IdiPAZ Instituto de Investigación Hospital Universitario La Paz
Hospital Universitario La Paz
Paseo de La Castellana, 261
Edificio Norte, 4ªPlanta
28046 - Madrid

POSITION

1. Project Title/ Job Position title:

Near infrared-responsive scaffolds for deliberate regulation of transgene expression in bone tissue engineering.

2. Area of Knowledge:

Life Sciences

3. Group of disciplines:

Biotechnology, Bioinformatics, Pharmaceuticals, Food Technology

4. Research project/ Research Group description

Bone defects result from a variety of pathologies: cancer, osteoporosis, congenital deformity, traumatisms or reconstructive surgery. Insufficient or inappropriate bone stock compromises the clinical success of autologous grafts, the "gold standard" in bone tissue engineering. There is thus a critical need for the development of innovative therapies for bone repair.

Hospital La Paz Institute of Health Research (IdiPAZ) research group of Bone Physiopathology and Biomaterials, led by Nuria Vilaboa, invites applications in the fields of bone tissue engineering and gene therapy. This project will continue developing a medical device composed by fibrin-based hydrogel containing degradable copper sulfide-derived nanoparticles (CuSNP) exhibiting an absorption band that peaks at near infrared (NIR) wavelengths. NIR wavelength range provides a therapeutic window that maximizes light penetrance in tissues. The project will test whether this approach may enhance bone regeneration in critical size bone defects.

Upon NIR-laser irradiation, CuSNP convert photon energy into heat. Composites thus developed can generate local hyperthermia in bone defects. The increase in local temperature will be used to control the production of key growth factors involved in bone regeneration, namely BMP-2 and VEGF, through the use of gene switches that can provide tight spatial and temporal control of in vivo transgene expression. These switches are only activated by heat in the presence of a small molecule ligand (rapamycin or AP21967). The switches to control the expression of BMP-2 and VEGF will be transferred to a high capacity adenoviral vector that will be incorporated to the composites. NIR-responsive fibrin hydrogels containing viral particles will be implanted in critical-size defects generated in calvarial and ulnar bone of mice and rabbit, respectively, and will serve as a platform to transduce locally host cells. We hypothesize that this system will enhance bone regeneration.

5. Job position description

Role: The PhD student will be in charge to develop a high capacity vector, to test it *in vitro* and to transfer it to suitable animal models to evaluate induced bone regeneration upon NIR-laser irradiation.

Responsibilities

Set up and perform experiments, maintain experimental resources (as cell lines, reagents, etc.) according to protocols, analyze & interpret results and contribute to the development of experimental strategies with accuracy and honesty.

Keep updated the laboratory notebook and properly store and manage the data produced during the project.

Collaborate with colleagues and participate in team activities (such as meetings, seminars, workshops, etc.) across the research group and wider scientific community while keeping up to date with current knowledge and recent advances.

Participate in knowledge exchange with several stakeholders, to promote the value of research in public health and to contribute to the dissemination of his/her research results in the principles of EU's Open Science policy.

Undertake any other duties of equivalent standing as assigned to him/her.

Skills

MSc degree, or equivalent, in Biochemistry, Molecular Biology, Pharmacy, Biotechnology or Chemistry.

Experience in molecular biology techniques, plus a keen interest in tissue engineering are desirable.

Motivation, critical thinking and problem-solving oriented skills.

Good interpersonal skills, including team working.

Good communication skills, willingness to engage in public presentations and ability to transmit complex concepts in a clear way.

Good time and workload management skills, including both initiative and flexibility.

GROUP LEADER

1. **Title:** Dr.
2. **Full name:** Nuria Vilaboa Díaz
3. **Email:** nuria.vilaboa@salud.madrid.org
4. **Research project/ Research Group website (Url):**
http://www.idipaz.es/PaginaDinamica.aspx?IdPag=300&Lang=EN

OTHER RELEVANT WEBSITES

https://www.ciber-bbn.es/en/groups/research-group?id=3631

The Bone Physiopathology and Biomaterials group is a full member of the *Centro de Investigación Biomédica en Red* (CIBER).