IBEC-BST INTERNATIONAL PhD PROGRAMME

Position

1. Project Title/ Job Position title:
   Immunological mechanisms in MSC-based bone repair: impact of HLA compatibility in tissue regeneration

2. Research project/ Research Group description:

Mesenchymal stromal cells (MSCs) can differentiate into multiple lineages such as chondrocytes, osteocytes or adipocytes, standing for a valuable therapeutic tool in regenerative medicine. The Musculoskeletal Tissue Engineering group at VHIR has previously demonstrated the safety and signs of efficacy of tissue engineering products (TEPs) based on MSCs in an autologous setting from preclinical development to clinical testing (EudraCT2010-023998-18, 2013-005025-23 and 2010-023999-12). These studies revealed that treatment with autologous cells entails several disadvantages and limitations that can be solved using cryopreserved, off-the-shelf MSCs. However, allogeneic MSCs have resulted in limited success regarding tissue regeneration in vivo, most likely due to limited persistence of donor cells in the recipient.

We hypothesize that the genetic characteristics of donor cells, particularly HLA match with the recipient, influence integration and efficacy of allogeneic MSC-based TEPs. Therefore, the main objective of this project is to define the criteria for donor selection in allogeneic MSC-based bone regeneration.

To this end, HLA-typed MSCs obtained from bone marrow, Wharton's jelly or pluripotent stem cells will be induced for osteogenic differentiation in vitro using different strategies (such as spheroids or bone constructs) developed in collaboration with the Nanobioengineering group at IBEC, and co-cultured with peripheral blood mononuclear cells from HLA-typed donors with different degree of HLA-match. Immunological features, including the study of cellular populations, the determination of released inflammatory cytokines and TCR analyses of T cell clones, as well as bone tissue formation and maturation will be evaluated. In a second phase of the project, the results obtained in vitro will be validated in vivo in humanized murine models of bone regeneration to define the mismatch threshold ensuring optimal bone regeneration while minimizing immune rejection.

3. Job position description:

We are looking for motivated and ambitious PhD candidates to join our cutting-edge research project at the intersection of tissue engineering and immunology. This interdisciplinary initiative focuses on developing innovative strategies to enhance tissue regeneration by integrating immunological principles into engineered solutions.

As part of our team, you will:

- Develop and optimize cell culture systems for engineering tissue constructs and studying immune cell-tissue interactions.
- Utilize flow cytometry to analyze immune cell populations and assess their behavior in response to engineered biomaterials.
- Conduct high-throughput sequencing to investigate cellular responses and gene expression profiles.
- Perform Luminex assays to quantify cytokines, chemokines, and other soluble factors involved in immune modulation.
- Design and execute *in vivo* experiments to evaluate the efficacy and compatibility of tissue-engineered constructs in preclinical models.
- Apply histological and immunohistochemical techniques to analyze tissue morphology, cell distribution, and immune markers in engineered and native tissues.
- Collaborate with experts in immunology, bioengineering, and regenerative medicine to advance the frontiers of tissue engineering.

We are seeking candidates with:

- A strong academic background in biological sciences, bioengineering, or a related field.
- Interest in interdisciplinary research and passion for immunology and tissue engineering.
- Previous experience with one or more of the techniques listed is beneficial but not mandatory.

This position provides a unique opportunity to contribute to transformative research with real-world applications, including organ regeneration, advanced therapeutic development, and disease modeling.

Join us in advancing the future of tissue engineering and regenerative medicine!

Group Leader at IBEC

1. Title: PI
2. Full name: Josep Samitier
3. Email: jsamitier@ibecbarcelona.eu
4. Research Group: Nanobioengineering

Group Leader at SJD

1. Title: PI
2. Full name: Joaquim Vives Armengol
3. Email: jvives@bst.cat
4. Research group: Musculoskeletal Tissue Engineering