

Low-Frequency, Whole Body Vibration Induced Neurite Outgrowth by Pc12m3 Cells with Impaired Nerve Growth Factor-Induced Neurite Outgrowth

Mcg\j\lgU' ?c]_Y1'z'FY]_c'Hih]XU'z'Mi_c' <UmUg\]z'Mc_c'MUaUb]g\]1 UbX'Mcg\]c' ?Ubc²

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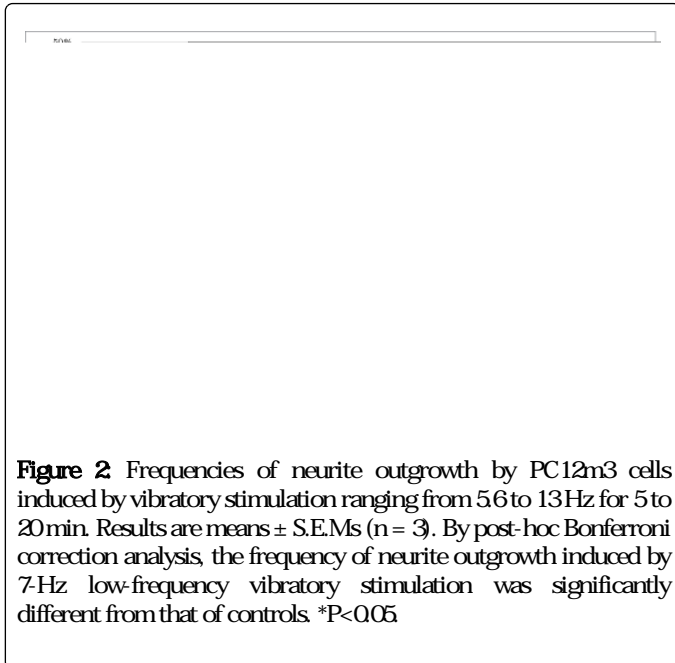
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vibratory stimuli of 10 Hz and 13 Hz had no effect on neurite outgrowth. The frequency of neurite outgrowth induced by 7-Hz low-frequency vibration was approximately 3-fold greater than that induced by NGF alone.



Induction of activated p38 MAPK and CREB expression in PC12m3 cells by 7-Hz low-frequency vibration

Because activation of p38 MAPK plays an important role in neuron differentiation by PC12 cells [10], we examined whether low-frequency vibratory stimulation induced neurite outgrowth by PC12m3 cells was due to its effects on p38 MAPK activity. PC12m3 cells were stimulated with vibrations of 7 Hz and 13 Hz for 10 min or were not stimulated (controls), after which activated p38 MAPK (phospho-p38) expression was assessed by immunoblotting (Figure 3).



Figure 3 Induction of activated p38 MAPK and CREB expression in PC12m3 cells by 7-Hz low-frequency vibratory stimulation. PC12m3 cells were serum-starved and then stimulated or not by vibration for 30 min along with NGF treatment. After treatment, cells were lysed, and protein extracts were analyzed by Western blot using anti-phospho-p38 MAPK and anti-phospho-CREB (Ser 133) antibodies.

[19]. In addition, Blumenthal reported that aerobic exercise is effective for alleviating depression in the elderly, with an effect comparable to that of antidepressant drugs [20]. In consideration of these findings, mitigation of depression due to VAT for elderly NH residents seems to be enhanced by vibro-tactile stimuli due to passive aerobic exercise. Still, the p38MAPK signaling pathway has been reported to have protective effects on cardiac muscle [21].

Vascular endothelial cell growth factor (VEGF) induces endothelial cell proliferation and movement, remodeling of the extracellular matrix, the formation of capillary tubules, and vascular leakage [22]. Moreover, VEGF plays a crucial role in the development of the cardiovascular system and in promoting angiogenesis that is associated with physiological and pathological processes [23]. VEGF is an endothelial cell-specific mitogen that promotes numerous other phenomena that are necessary for angiogenesis [24].

Mitogen-activated protein kinase (MAPK) is important in the induction of endothelial cell proliferation that is induced by VEGF

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