

Molecular Mechanisms of Sarcopenia Prevention and Improvement by Exercise

Skeletal muscles have high plasticity that enables them to adapt to different conditions by either reducing (atrophy) or gaining (hypertrophy) mass. Aging, inactivity, and chronic diseases (congestive heart failure, chronic obstructive pulmonary disease, chronic kidney disease, and others) reduce skeletal muscle mass. Conversely, exercise and nutrition increase skeletal muscle mass and strength. Sarcopenia is a progressive loss of skeletal muscle mass, strength, and physical function that occurs with aging. Increasing oxidative stress (associated with aging and chronic diseases), mechanical unloading (inactivity), metabolic overloading (hyperglycemia or insulin resistance), and changing hormonal milieu (menopause) are key factors that might contribute to sarcopenia. Exercise is an extremely beneficial intervention for sarcopenia prevention and treatment. Exercise-induced muscle hypertrophy is affected by several factors, such as estrogen levels and circadian rhythm.

Here, we present the cellular and molecular mechanisms of muscle atrophy induced by mechanical unloading and metabolic overloading (Prof. Ono), oxidative stress (Prof. Okutsu). We also present the effects of circadian rhythm (Dr. Chang) and estrogen (Dr. Hung) on exercise-induced muscle hypertrophy and provide novel insights into the molecular mechanisms of sarcopenia prevention and improvement by exercise.