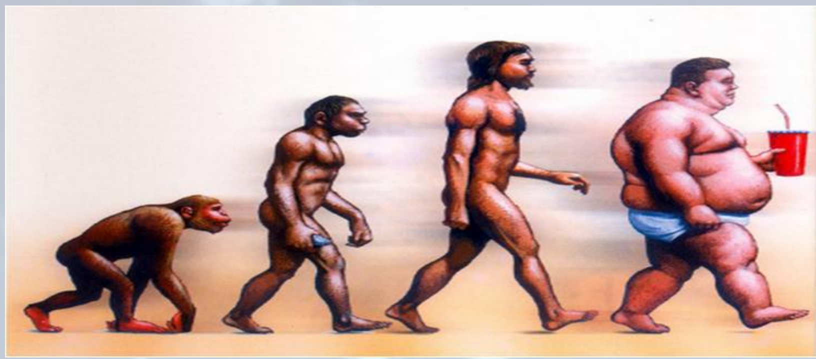
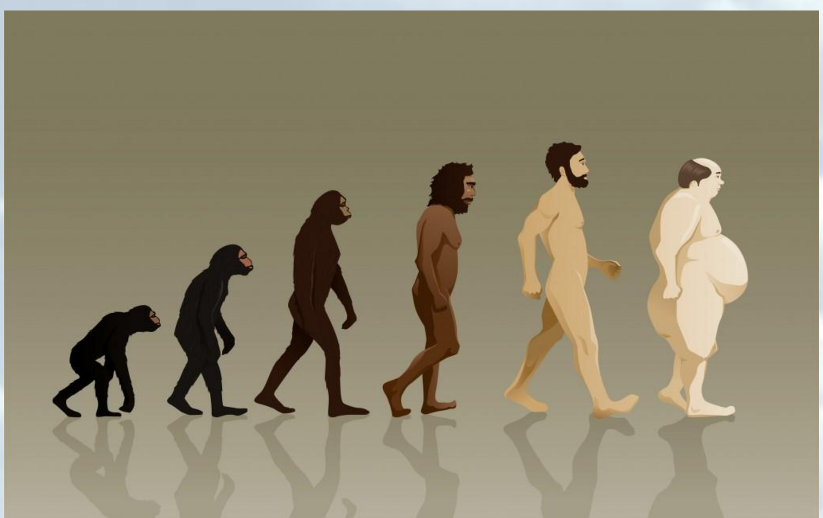
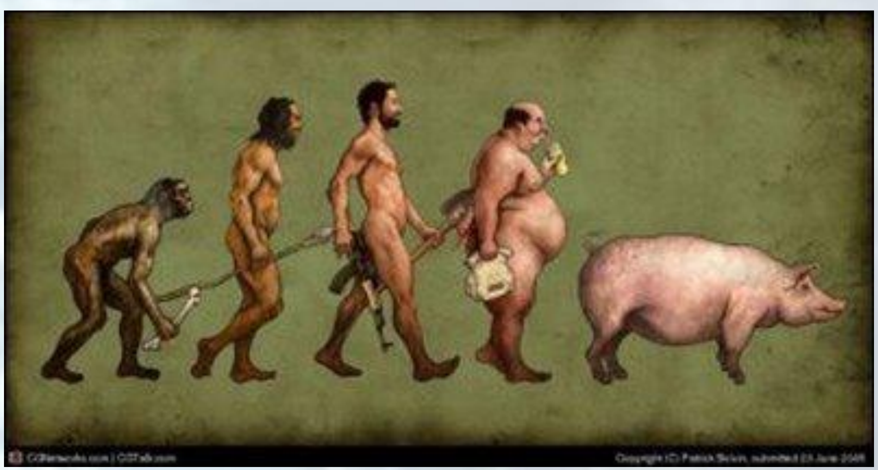
FISIOLOGÍA DEL MÚSCULO Y SU PAPEL EN LA SALUD Y ENFERMEDAD

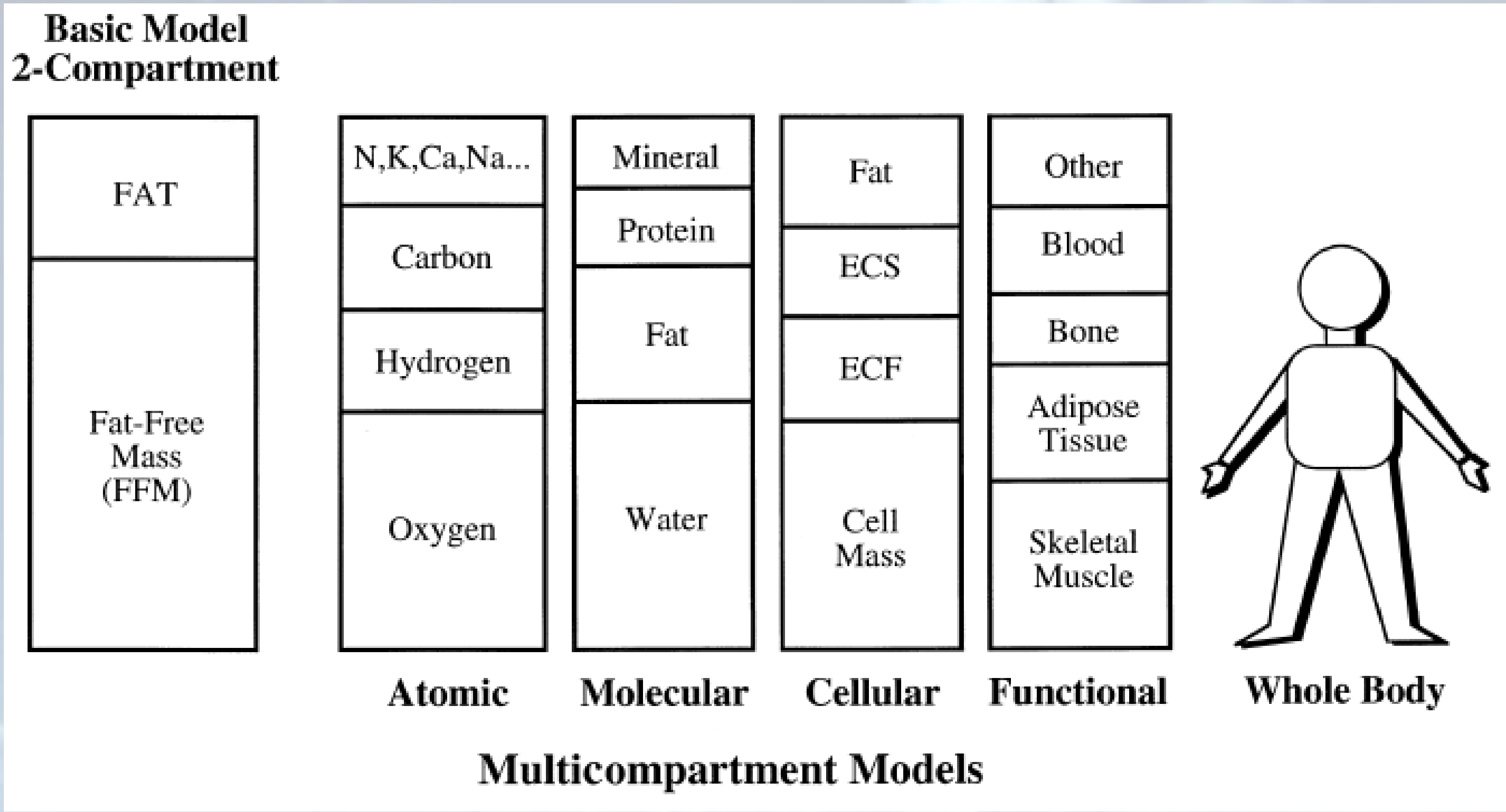
Henry Humberto León Ariza.
Licenciado en Educación Física
Médico Cirujano
Aspirante a Doctor en Biociencias

