

Plenary Lecture 3

Chairperson

Kwan Woo Lee
Ajou University, Korea

Speaker

William Evans
University of California, Berkeley, USA



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• Education

Period	Affiliation	Position
– 1980	Human Bioenergetics, Ball State University, Human Performance Laboratory	Ph.D.
– 1976	Biology, Ball State University, Human Performance Laboratory	M.S.
– 1972	Zoology, University of North Carolina at Chapel Hill	B.A

• Affiliations / Experience

Period	Affiliation	Position
– 2017-Present	Department of Nutritional Sciences & Toxicology, University of California, Berkeley	Adjunct Professor of Human Nutrition
– 2010-Present	Division of Geriatrics, Duke University Medical Center	Adjunct Professor of Medicine
– 2014-2016	Muscle & Health Division, KineMed, Inc	President/ Director
– 2009-2014	Muscle Metabolism Discovery Unit, GlaxoSmithKline, Research Triangle Park, NC	Vice President
– 1997-2009	Donald W. Reynolds Institute on Aging at the University of Arkansas for Medical Sciences Park, NC	Jane and Ed Warmack Chair/ Director

• Committee Memberships

- American Federation for Aging Research
- Skeletal muscle, and exercise physiology study section, Clinical and Integrative Diabetes and Obesity Study Section, and Multicenter AIDS Cohort Study (MACS)- NIH, Small Business Innovative Research grant, Pepper Center for Independent Living grants
- Society on Cachexia and Wasting Disorders” (SCWD)
- UAMS Institutional Review Board
- Neurological, Aging, and Musculoskeletal Epidemiology Study

• Publications

- WJ Evans, M Hellerstein, RJ Butterfield, E Smith, M Guglieri, N Katz, B Nave, L Branigan, S Thera BS3, KL Vordos, L Behar, M Schiava, M James, T Field, H Mohammed, and M Shankaran, Reductions in functional muscle mass measured using D3Creatine dilution and ability to ambulate in Duchenne muscular dystrophy from ages 4 – 24 years, (in review)
- M Hetherington-Rauth , CE McCulloch, SR Cummings, WJ Evans, M Hellerstein, JA Cauley, K Ensrud, L Langsetmo , ES Orwoll, and PM Cawthon Change in D3Cr muscle mass in oldest old men and its association with changes in grip strength and walking speed (in review)
- HR Banack, J Wactawski-Wende, HM Ochs-Balcom, EM Cespedes Feliciano, B Caan, C Lee, G Anderson, M Shankaran, WJ Evans A protocol for remote collection of skeletal muscle mass via D3-creatine dilution in community-dwelling postmenopausal women from the Women’s Health Initiative, PLOS One, 19: e0300140, DOI: 10.1371/journal.pone.0300140
- PM Cawthon, Blackwell TL, Kritchevsky SB, Newman AB, Hepple RT, Coen PM, Goodpaster BH, Duchowny K, Hetherington-Rauth M, Mau T, Shankaran M, Hellerstein M, Evans WJ, Cummings SR. Associations between D3Cr muscle mass and MR thigh muscle volume with strength, power, physical performance, fitness, and limitations in older adults in the SOMMA study. J Gerontol A Biol Sci Med Sci. Accepted
- E Cheng, BJ Caan, PM Cawthon, WJ Evans, MK Hellerstein, M Shankaran, KL Campbell, AM Binder, B Sternfeld, JA Meyerhardt, KH Schmitz, EM Cespedes Feliciano, D3-creatine dilution, computed tomography and dual-energy X-ray absorptiometry for assessing myopenia and physical function in colon cancer: A cross-sectional study, J Cachexia Sarcopenia Muscle, 10.1002/jcsm.13353

Plenary Lecture 3

How Muscle Mass and Metabolism Affects Energy Metabolism and Functional Capacity

William Evans (University of California, Berkeley, USA)

Muscle plays a central role in physiological metabolism beyond its role in physical function¹. The maintenance of normal glucose homeostasis is dependent on appropriate regulation of glucose uptake by muscle. The torque resulting from muscular contraction is necessary for bone health. In periods of inadequate nutritional intake, skeletal muscle plays a key role as a “reservoir” of amino acids to maintain the rate of protein synthesis in other tissues and organs more essential for acute survival. It is for these reasons that there is an inverse relationship between LBM and morbidity and mortality from serious diseases in the elderly, including chronic obstructive pulmonary disease, congestive heart failure, and cancer². Perhaps even more important in the context of weight management, muscle plays a key role in energy metabolism. Loss of muscle mass with advancing age results in a substantial decrease in basal metabolic rate and reduced energy needs in older vs younger men and women^{3,4}. Low muscle mass in older people (sarcopenia⁵) is strongly associated with poor functional status, risk of disability, hip fracture, and mortality. Aging results in a decreased total daily energy need and an increase the dietary protein requirement⁶. Healthy older men and women consuming a eucaloric diet providing the current RDA for protein (0.8 g·kg⁻¹·d⁻¹) lose a significant amount of muscle. Reduced energy intake results in a substantial decrease in the rate of muscle protein synthesis in rats⁷ and humans⁸, resulting in a loss of muscle mass. A decrease in total energy intake in older obese individuals during weight loss results in a dietary protein intake that is well below the protein RDA that, along with the substantial decrease in synthesis rate, and, potentially, an exaggerated loss of muscle mass compared to younger people. Decreased muscle protein synthesis is a significant component of the decrease in total energy expenditure with weight loss. Reduced muscle protein synthesis can potentially affect both the resting energy expenditure (REE) and the diet induced thermogenesis. The energy expenditure related to muscle protein synthesis is the only component of REE that can vary considerably. The resting metabolic requirements of splanchnic tissues, brain and skin vary little under normal conditions because of relatively constant tissue mass and protein turnover rates. In contrast, large variations in muscle mass are possible, and the rate of muscle protein turnover may vary as well. Obese older men and women may lose an exaggerated amount of muscle during GLP-1 induced weight loss that may not be recovered, even during weight regains. Low muscle mass in obese older people is associated with poor functional status and increased risk of a mobility disability⁹. Strategies for retaining muscle mass during weight loss, particularly in older people should be a high clinical priority.