SPACE SYSTEMS DESIGN FOR RESEARCH ON THE INTERACTION OF OSTEOBLAST-LIKE CELLS AND BIOMATERIALS (HYDROXYAPATITE PARTICLES AND TITANIUM) IN MICROGRAVITY ENVIRONMENT

M. Carnio[1], C. Massimiani[1], S. G. Piperni, W. Zambuzzi[2], C. Cappelletti[1], F. Graziani[3]

[1]GAUSS Srl., Italy

[2]Universidade Estadual Paulista-UNESP, Brazil

[3]University of Rome "La Sapienza", Italy

marti.catnio@gmail.com, chi.massimiani@gmail.com, sara.gemini@hotmail.com, wzambuzzi@gmail.com, chantal.cappelletti@gmail.com, filgraziani@gmail.com

Abstract

The space environment is characterized by special conditions such as the microgravity and ionizing radiations. These conditions cause major changes in human bodies, or in biomedical samples. Particularly, the bone tissue in microgravity conditions, present in orbit, lack of mechanical loading, which is one of the main stimulus to bone remodelling needed, also in the adults, to keep elasticity and toughness of the bone tissue.

In 2014 a cooperation between GAUSS s.r.l. (Group of Astrodynamics for the Use of Space System, Rome, Italy), the University of Brasilia (UnB, Brasilia, Brazil) and the State University of Sao Paulo(UNESP, Botucatu, Sao Paulo, Brazil) as been started to study in orbit the effects of the exposure of osteoblast-like cells, responsible to forming-up a new bone, to gold standard biomaterials (hydroxyapatite particles and titanium).Biomaterials are artificial materials, with potential biocompatibility. They are more and more used in regenerative medicine to support cells behaviour to repair the damage. Nowadays, this field of medicine requires collaboration among engineers, biologists, chemists to create and test new biomaterials and to investigate what might be the best to use to enhance the performance during the repair of the damage. By now, in a field so critical to human health and biomaterial development, it is very important to explore and exploit new research pathways and hence, it is clear that the exposition of osteoblast-like cells to biomaterials under reduced gravity conditions certainly will induce changes in cell adhesion, growth and differentiation of those cells.

Each experiment will use the microgravity environment to conduct experimentation that could produce tremendous health benefits for humankind such as advancements in biomaterial screening, tissue engineering/regeneration, cell replacement therapy. Therefore the main goal of this project is to investigate potential effects of the space environment exposure on osteoblast-like cells and biomaterials through an autonomous space system, designed and manufactured specifically for this goal. Purposely, this paper describes the engineering solutions to design and manufacturing autonomous space system that can allow to keep alive and to study these kinds of cells.