Universidad de Navarra
Facultad de Ciencias

MÁSTER EN INVESTIGACIÓN BIOMÉDICA
Research Project Proposal
Academic year 2026-2027

Project Nº 64

Title: *TrabecSENSE: A perfused 3D platform for the mechanobiological study of the ocular trabecular meshwork and its modulation in glaucoma pathology*

Department/ Laboratory *School of Engineering, University of Navarra, Tecnun. Department of Biomedical Engineering and Science, Tissue Engineering and Nucleic Acid Technologies Group in collaboration with Clínica Universidad de Navarra (CUN) and UPV/EHU–Biogipuzkoa. (in San Sebastián)*

Director: *Jacobo Paredes*
Contact: *jparedes@unav.es*

Summary

Glaucoma is the leading cause of irreversible blindness worldwide. Its progression is associated with dysfunction of the trabecular meshwork (TM), a tissue responsible for aqueous humor drainage and the regulation of intraocular pressure. Despite its clinical relevance, the mechanisms leading to the pathological remodeling of this tissue remain unclear, partly due to the lack of experimental models capable of reproducing its three-dimensional architecture and dynamic mechanical environment.

This project aims to develop, optimize, and validate a perfused 3D culture platform for the functional study of human TM. The platform operates under flow-controlled conditions, continuously recording transmembrane pressure as a direct readout of the hydraulic conductivity of the cellular system. The student will work from an existing prototype and contribute to its adaptation for long-term experiments, incorporating solutions for oxygenation, sterility, and medium renewal in a closed-loop system.

The methodology includes: fabrication and characterization of polymeric scaffolds using solution electrospinning and melt electrowriting; culture of primary human trabecular cells on 3D structures with monitoring of viability and phenotype; structural and functional characterization by electron, optical, and confocal microscopy with immunostaining; and systematic validation of the platform's reproducibility under physiologically relevant conditions.

The student will gain practical training in tissue engineering, biomaterials, and 3D cell culture within a multidisciplinary environment at the interface between engineering, biology, and clinical ophthalmology.

yes	
no	X

Does the project include the possibility of supervised animal manipulation to complete the training for animal manipulator?