EVOLUCIÓN Y OBESIDAD









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RABDOMIOCITO VS ADIPOCITO

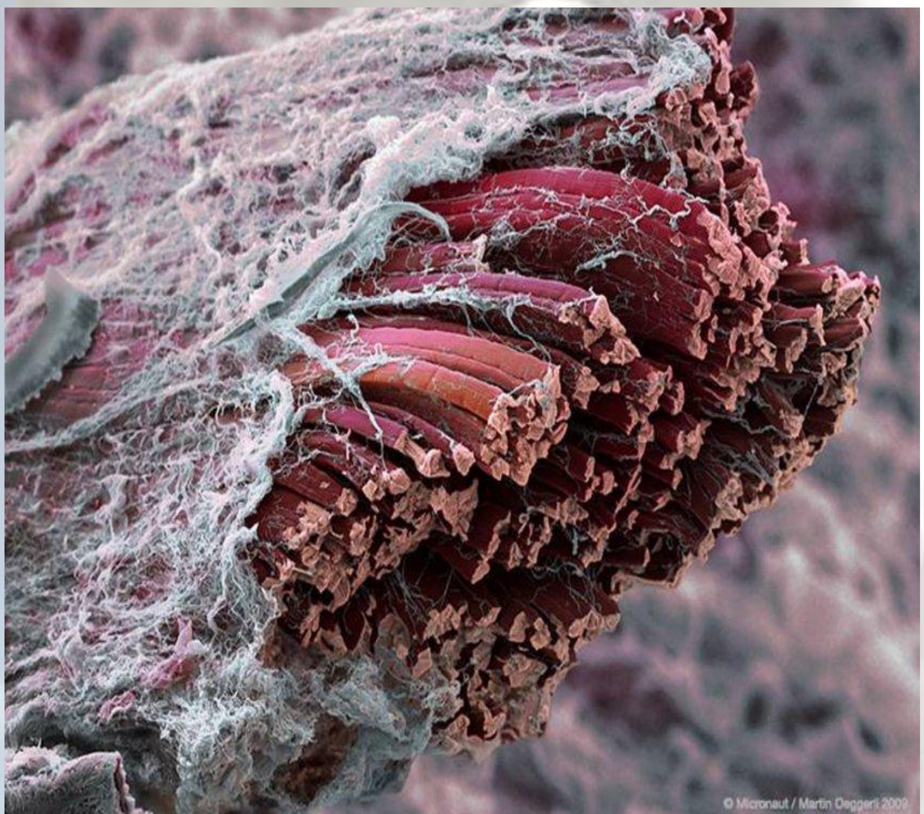


Tabla 3. Análisis de correlación entre los porcentajes de masa muscular y grasa encontrados y las demás variables, en hombres

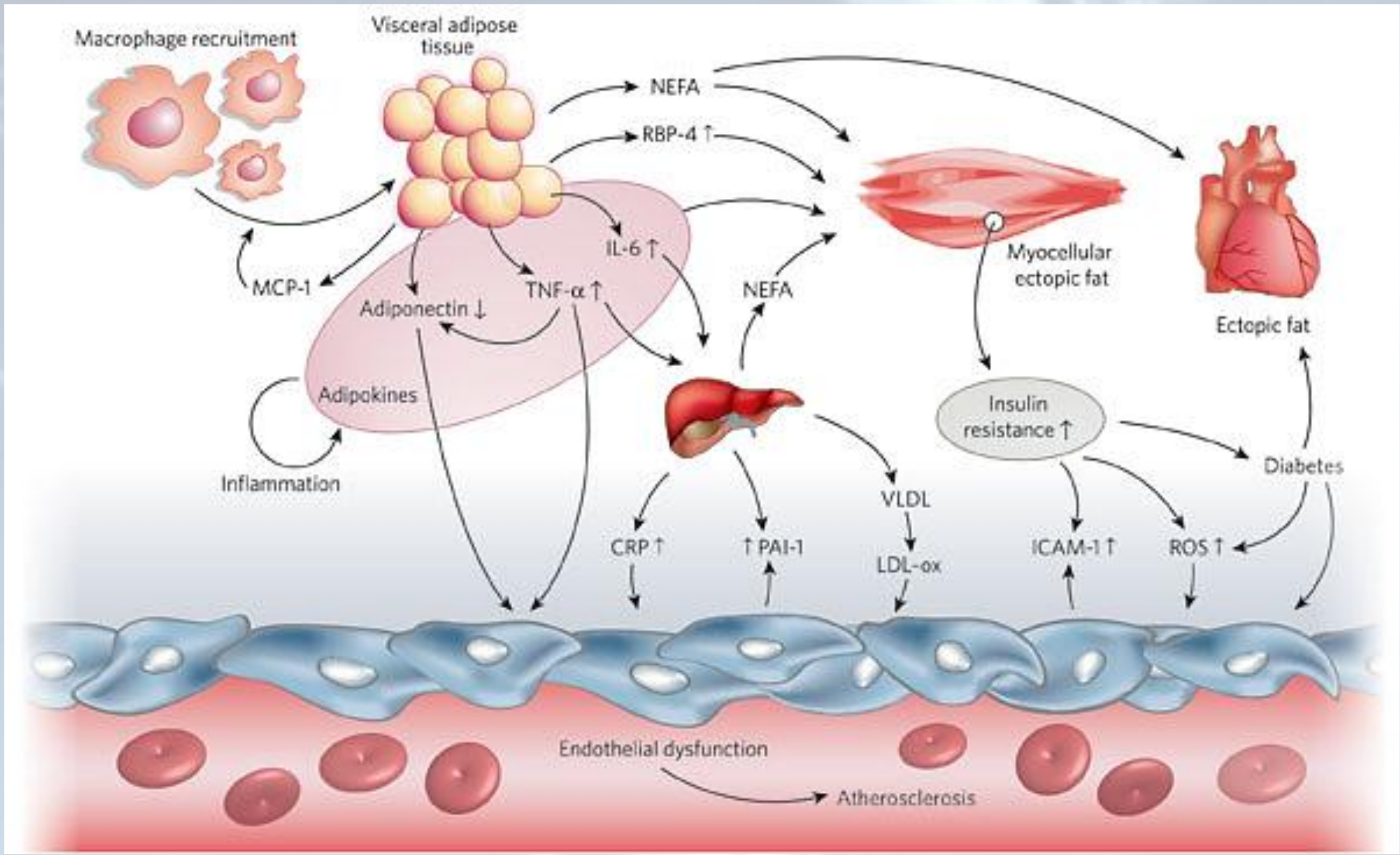
Variable	(%) Masa muscular		(%) Grasa	
	r	P	r	p
Edad	-0,32	0,00*	0,36	0,00*
Peso	-0,60	0,00*	0,70	0,00*
IMC	-0,61	0,00*	0,80	0,00*
Grasa Visceral	-0,63	0,00*	0,84	0,00*
Perímetro Abdominal	-0,64	0,00*	0,75	0,00*
Presión arterial sistólica	-0,11	0,30	0,14	0,18
Presión arterial diastólica	-0,27	0,01*	0,31	0,00*
Glucosa	-0,22	0,03*	0,27	0,01*
Colesterol total	-0,24	0,02*	0,33	0,00*
Triglicéridos	-0,25	0,02*	0,30	0,00*
Colesterol HDL	0,23	0,03*	-0,29	0,00*
Colesterol LDL	-0,21	0,04*	0,31	0,00*
Índice aterogénico en plasma	-0,31	0,00*	0,39	0,00*

