Exploring ways to maintain and improve elderly muscle function with mitochondrial mechano-medicine

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Background

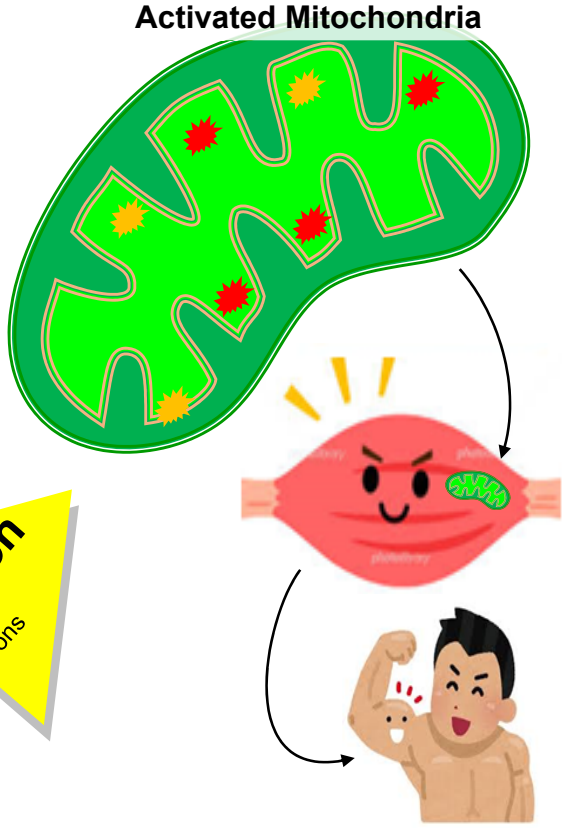
Age-related frailty and reduced physical activity cause a progressive loss of muscle mass and function, also known as sarcopenia or disuse atrophy. However, the molecular mechanisms that underlie sarcopenia or disuse atrophy are poorly understood. Therefore, therapeutic approaches are limited.

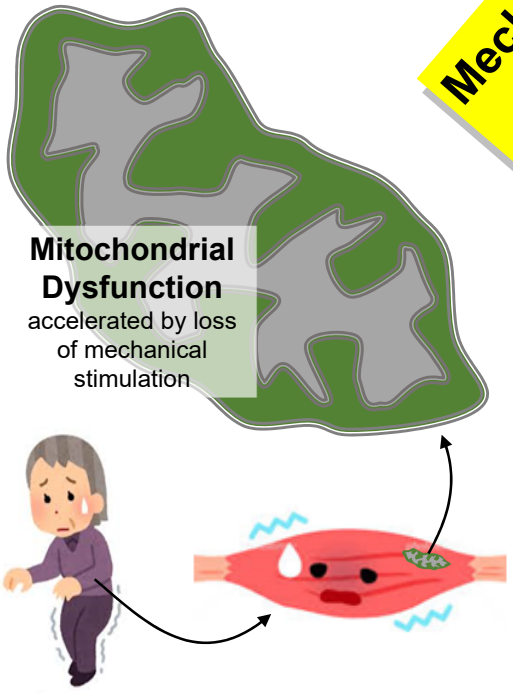
Our Innovative Project

Overview: We are exploring pharmacological, nutritional or physical interventions to alleviate and to reverse sarcopenia or disuse atrophy by activating mitochondrial functions.

Innovation: Recently we found that intracellular organelle, mitochondria, could sense mechanical stimulation and generate a signaling factor maintaining muscular homeostasis. Actually, we have confirmed that genetic disruption of mitochondrial mechano-sensing or -signal transduction system contributes to abnormality in homoeostasis of skeletal muscle. Based on our findings, we are developing the prevention / treatment methods for sarcopenia and disuse muscular atrophy by modulating mitochondrial functions. Although several drugs including myostatin inhibitors have been used in clinical trials to increase muscle mass and improve mobility, they have not been developed as targeting muscular mitochondria. Our study will provide an innovative treatment not seen heretofore.

Impact: Development of prevention / treatment methods for sarcopenia and disuse muscular atrophy may greatly contribute to improving the quality of life of the elderly.





Scope: For the maintenance and improvement of daily life operation of the elderly, it is essential to overcome diseases with motor dysfunction such as sarcopenia and disuse muscle atrophy. It has been reported that sarcopenia occurs in 15% of those aged 65-70 years, and in nearly half of those above 80 years of age.

Project Status

We've cleared mechano-sensing/signaling mechanism in mitochondria and mitochondrial-derived signals to control muscle function and analyze the structural basis of force transmission in mitochondria.

Next Steps & Future Directions

- Development of a method for exogenically loading of mechanical stress (organelle rehabilitation method) aimed at restoring mitochondrial function in an animal model of disuse muscular atrophy such as mice, and evaluation of its effectiveness.
- Exploration of alternative pharmacological or nutritional interventions (such as drugs and foodstuffs) to activate mitochondrial functions,.