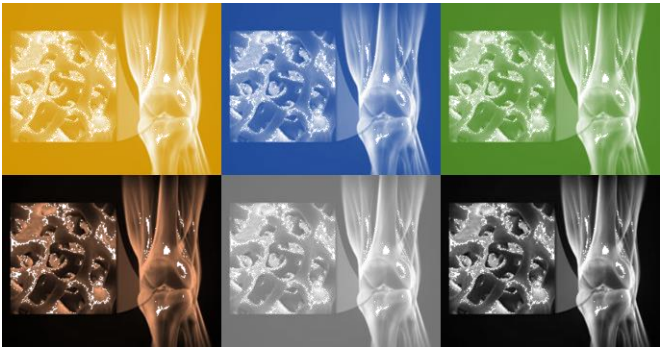


MULTIMODAL IMAGING OF THE IN VIVO FATE OF BONE TRANSPLANTS

VIVOIMAG

Research and Innovation Staff Exchange (RISE)

Call: H2020-MSCA-RISE-2014

Horizon 2020 Funding
Starting from 1/1/2014

European Commission

The problem

There is an emerging need for innovative approaches to augment and repair musculoskeletal tissues. Millions of bone grafts are being performed worldwide to repair large segments of bone lost due to trauma, surgery or the removal of cancerous tissue. It is estimated that the bone graft market exceeds $2.5 billion/year. A continuously ageing population forecasts a steady increase in those numbers.

The main objective of **VIVOIMAG** is to develop bone implants including a new contrast agent sensitive to enzymatic activity of metaloproteases, which will permit for the first time to follow the integration and cell differentiation activity in bone tissue bioreactors in vitro and in grafts in vivo using existing non invasive magnetic resonance imaging techniques.

VIVOIMAG Objectives

The main objective of VIVOIMAG is to develop bone implants including a new contrast agent sensitive to enzymatic activity of metaloproteases, which will permit for the first time to follow the integration and cell differentiation activity in bone tissue bioreactors in vitro and in grafts in vivo using existing non invasive magnetic resonance imaging techniques.

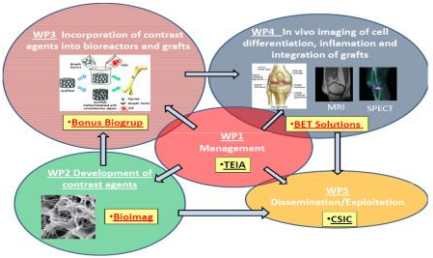
Complementary expertise of the partners will permit:

- Development of new magnetically labelled contrast agents capable of detecting metaloproteases enzymatic activity. Upon enzymatic degradation, the contrast agent will give different signal detectable with magnetic resonance imaging.
- Incorporation of these new materials within scaffolds used for bone regeneration. Mesenchymal stem cells (MSCs), which can self-replicate and differentiate into osteaoblasts will be integrated within custom-shaped porous scaffolds for de novo bone formation.

- Development of bone tissue bioreactors and implantation of regenerated tissue into animal models. Growth of 3D high-density bone graft based on multi-cells cultures
- Exploitation of state of the art MRI and nuclear medicine imaging to evaluate and optimize the capacity of the contrast agent within the implants for detecting in vitro and in vivo enzymatic activity of metaloproteases.
- Local detection of metaloprotease activity in real time to follow cell differentiation in the bone engineered bioreactor in vitro and to follow inflammation, differentiation and integration of the implanted material in the animal models.

Methodology and Work flow

The project is split into eight Work Packages. The total duration of the project is 4 years. The WPs are closely interlinked and are schematically described in the next diagram.



The Consortium

The VIVOIMAG project brings together a multidisciplinary consortium of specialists in different areas of bone implant research, nanoparticles formulation and characterization, magnetic resonance and scintigraphic imaging, who will join forces in order to propose and assess a novel technique for the evaluation of the progress of bone implants in vivo, which can substitute existing invasive techniques based on biopsies.

Acknowledgment

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The 4 year project will run from 1st June 2015 until 31th May 2019.

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