Tabla 4. Análisis de correlación entre los porcentajes de masa muscular y grasa encontrados y las demás variables, en mujeres

Variable	(%) Masa muscular		(%) Grasa	
	r	P	r	p
Edad	0,07	0,50	0,03	0,78
Peso	-0,32	0,00*	0,77	0,00*
IMC	-0,53	0,00*	0,93	0,00*
Grasa Visceral	-0,53	0,00*	0,88	0,00*
Perímetro Abdominal	-0,42	0,00*	0,74	0,00*
Presión arterial sistólica	-0,11	0,32	0,26	0,01*
Presión arterial diastólica	-0,23	0,03*	0,32	0,00*
Glucosa	-0,43	0,00*	0,56	0,00*
Colesterol total	-0,18	0,10	0,32	0,00*
Triglicéridos	-0,17	0,11	0,20	0,06
Colesterol HDL	0,18	0,08	-0,40	0,00*
Colesterol LDL	-0,16	0,14	0,32	0,00*
Índice aterogénico en plasma	-0,21	0,04*	0,35	0,00*

Zea-Robles AC, et al. [University students cardiovascular risk factors and their relationship with body composition]. Rev Salud Publica (Bogota) 2014 Aug;16(4):505-15.

EL TEJIDO ADIPOSO COMO ÓRGANO ENDOCRINO



Van Gaal LF, Mertens IL, De Block CE. Mechanisms linking obesity with cardiovascular disease. Nature 2006 Dec 14;444(7121):875-80.

EL MÚSCULO COMO ÓRGANO ENDOCRINO

Table 3. *Plasma cytokine changes in response to running a competitive marathon race in carbohydrate and placebo groups*

	n	Prerace	Postrace	1.5 Postrace	Effect: Interaction; Time
IL-1β, pg/ml					
Carbohydrate	23	0.30 ± 0.06	0.45 ± 0.04	0.30 ± 0.06	0.259
Placebo	22	0.31 ± 0.05	0.35 ± 0.06	0.32 ± 0.06	0.025
IL-6, pg/ml					
Carbohydrate	46	1.5 ± 0.19	59.4 ± 8.0	31.9 ± 7.3	0.655
Placebo	50	1.2 ± 0.16	50.5 ± 5.0	25.9 ± 3.7	<0.001
IL-8, pg/ml					
Carbohydrate	47	9.7 ± 1.1	29.6 ± 2.4	26.9 ± 2.4	<0.001
Placebo	49	9.9 ± 1.3	25.6 ± 1.4	19.0 ± 1.1*	<0.001
TNF-α, pg/ml					
Carbohydrate	24	3.7 ± 0.2	4.5 ± 0.2	4.6 ± 0.4	0.197
Placebo		3.6 ± 0.2	4.5 ± 0.3	4.0 ± 0.3	<0.001

Values are means ± SE. IL, interleukin; TNF-α, tumor necrosis factor-α. *Different from prerace, $P < 0.001$.

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EL MÚSCULO COMO ÓRGANO ENDOCRINO

"The recent discovery of myokines – that is, cytokines that are produced and secreted by skeletal muscle cells – sheds light on the association between exercise and inflammation'"

