Universidad de Navarra
Facultad de Ciencias

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

Project Nº 53

Title: Impact of CAF co-culture on PDAC organoid phenotype, growth and chemoresistance within tunable 3D biomimetic scaffolds

Department/ Laboratory *Microphysiological Systems and Quantitative Biology / Biomedical Engineering / Advanced Technologies Division / CIMA University of Navarre*

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Summary

Traditional 2D cultures fail to recapitulate the biomechanical and biochemical complexity of the tumor microenvironment (TME). In pancreatic ductal adenocarcinoma (PDAC), cell-extracellular matrix (ECM) interactions dictate progression and chemoresistance. Our previous research (Gels 2025, 11(7):562) demonstrated that biomimetic hydrogels provide physiological scaffolds where matrix stiffness and composition directly modulate PDAC phenotypes. The TME, however, comprises a multifaceted ecosystem of diverse components, including immune cells, vasculature, and stromal fibroblasts. Among these, cancer-associated fibroblasts (CAFs) are particularly critical, as they actively modulate matrix remodeling and pro-survival signaling.

This project aims to advance model complexity by engineering PDAC-CAF co-cultured organoids within Matrigel/Collagen-I scaffolds with tunable mechanical properties. Specifically, we will evaluate how CAFs modulate organoid morphology and growth via fluorescence microscopy, and determine how this multicellular environment influences chemotherapeutic sensitivity compared to PDAC monocultures. To this end, we will employ an interdisciplinary approach combining PDMS microfluidic technology, advanced cell culture, and multidimensional image analysis.

To achieve these objectives, the following tasks are proposed:

- *Hydrogel Engineering: Fabricating Collagen-I matrices with controlled stiffness.*
- *Co-culture Optimization: Establishing optimal PDAC-CAF ratios for stable organoids.*
- *Device Fabrication: Producing custom PDMS multi-well platforms for organoid culture.*
- *Drug Screening: Assessing co-culture viability and morphological changes under chemotherapy.*
- *Quantitative Characterization: Adapting immunofluorescence and image analysis protocols to quantify tumor invasion and phenotypic shifts*

yes	
no	X

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