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| **Fiscal Year:** | FY 2012 | **Task Last Updated:** | FY 10/26/2011 |
| **PI Name:** | Vignaux, Guillaume F. Ph.D. | | |
| **Project Title:** | Contribution of the Vestibular and Sympathetic Nervous Systems to Space-Induced Bone Loss | | |
| **Division Name:** | Human Research | | |
| **Program/Discipline:** | NSBRI | | |
| **Program/Discipline--Element/Subdiscipline:** | NSBRI--Musculoskeletal Alterations Team | | |
| **Joint Agency Name:** | | **TechPort:** | No |
| **Human Research Program Elements:** | (1) **HHC**:Human Health Countermeasures | | |
| **Human Research Program Risks:** | (1) **Bone Fracture**:Risk of Bone Fracture due to Spaceflight-induced Changes to Bone<br>(2) **Osteo**:Risk Of Early Onset Osteoporosis Due To Spaceflight | | |
| **Space Biology Element:** | None | | |
| **Space Biology Cross-Element Discipline:** | None | | |
| **Space Biology Special Category:** | None | | |
| **PI Email:** | guillaume.f.vignaux@vanderbilt.edu | **Fax:** | FY |
| **PI Organization Type:** | UNIVERSITY | **Phone:** | 615-322-7883 |
| **Organization Name:** | Vanderbilt University | | |
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| **PI Address 2:** | 1211 Medical Center Drive | | |
| **PI Web Page:** | | | |
| **City:** | Nashville | **State:** | TN |
| **Zip Code:** | 37232 | **Congressional District:** | 5 |
| **Comments:** | | | |
| **Project Type:** | GROUND | **Solicitation / Funding Source:** | 2011 NSBRI-RFA-11-01 Postdoctoral Fellowships |
| **Start Date:** | 11/01/2011 | **End Date:** | 10/31/2013 |
| **No. of Post Docs:** | 1 | **No. of PhD Degrees:** | |
| **No. of PhD Candidates:** | | **No. of Master' Degrees:** | |
| **No. of Master's Candidates:** | | **No. of Bachelor's Degrees:** | |
| **No. of Bachelor's Candidates:** | | **Monitoring Center:** | NSBRI |
| **Contact Monitor:** | | **Contact Phone:** | |
| **Contact Email:** | | | |
| **Flight Program:** | | | |
| **Flight Assignment:** | | | |
| **Key Personnel Changes/Previous PI:** | | | |
| **COI Name (Institution):** | Elefteriou, Florent ( MENTOR/ Vanderbilt University ) | | |
| **Grant/Contract No.:** | NCC 9-58-PF02603 | | |
| **Performance Goal No.:** | | | |
| **Performance Goal Text:** | | | |

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| **Task Description:** | POSTDOCTORAL FELLOWSHIP<br>A milestone was reached with the first step on the Moon, but the upcoming project to reach Mars poses additional challenges. DXA measurements realized after four- to-six-month space missions reported a 1-2 percent monthly decline in bone mineral density (BMD). BMD loss will certainly progress further following the six-month period required to reach Mars, and it is unlikely that fractional gravity on Mars will mitigate the bone loss that will occur during travel.<br><br>The vestibular system is disturbed in microgravity, inducing cardiovascular alterations via sympathetic activation. Sympathetic activation also provokes bone loss following stimulation of the b2-adrenergic receptor (b2AR) in osteoblasts -- the bone forming cells.<br><br>Hypothesis. Based on these observations, the researchers hypothesize that the vestibular system participates to the maintenance of BMD on Earth and its dysfunction under microgravity may contribute to the bone loss associated with space travel.<br><br>Preliminary findings have provided evidence to support the hypothesis. Vestibular lesion (VBX) using sodium arsanilate injections in rats destroyed bladderwort sensorial cells (gravity sensors) without any other neuronal damage and led to significant bone loss associated to a decrease in osteoblasts number. The researchers have observed a similar bone phenotype in mice after VBX.<br><br>Specific Aims<br><br>1) To determine if VBX causes bone loss by activation of the sympathetic nervous system in the VBX model using b-blocker-treated mice and mice lacking the b2AR globally or specifically in osteoblasts;<br><br>2) To analyze the bone phenotype of mice devoid of vestibular gravity sensor (Het-/- mice); and<br><br>3) To determine if vestibular stimulation by centrifugation could be used as a countermeasure to bone loss under microgravity.<br><br>This study may uncover of a new pathway of bone regulation, a novel approach for the treatment of low bone mass diseases on Earth, and novel countermeasures to reduce risk of bone fracture in microgravity. |
| **Rationale for HRP Directed Research:** | |
| **Research Impact/Earth Benefits:** | This study may uncover of a new pathway of bone regulation, a novel approach for the treatment of low bone mass diseases on Earth, and novel countermeasures to reduce risk of bone fracture in microgravity. |
| **Task Progress:** | New project for FY2012. |
| **Bibliography Type:** | Description: (Last Updated: 04/12/2016) |