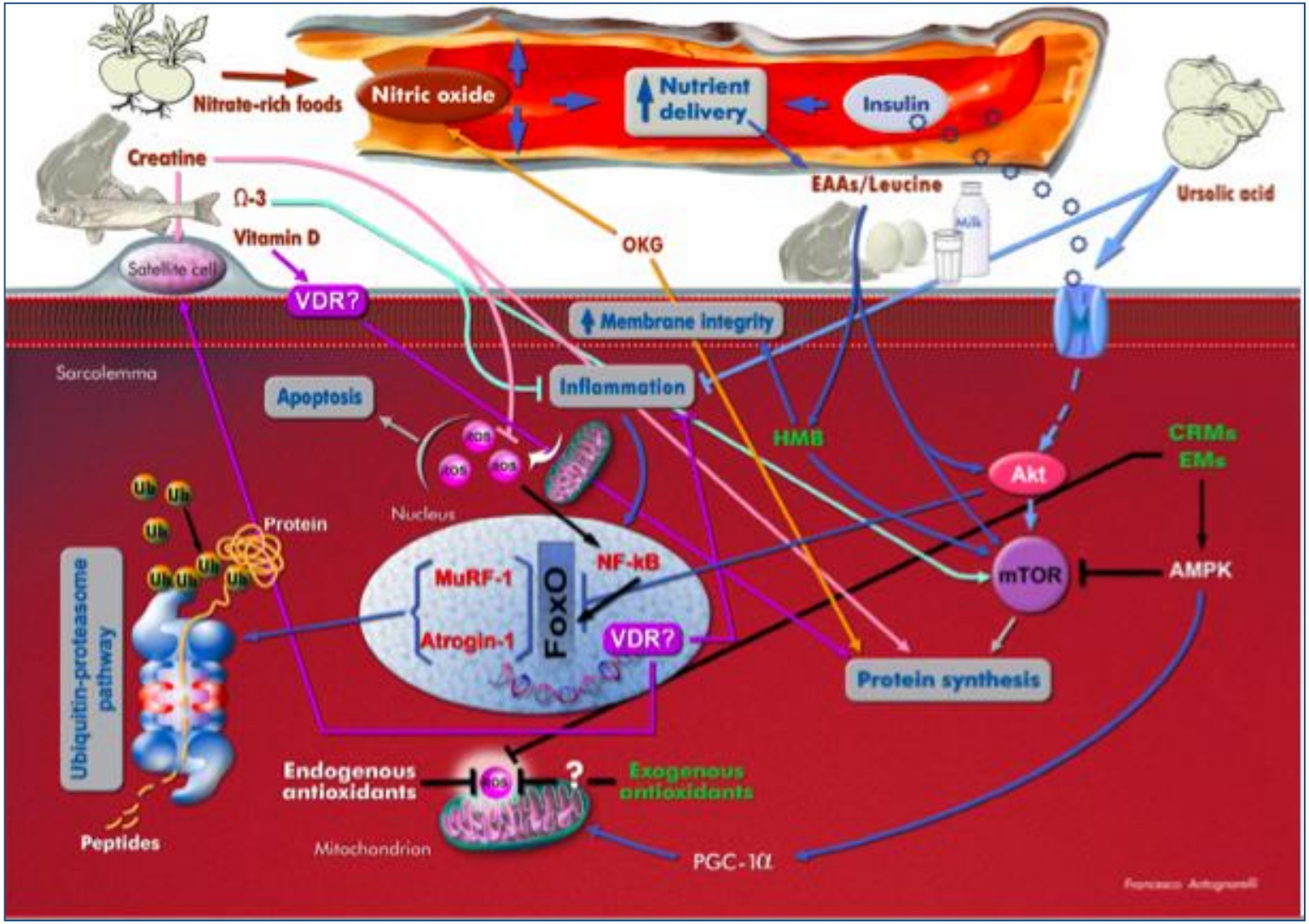

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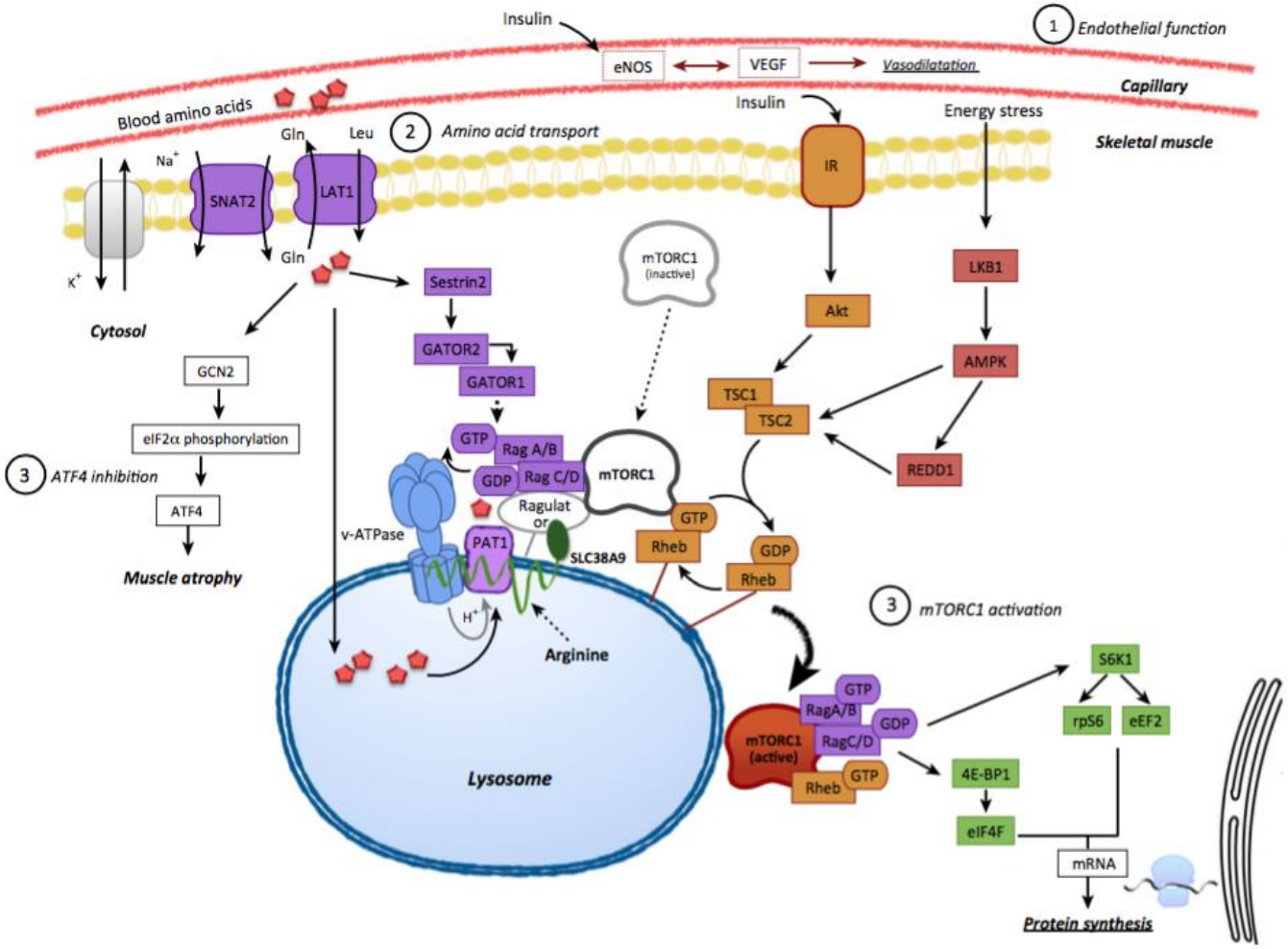
Amino Acid Sensing in Skeletal Muscle

Tatiana Moro,[1,2] Scott M. Ebert,[3,4,5] Christopher M. Adams,[3,4,5] and Blake B. Rasmussen[1,2,*]