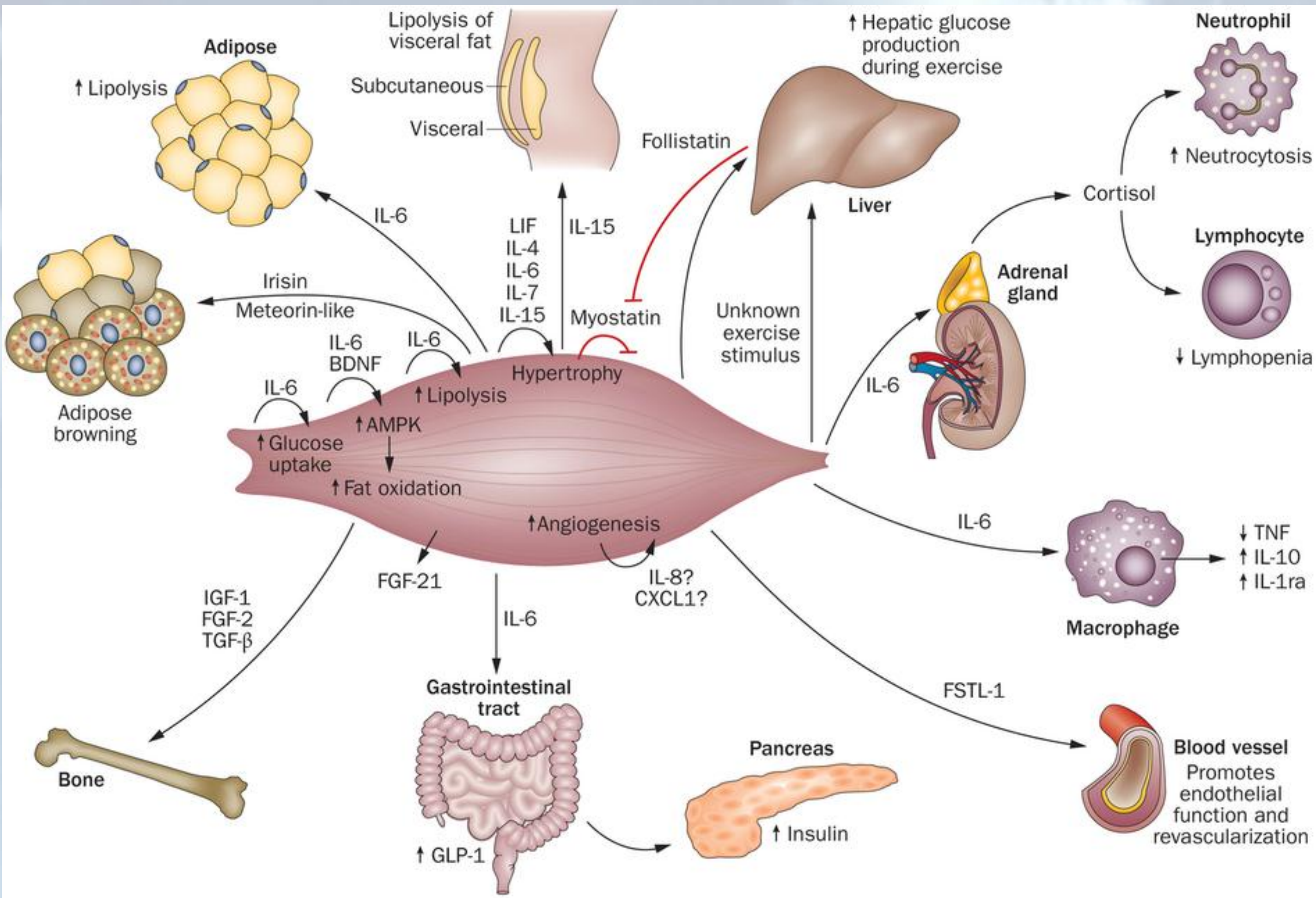
Handschin C, Spiegelman BM. The role of exercise and PGC1alpha in inflammation and chronic disease. Nature 2008 Jul 24;454(7203):463-9.

EL MÚSCULO COMO ÓRGANO ENDOCRINO

“Skeletal muscle: not simply an organ for locomotion and energy storage”

Lancaster GI, Febbraio MA. Skeletal muscle: not simply an organ for locomotion and energy storage. J Physiol 2009 Feb 1;587(Pt 3):509-10.

EL MÚSCULO COMO ÓRGANO ENDOCRINO



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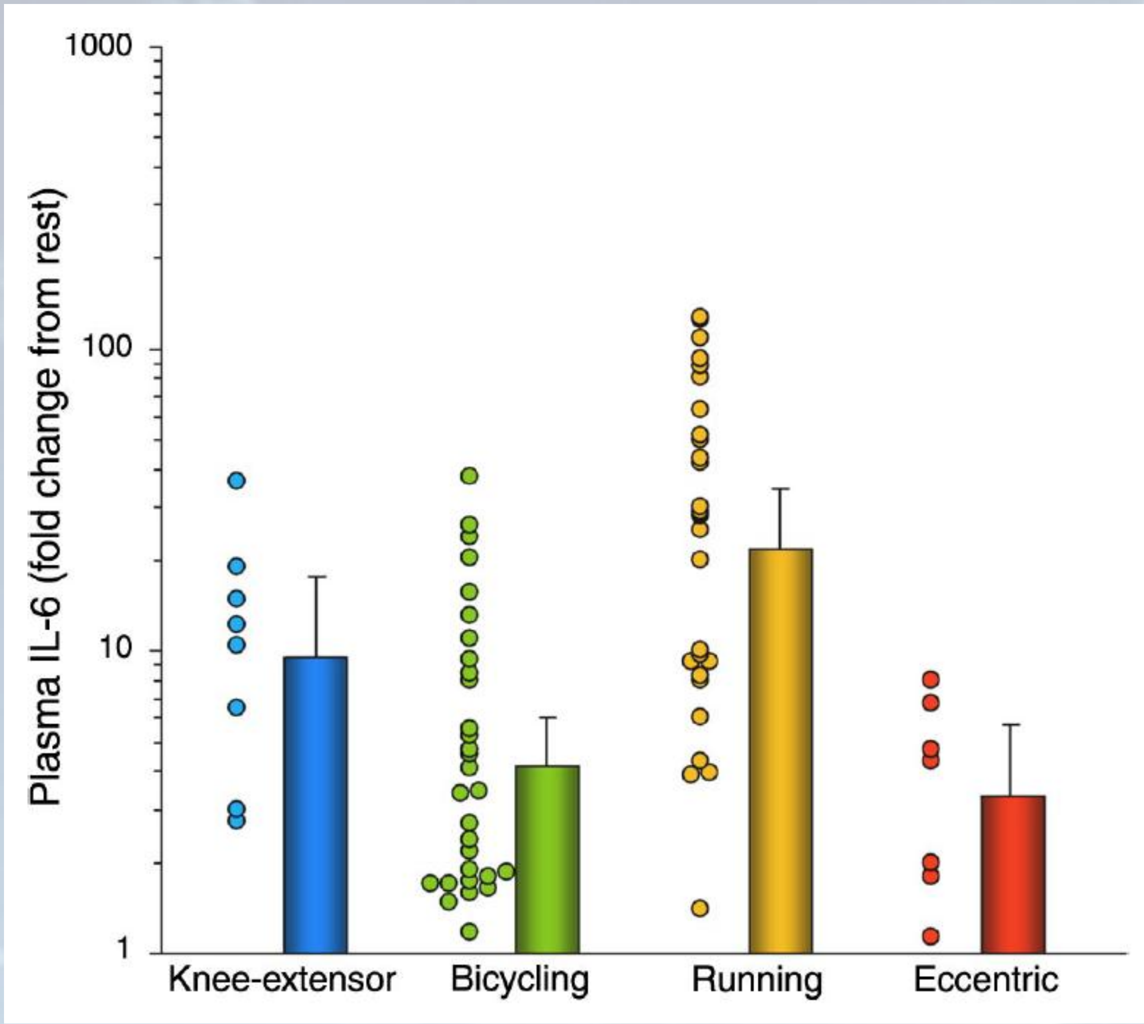

Resultado de 73 diferentes estudios realizados (800 sujetos), con diferentes formas de ejercicio.

