Propuesta de Trabajo Fin de Máster
Año académico 2025-2026
MÁSTER EN CIENCIA DE DATOS PARA CIENCIAS EXPERIMENTALES

Proyecto Nº 12
Título: Defining the core healthy human microbiome using deep learning models.
Departamento/ Laboratorio: Microbiome and Clinical Physiology
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Resumen: Defining a core healthy human microbiome remains a challenge due to the vast individual variability and functional redundancy among microbial species. Multiple human diseases are frequently associated with microbiome alterations, yet the fundamental microbial functions essential for maintaining health remain poorly defined. **This project leverages deep learning models and advanced computational methodologies, integrating metatranscriptomics and metagenomics from large-scale datasets such as the Spanish Microbiomics Project and the Human Microbiome Project**. Using non-redundant microbial gene catalogs (e.g., UniRef90, IGC) and high-throughput alignment tools like DIAMOND, we will identify shared, actively expressed microbial genes across individuals, defining the core functional microbiome. Deep learning techniques will enable us to model microbial interactions, predict functional redundancies, and refine the selection of a minimal bacterial consortium representative of a healthy gut microbiome.   This defined microbiome will be reconstructed *in vitro* and transplanted into mouse models to assess its stability, resilience to dietary perturbations, and functional consistency. Computational approaches will be applied to analyze longitudinal sequencing data, tracking microbial gene expression dynamics under different dietary conditions. Finally, we will validate the translational potential of this model by testing its ability to predict therapeutic responses, addressing the limitations of current preclinical models.   By combining deep learning, metagenomics, metatranscriptomics, and experimental validation, **this project aims to refine our understanding of microbiome functionality, improve disease modeling, and enhance the development of microbiome-based therapies and drug discovery pipelines, bridging the gap between animal models and human clinical outcomes.**

OPTATIVAS RECOMENDADAS   1. Análisis de datos de alto rendimiento.   2. Machine Learning.   3. Advanced topics in Machine Learning.