INTERBONE - the interplay among bone cells, matrices and systems

Project objectives

The skeleton does more than provide just a physical structure to the body. Bone cells play an important role in metabolism, in regulating health and protecting against disease. There is a highly complex web of interactions between bone cells, the other components of skeletal tissue, and cells and organs in other parts of the body. This is still poorly understood.

INTERBONE, an interdisciplinary network for international exchange of scientists, has been supported by the European Union Framework 7 programme to study the central role of the skeleton in three areas of health. Work on energy metabolism in INTERBONE built on previous research findings that suggest a link between bone-derived signals, glucose metabolism and insulin sensitivity. The network also investigated the role of candidate secreted factors in the disruption of hematopoiesis in the development of leukemia. Research on fracture repair and tissue regeneration has addressed biomaterials interactions with cells, and stimulation of angiogenesis in fracture repair with biophysical approaches.

The network, coordinated by Professor Anna Maria Teti at the University of L'Aquila, Italy, aimed to integrate research and training activities between 6 institutions:

- University of L'Aquila, Italy
- Erasmus Medical Centre, Netherlands
- Universidade do Grande Rio, Brazil
- Universidade Estadual Paulista, Brazil
- Anna University, Chennai, India
- Columbia University, USA

INTERBONE Marie Curie Fellows and principal investigators at the kick-off meeting in Stockholm, May 18, 2012

The planned research collaboration was supported by a programme of staff exchanges, training and networking activities. The network planned regular meetings integrated with established international conferences in bone-related research, to support networking and dissemination, a workshop on tissue regeneration and angiogenesis, and a programme of webinars. INTERBONE aimed to make a contribution to the opening of the European Research Area to international cooperation, and interaction with three of Europe's strategic global partners (USA, India and Brazil) in this emerging interdisciplinary area of research.

Progress and results

INTERBONE exchanges involved 20 fellows from the participating laboratories, including PhD students, experienced researchers and technicians. Fellows were trained on i) generation of animal models (conditional knock-out and transgenics), ii) in vitro and in vivo assays to determine energy metabolism, iii) endothelial cell biology and cross-talk with bone cells and hematopoietic cells, iv) bone-cell endothelial cells cross-talk in unloading conditions and tissue repair and v) use of innovative biomaterials to improve osteointegration and fracture healing. A network has been created among the fellows, with a continuous and fertilizing exchange of methods, protocols, hypothesis and experimental designs. Fellow profiles are available in the INTERBONE website.

INTERBONE has obtained new results on in vitro and in vivo studies, that give us new knowledge on the interactions of bone and other tissues. INTERBONE results have included:

Fellows working in the INTERBONE laboratory in Italy

i) protocols for bone-endothelial cell and endothelial - hematopoietic cell cocultures
ii) characterisation of energy metabolism in new mouse models
iii) identification of a role of osteoblasts in leukemogenesis
iv) kinome profile map in osteoblasts exposed to new biomaterials
v) set up of experimental methods and results on the interaction between bone cells and endothelial cells under unloading conditions
vi) role of osteoblast factors in hypoxia conditions
vii) role of LCN2 in bone and energy metabolism
viii) characterization of mesenchymal stem cells under osteogenic conditions.

Some of these results are already published in peer review journals. Fellows have been able to reproduce the experimental protocols set up during their exchange after returning to their home laboratories and have maintained a tight interaction and collaboration with their supervisors in the host laboratories.

Training activities also included a cycle of 7 webinars delivered by the INTERBONE principal investigators, as well as public workshops held by INTERBONE at the annual Calcified Tissue Symposia in Lisbon (May 2013), Prague (May 2014) and Rotterdam (April 2015). INTERBONE also organised the Workshop on Wound Healing and Angiogenesis, held in Chennai (India) in December 2013. Furthermore, INTERBONE organised a special issue of the Archives of Biochemistry and Biophysics entitled “Bone: a dynamic and integrating tissue”. This issue contributed to the international visibility of INTERBONE and represented an additional collaborative task for the partners, providing opportunities for INTERBONE fellows to disseminate their results and gain complementary training in an aspect of scientific publication.

Expected impact

We expect our INTERBONE fellows will develop their scientific careers with a strong degree of independence, mobility at the global level, and experience of interdisciplinary research. INTERBONE provided them a network of interactions with other scientists which will create a solid background for future international collaborations. We have obtained results that have been published, while further manuscripts have been submitted or are in preparation on work just finished. Our results could have a significant impact for the bone field with new knowledge characterised by a robust translational potential, which in the future can be exploited in medicine and health science.

Project website

For more information please see the project website, **http://www.interbone.org**.