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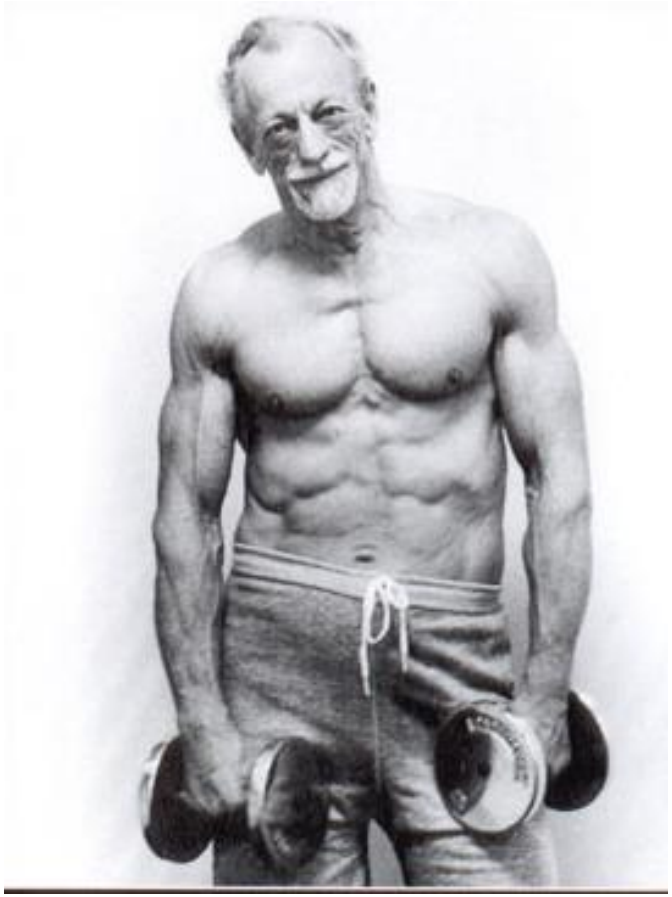
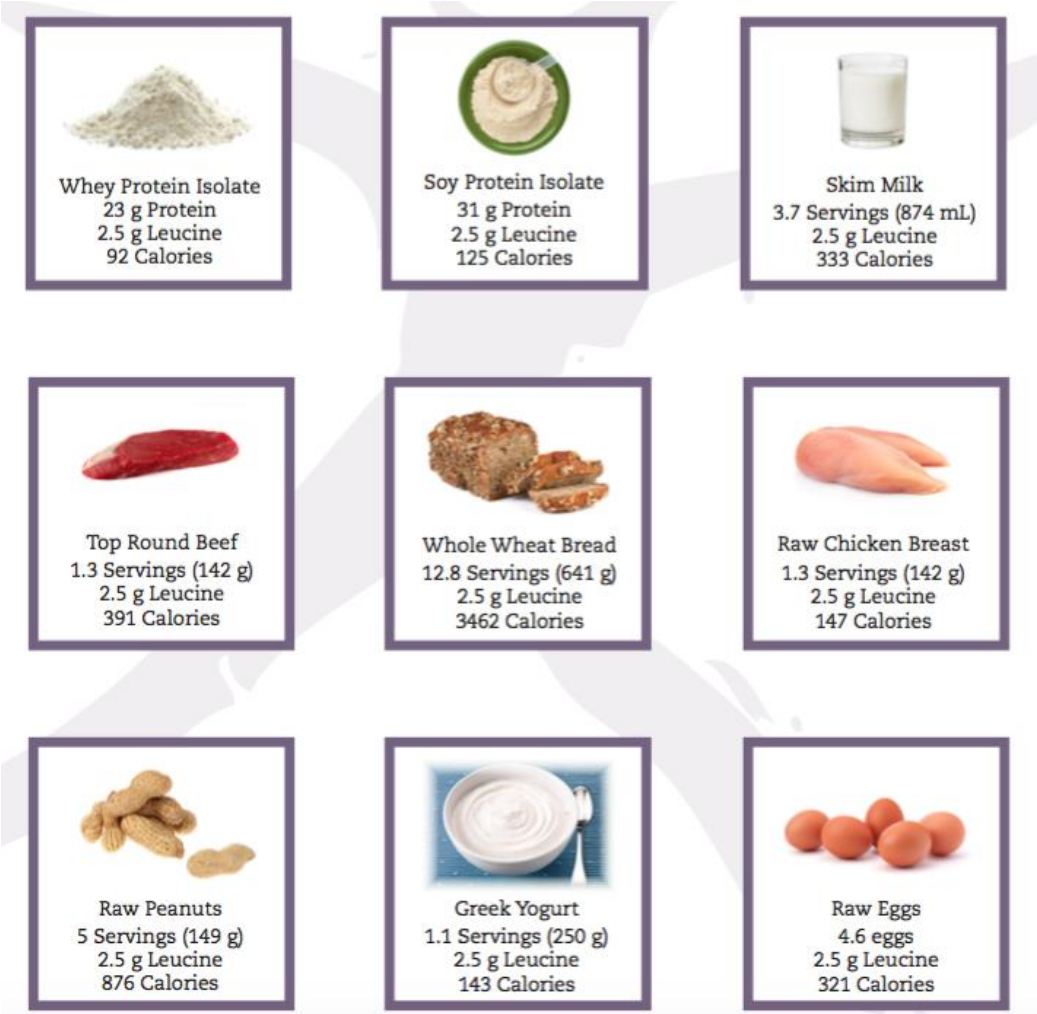
John Turner