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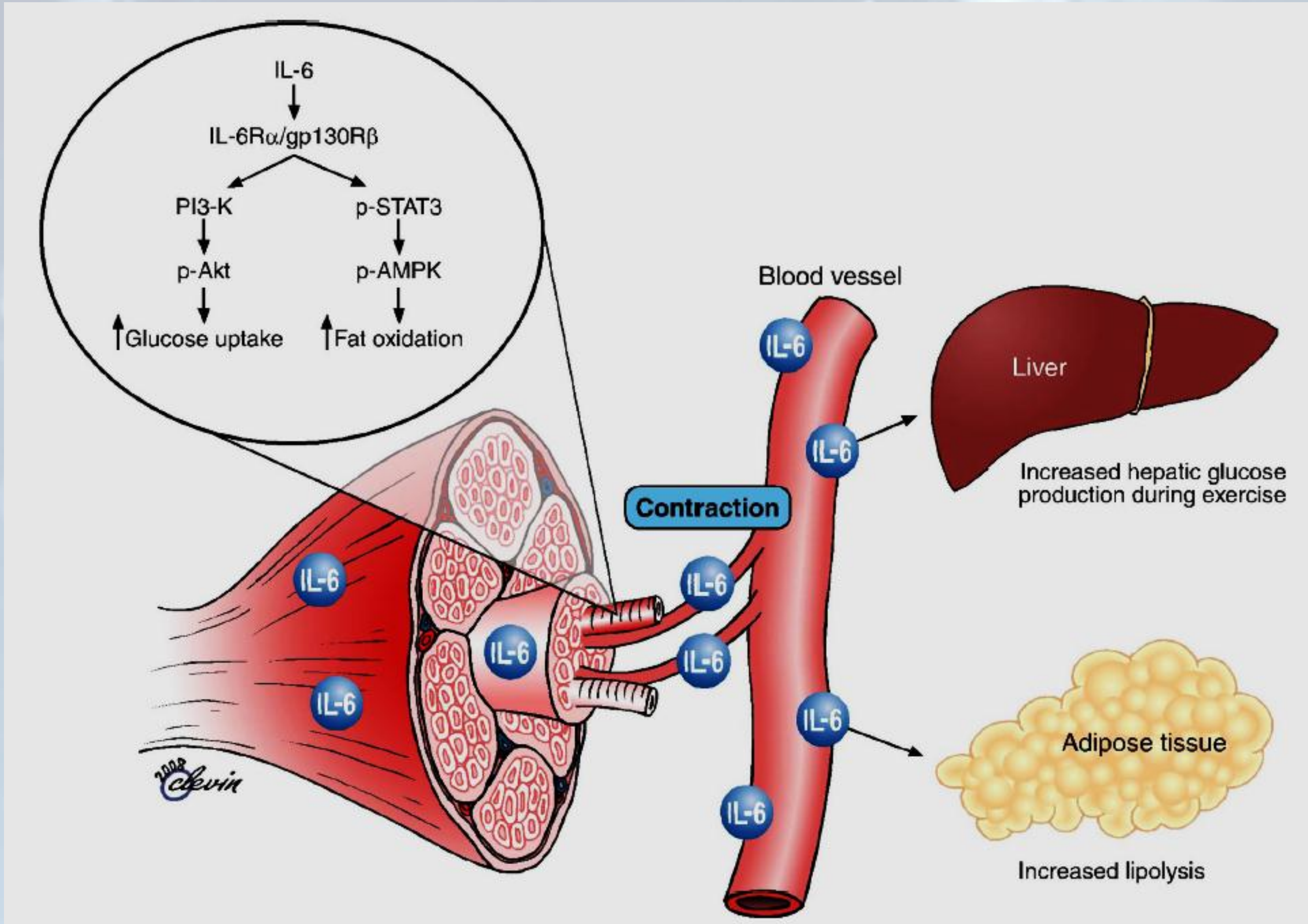

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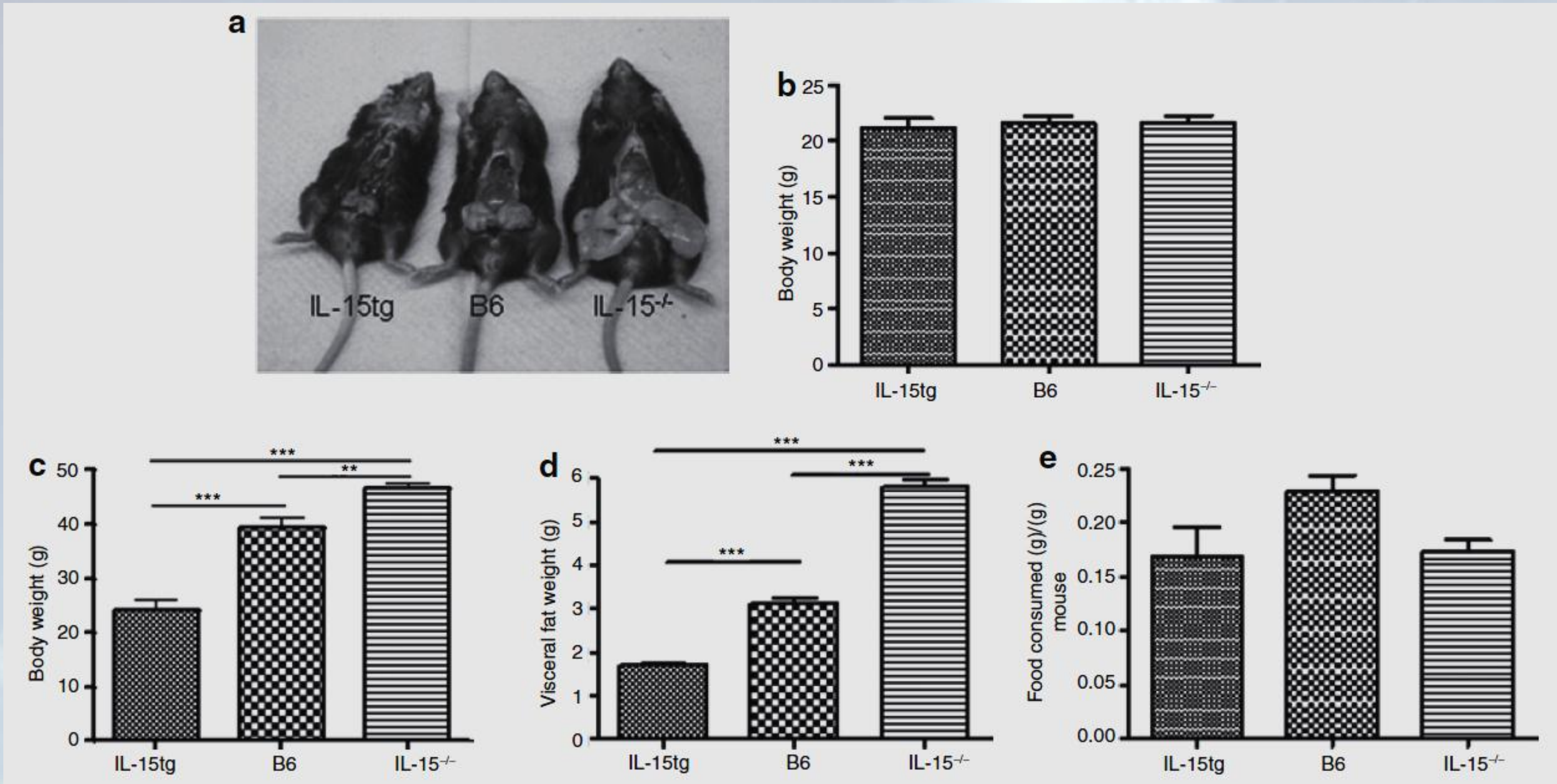
INTERLEUCINA 15 (IL-15)



N. G. Barra, S. Reid, R. MacKenzie et al., “Interleukin-15 contributes to the regulation of murine adipose tissue and human adipocytes,” Obesity, vol. 18, no. 8, pp. 1601–1607, 2010.

