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線虫 C エレガンスの宇宙フライト影響

Effects of spaceflight on the nematode *C. elegans*

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Abstracts:

It is well known that the bones and skeletal muscles of astronauts are significantly atrophied by the prolonged stay of microgravity in space. When grown in space microgravity, the small nematode *C. elegans*, which is composed of only 1,000 somatic cells, has significantly reduced muscle, mitochondria, and cytoskeletal-related proteins.[1] We also found upregulation of an ortholog of human SIRT1 (sirtuin 1), *sir-2.1* under microgravity conditions.[1] Either microgravity, fluid dynamics or hydrostatic pressure can alter overall gene expression.[1-3] These strongly suggested that mechanical force including gravity affects at the individual cell level and has major changes in mitochondria and metabolic activity. In addition, *C. elegans* could be a useful model system for studying the mechanism of muscle atrophy that have been unloaded or disused. Therefore, we are working to clarify the details of the process from mechano-stress to muscle atrophy. As a result, an excessive increase in Ca^{2+} in myocytes was commonly observed in response to several stress conditions.[4, 5] Ca^{2+} overload promotes mitochondria fragmentation and dysfunction.[4] In addition, myocyte extracellular matrix (ECM) degradation is accelerated, ultimately leading to the muscle cell degradation process.[5] Both matrix metalloproteinases (MMPs), which is involved in the degradation of ECM, and its activating enzyme Furin are Ca^{2+}-dependent endopeptidases. Inhibitions of not only these enzymes but also Ca^{2+} release from sarcoplasmic reticulum could suppress muscular atrophy under several stress conditions.[4, 5] These manipulations may help muscle atrophy under space microgravity.

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