Psichiatra e sollevatore di pesi

Età = 69 anni





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Psichiatra e sollevatore di pesi

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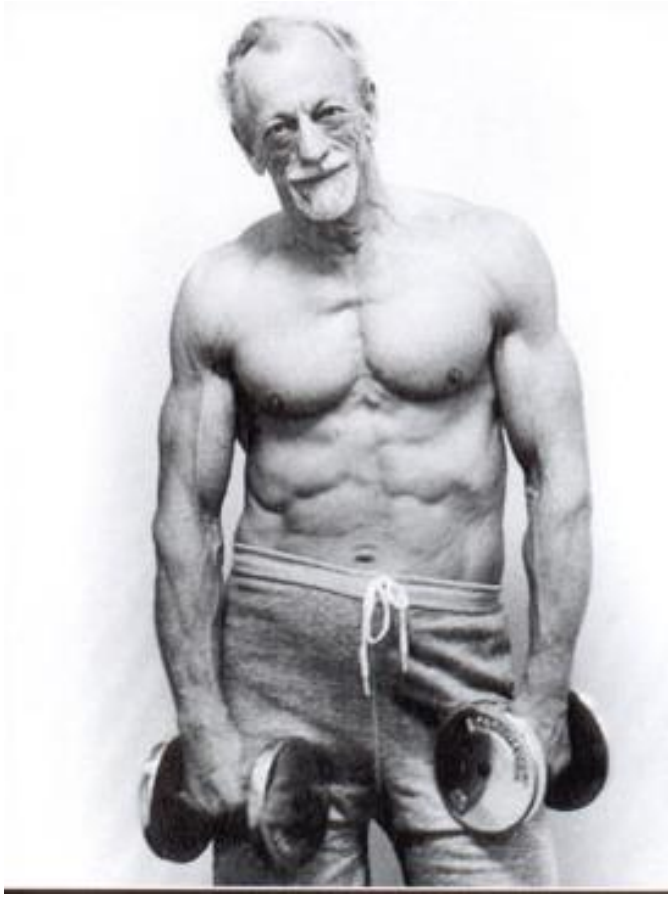
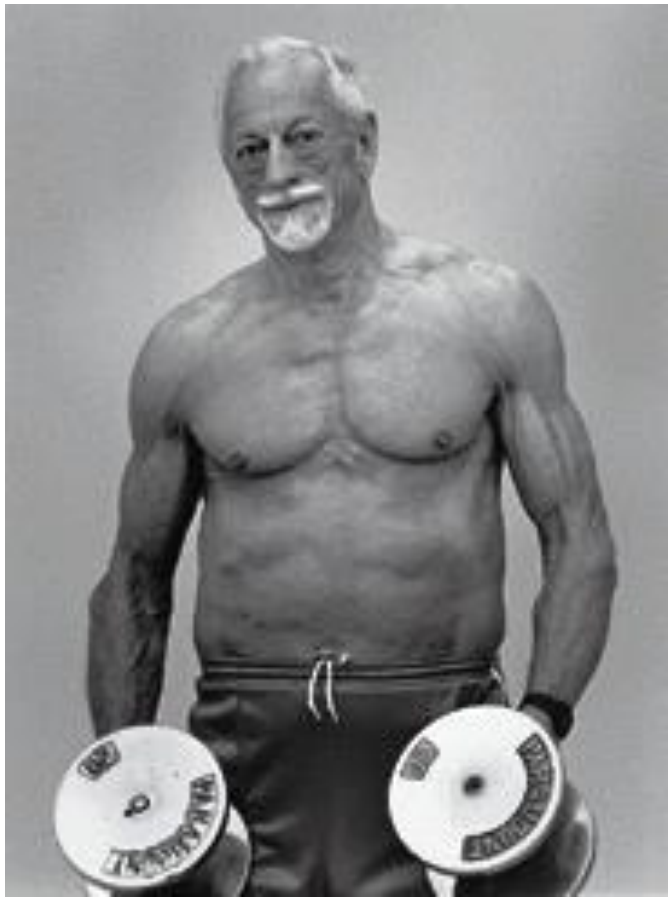
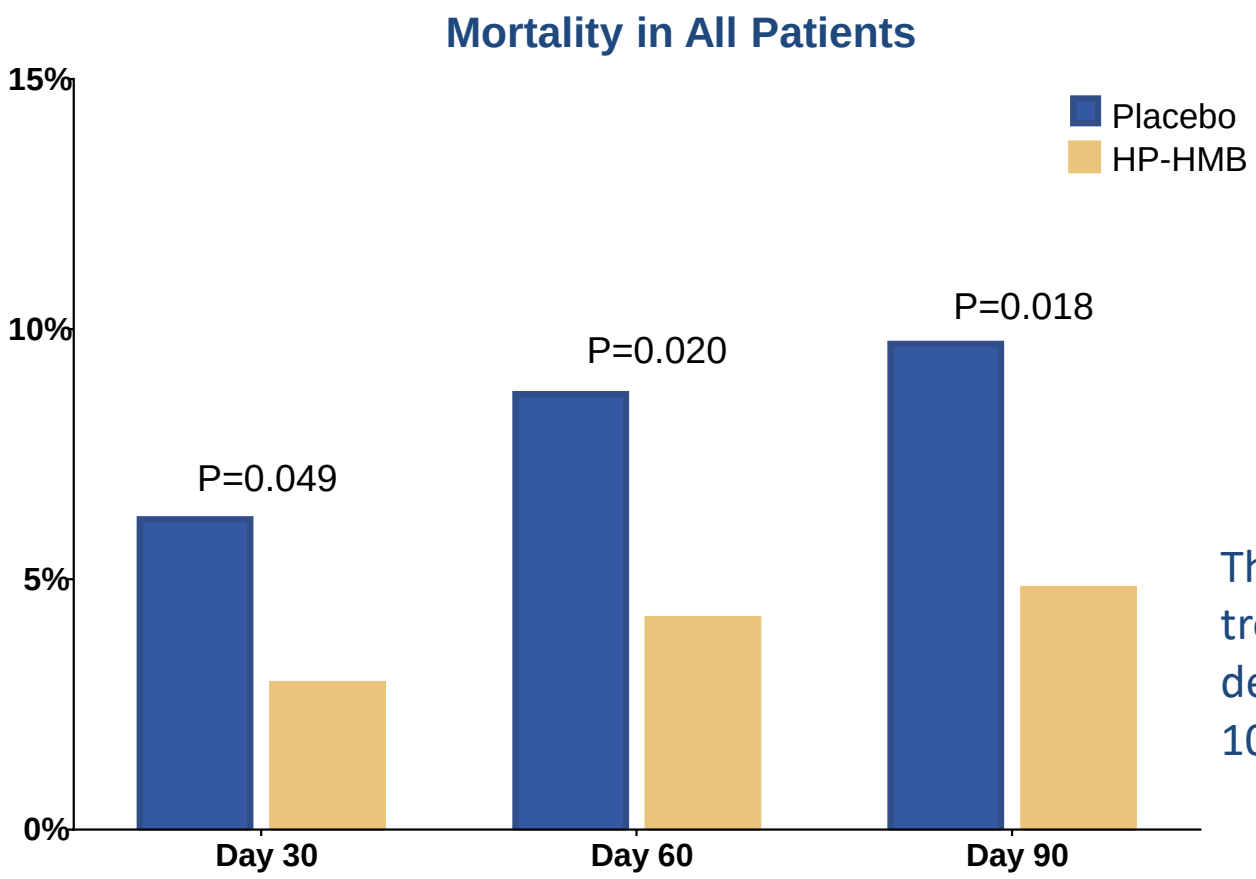