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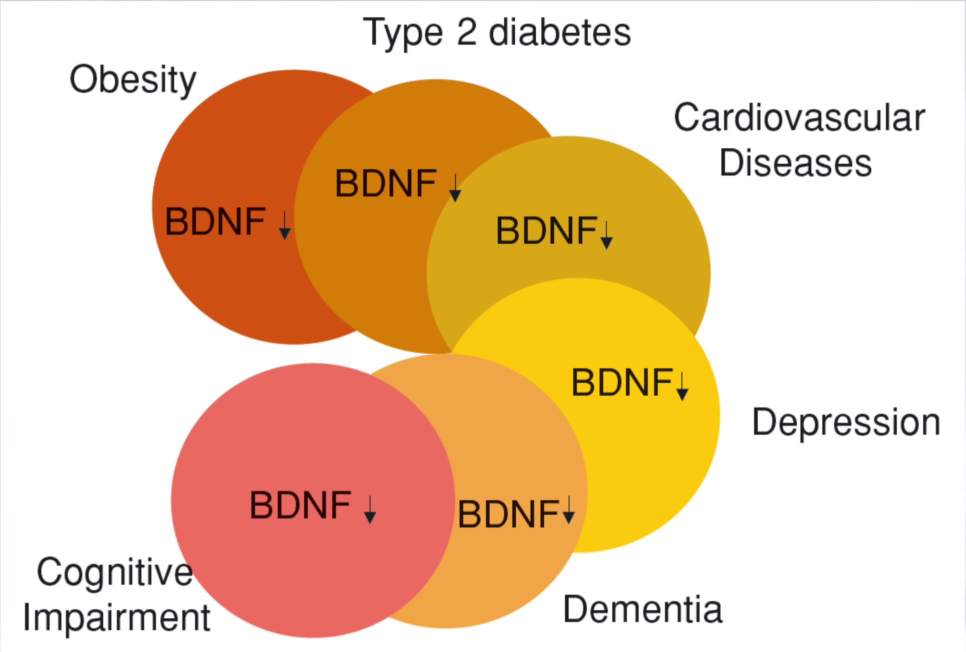

