Universidad de Navarra
Facultad de Ciencias

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

Project Nº 04

Title: From Data to Therapy: Selecting the Best TCRs to Fight Cancer

Department/ Laboratory
Adoptive T-cell Therapy Group, Immunology and Immunotherapy Program.
Cancer Division, Center for Applied Medical Research (CIMA)

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Summary:

TCR-T cell therapy, where a patient's immune cells are genetically reprogrammed with tumor-specific T-cell receptors (TCRs), is a leading strategy in cancer treatment. However, many therapies fail as engineered T cells become exhausted and lose their ability to eliminate tumors.

Our lab recently addressed this challenge using **cutting-edge single-cell RNA and TCR sequencing**. We identified a gene expression signature that distinguishes highly effective TCRs from poorly performing ones. Remarkably, we discovered that success is determined not only by antigen recognition but by the **metabolic fitness** of the T cells. This allows for predicting TCR performance based on the transcriptional profile of the tumor-infiltrating lymphocytes (TILs)—a highly novel concept in the field.

This project aims to select and clone TCRs based on the identified genetic signature. We will engineer murine T cells using retroviral transduction, **mirroring the clinical-grade protocols used for human T-cell therapies**. To validate these cells, we will conduct a comprehensive functional characterization, including **in vitro** assays for functional avidity and antitumor activity, alongside **in vivo** studies in relevant murine models to measure tumor control and T-cell persistence. Furthermore, we will leverage **high-dimensional flow cytometry** as a primary tool to dissect the exhaustion profiles and metabolic fitness of the engineered cells

This project provides hands-on training in molecular bioengineering, advanced cell culture, high-dimensional cytometry, and preclinical models. By joining a **Center of Excellence (CIMA)**, the student will work at the intersection of genetics, immunology, and metabolism, contributing to research with a direct translational impact on future cancer immunotherapies.

yes	x
no	

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