Età = 79 anni



HP-HMB Associated with 50% Reduction in Mortality



The number needed to treat (NNT) to prevent 1 death was 20.3 (95% CI, 10.9 to 121.4)

Reference: Deutz NE, et al., Clinical Nutrition (2016) 2016;35(1):18-26

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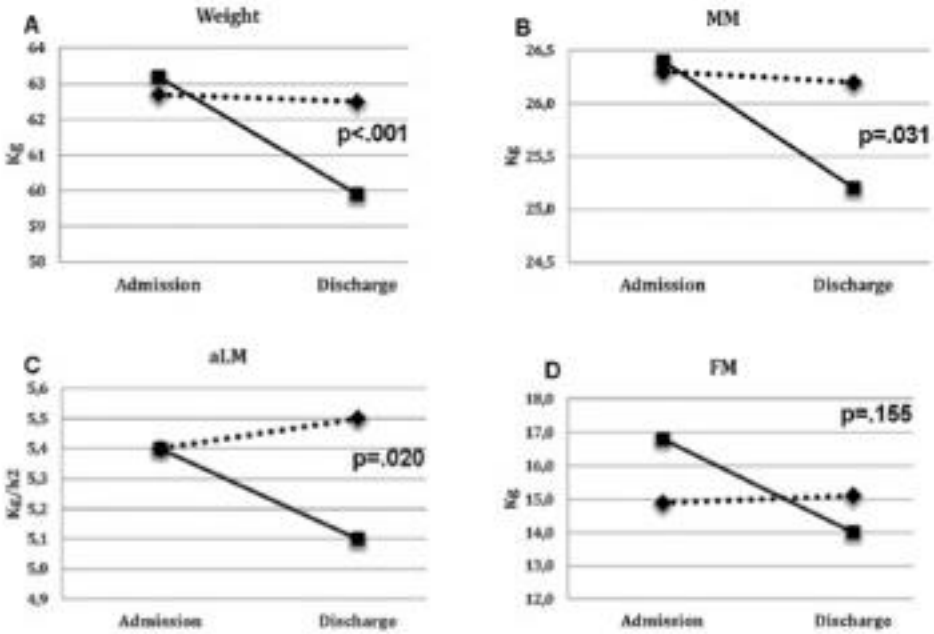
Improved Muscle Mass & Reduced Onset of Sarcopenia in Hip Fracture Patients on Specialized ONS

Elderly patients with hip fracture admitted to rehabilitation therapy

Intervention Group
Standard Diet + 2/ day Specialized ONS (n=49)

Control Group
Standard Diet (n=43)



References: 1 Malafarina V et al. Maturitas. 2017 Jul;101:42-50.

Età 6 mesi
Peso 8 Kg

Età 70 anni
Peso 70 Kg

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Età 6 mesi
Peso 8 Kg

Età 70 anni
Peso 70 Kg

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80 tonnellate!!!!

Età 6 mesi
Peso 8 Kg

Età 70 anni
Peso 70 Kg

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leucina, idrossimetilbutirrato (HMB), creatina, vitamina D, acido ursolico, acido fosfatidico, apigenina, tomatidina, nicotinamide riboside