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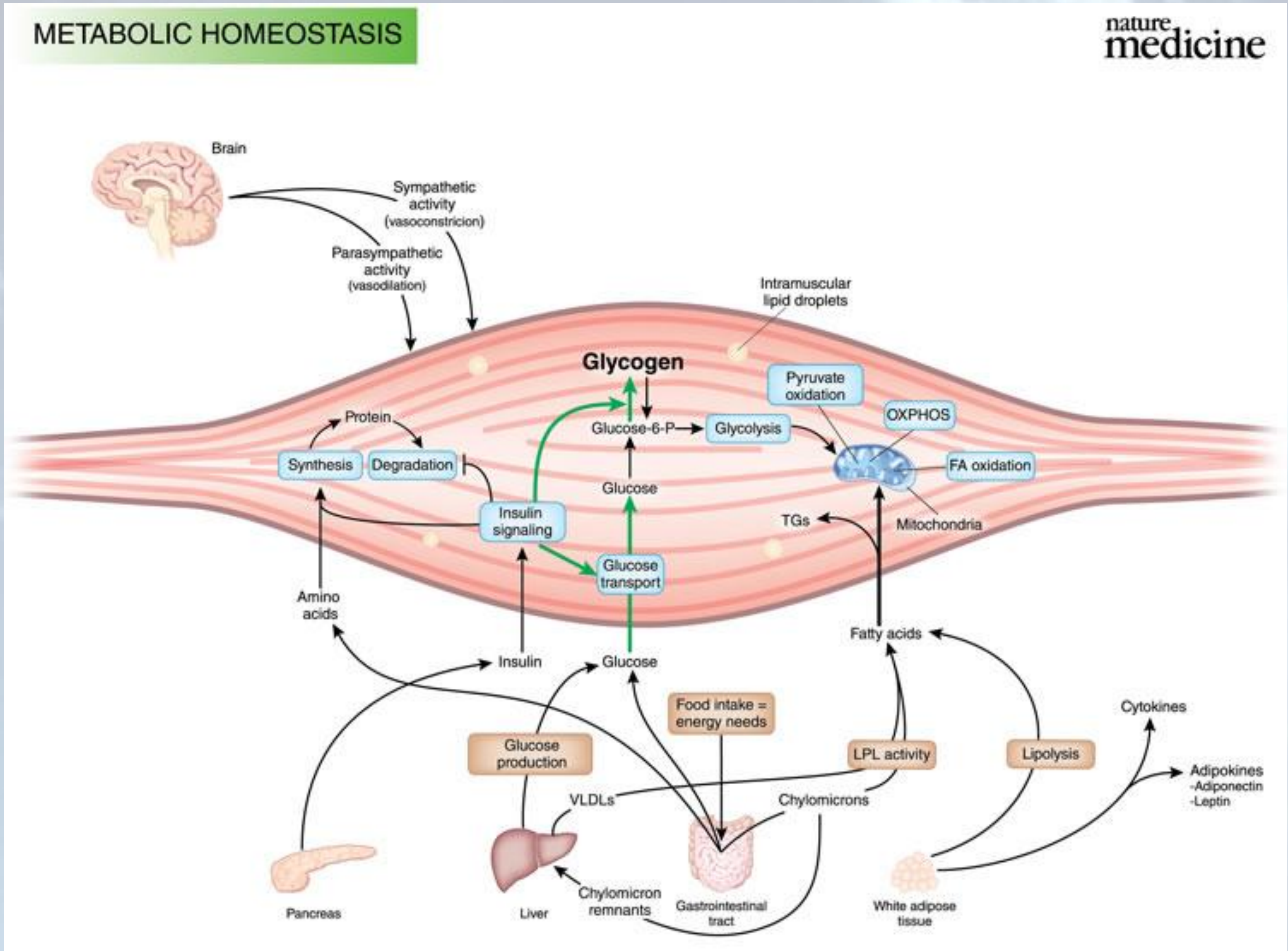
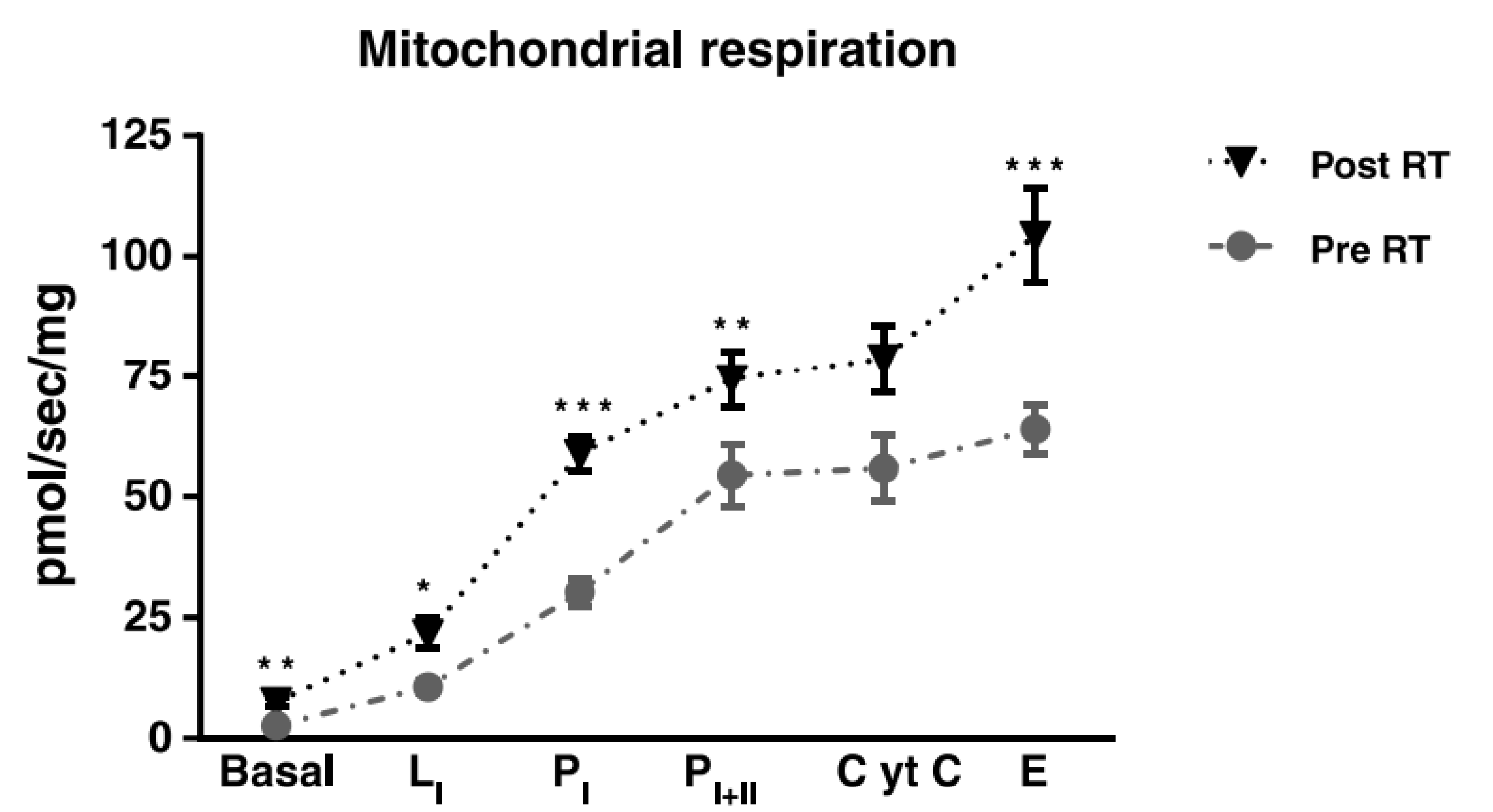


Stefano Schiaffino, Carlo Reggiani, Fiber Types in Mammalian Skeletal Muscles, Physiological Reviews 2011 91 (4), 1447-1531

Fuerza y adaptaciones mitocondriales



Porter C., P. T. Reidy, N. Bhattarai, L. S. Sidossis, and B. B. Rasmussen. Resistance Exercise Training Alters Mitochondrial Function in Human Skeletal Muscle. Med. Sci. Sports Exerc., 47 (9) 1922–1931, 2015

Variable	Aerobic Exercise	Resistance Exercise
Total body fat	↓↓	↓
Intra-abdominal fat	↓↓	↓↔
Lean body mass	↔	↑↑
Body weight	↓	↔
Resting metabolic rate	↑	↑↑
Muscular strength	↔	↑↑↑
Muscular mass	↔	↑↑
Muscular power	↔	↑
Capillary density	↑	↔
Mitochondrial volume	↑↑	↓↔
Mitochondrial density	↑↑	↓↔
Basal insulin levels	↓	↓
Insulin sensitivity	↑↑	↑↑
Insulin response to glucose challenge	↓↓	↓↓
Resting heart rate	↓↓	↔
SBP at rest	↓↓	↓
DBP at rest	↓↓	↓
Peak VO_2	↑↑↑	↑↔
Submaximal and maximal endurance time	↑↑↑	↑↑
Submaximal exercise rate-pressure product	↓↓↓	↓↓

Abbreviations: DBP, diastolic blood pressure; SBP, systolic blood pressure.
[a]↑ indicates increased; ↓, decreased; ↔, negligible effect; 1 arrow, small effect; 2 arrows, moderate effect; 3 arrows, large effect.

Artero EG, Lee D, Lavie CJ, España-Romero V, Sui X, et al. (2012) Effects of muscular strength on cardiovascular risk factors and prognosis. J Cardiopulm Rehabil Prev 2012;32:351-358

