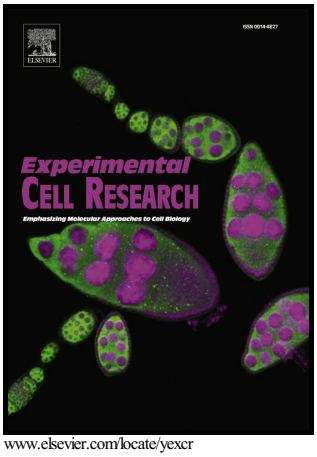
Author's Accepted Manuscript



www.elsevier.com/locate/yexcr

The calcium transient characteristics induced by fluid shear stress affect the osteoblast proliferation

Liyin Yu, Xiangmiao Wang, Xiaohang Gao, Jie Tong, Jianbao Zhang

PII: S0014-4827(17)30586-4
DOI: https://doi.org/10.1016/j.yexcr.2017.11.001
Reference: YEXCR10801

To appear in: *Experimental Cell Research*

Received date: 19 July 2017
Revised date: 7 October 2017
Accepted date: 1 November 2017

Cite this article as: Liyin Yu, Xiangmiao Wang, Xiaohang Gao, Jie Tong and Jianbao Zhang, The calcium transient characteristics induced by fluid shear stress affect the osteoblast proliferation, *Experimental Cell Research,* https://doi.org/10.1016/j.yexcr.2017.11.001

The calcium transient characteristics induced by fluid shear stress affect the osteoblast proliferation.

Liyin Yu, Xiangmiao Wang, Xiaohang Gao, Jie Tong, Jianbao Zhang*

Key Laboratory of Biomedical Information Engineering of Ministry of Education, School of Life Science and Technology, Xi'an Jiaotong University, Xi'an, 710049, P.R. China

*Corresponding author. jbzhang1111@163.com

Abstract

Ca^{2+} signaling is essential for bone metabolism. Fluid shear stress (FSS), which can induce a rapid release of calcium from endoplasmic reticulum (ER) to produce calcium transients, plays a significant role in osteoblast proliferation and differentiation. However, it is still unclear of how calcium transients induced by FSS activating a number of downstream signals which subsequently regulate cell functions. In this study, we performed a group of Ca^{2+} transients models, which were induced by FSS to investigate the effects of different magnitudes of Ca^{2+} transients in osteoblast proliferation. Further, we performed a global proteomic profile of MC3T3-E1 cells in different Ca^{2+} transients models stimulated by FSS. GO enrichment and KEGG pathway analysis revealed that the TCA cycle was activated in the proliferating process. The activation of TCA needed mitochondrial Ca^{2+} uptake which were influenced by the amplitude of Ca^{2+} transients induced by FSS. Our work elucidate that osteoblast proliferation induced by FSS was related to the magnitude of calcium transients, which further activated energetic metabolism signaling pathway. This work revealed further understanding the mechanism of osteoblast proliferation induced by mechanic loading and help us to design new methods for osteoporosis therapy.

Keyword: shear stress, proteomic, TCA cycle, calcium transients, mitochondrial calcium uptake

1 Introduction

Fluid shear stress (FSS) affected both proliferation and differentiation of osteoblasts.