

# Acute transcriptional up-regulation specific to osteoblasts/osteoclasts in medaka fish immediately after exposure to microgravity

Chatani M., Morimoto H., Takeyama K., Mantoku A., Tanigawa N., Kubota K., Suzuki H., Uchida S., Tanigaki F., Shirakawa M., Gusev O., Sychev V., Takano Y., Itoh T., Kudo A.  
*Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia*

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## Abstract

© The Author(s) 2016. Bone loss is a serious problem in spaceflight; however, the initial action of microgravity has not been identified. To examine this action, we performed live-imaging of animals during a space mission followed by transcriptome analysis using medaka transgenic lines expressing osteoblast and osteoclast-specific promoter-driven GFP and DsRed. In live-imaging for osteoblasts, the intensity of osterix- or osteocalcin-DsRed fluorescence in pharyngeal bones was significantly enhanced 1 day after launch; and this enhancement continued for 8 or 5 days. In osteoclasts, the signals of TRAP-GFP and MMP9-DsRed were highly increased at days 4 and 6 after launch in flight. HiSeq from pharyngeal bones of juvenile fish at day 2 after launch showed up-regulation of 2 osteoblast- and 3 osteoclast- related genes. Gene ontology analysis for the whole-body showed that transcription of genes in the category "nucleus" was significantly enhanced; particularly, transcription-regulators were more up-regulated at day 2 than at day 6. Lastly, we identified 5 genes, *c-fos*, *jun-B-like*, *pai-1*, *ddit4* and *tsc22d3*, which were up-regulated commonly in the whole-body at days 2 and 6, and in the pharyngeal bone at day 2. Our results suggested that exposure to microgravity immediately induced dynamic alteration of gene expression levels in osteoblasts and osteoclasts.

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