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Review Article

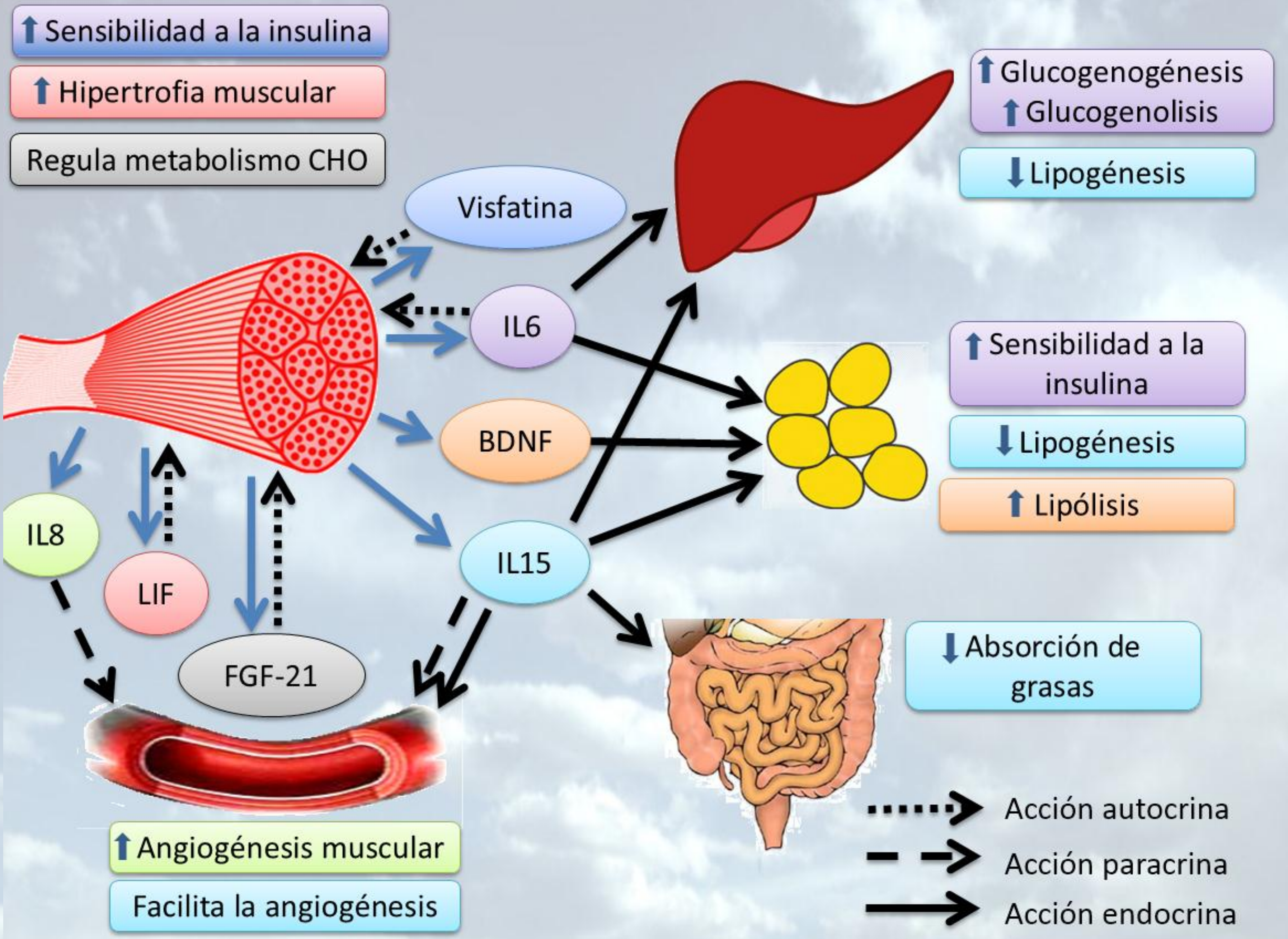
Muscular strength as a strong predictor of mortality: A narrative review

Konstantinos A. Volaklis [a,b,*], Martin Halle [a,c], Christa Meisinger [d]

Table 2
Summary of studies examining the association between muscular strength and mortality in clinical populations.

Study	n/age/disease	Follow up	Muscular testing	Adjustments for cofactors	Major findings
Wang et al. (2005)	120 men and 113 women/ 53–57 years/end-stage renal failure	Mean 30 months	Hand grip	Age, sex, diabetes, CVD-disease, GFR, Hb, CRP, Alb	HR: 0.94 (95%CI = 0.92–0.98) & HR: 0.95 (95%CI = 0.92–0.99) in the highest vs lowest tertile of strength for CVD-mortality and all-cause mortality, respectively
Swallow et al. (2007)	108 men and 54 women/ 63.7 ± 9.3 years/COPD	5 years	Quadriceps maximal testing	Age, BMI, FEV1, fat-free mass, medication	HR: 0.91 (95%CI = 0.83–0.99) in the highest vs lowest levels of strength for all-cause mortality
Ali et al. (2008)	136 men and women/ 57.7 ± 15.5/critical illness	60 days after ICU admission	Hand grip	Age, sex ventilator days, illness severity, organ failures	OR: 4.5 (95%CI = 1.5–13.6) in the lowest vs highest levels of strength for hospital mortality
Mehrotra et al. (2010)	154 men & 114 women/ 70–79 years/COPD	Mean 6.1 years	Hand grip Knee extension	BMI, dyspnea, FEV1, medication PA, demographics, comorbidities	HR: 1.34 in the lowest vs highest levels of strength for all-cause mortality only for KES
Singh et al. (2010)	246 men and women/ 75.0 ± 8.2/PAD	Mean 30 months	Isometric testing	Age, race, comorbidities, smoking, BMI, ABI	HR: 2.23 (95%CI = 1.02–4.87) & HR: 4.20 (95%CI = 1.12–15.79) in the lowest vs highest quartile of strength for all-cause and CVD-mortality, respectively
Artero et al. (2011)	1506 men/50.2 ± 7.4 years/hypertension	Mean 18.3 years	Maximal leg strength Maximal bench press	Age, PA, smoking, alcohol, BMI, BP, TC, comorbidities, CRF	HR: 0.66 (95%CI = 0.45–0.98) in the upper vs lowest third of strength for all-cause mortality
Dermott et al. (2012)	233 men and 201 women/ 75.0 ± 8.2/PAD	Mean 47.6 months	Knee extension Hand grip	Age, sex, race, BMI, ABI, smoking status, PA, comorbidities	HR: 1.71 (95%CI = 0.89–3.32 & HR: 1.96 (95%CI = 0.90–4.26) in the poorest vs best tertile of HGS and KES for all-cause mortality, respectively
Puhan et al. (2013)	233 men and 176 women/>67.3 ± 10.0/COPD	2 years	Hand grip	Age, sex, dyspnea, FEV1, medication	HR = 0.84 (95%CI = 0.72–1.00) for high vs low levels of strength for all-cause mortality

ABI: ankle–brachial index, Alb: Albumin, BMI: body mass index, BP: blood pressure, CRP: C-reactive protein, COPD: chronic obstructive pulmonary disease, CI: confidence interval, CRF: cardio-respiratory fitness, GFR: glomerular filtration rate, FA: fat area, FM: fat mass, FEV1: forced expiratory capacity in 1 s, Hb: Hemoglobin, HGS: hand grip strength, HR: hazard ratio, KES: knee extension strength, OR: odds ratio, PA: physical activity, PAD: peripheral arterial disease, RR: relative risk.



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HENRY HUMBERTO LEON ARIZA

preparacionfisica2@gmail.com
henrylear@clinicaunisabana.edu.co
henry.leon@basemedica.co

www. Basemedica.co
@sportphysiology