

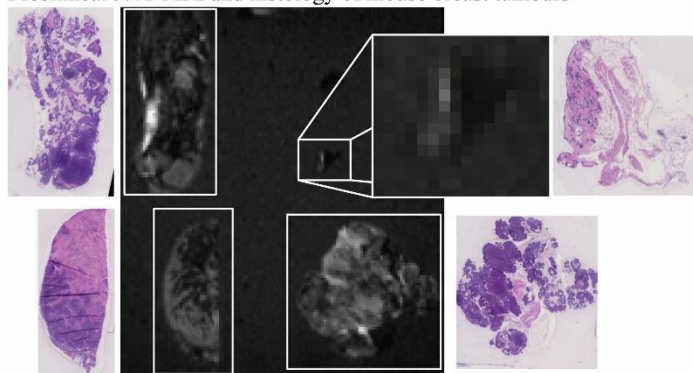
Training programme in *Computational Biophysics*

TFG and TFM (BSc and MSc) projects

Virtual MRI biopsies through physics-informed deep learning and biophysical simulations

Non-invasive characterization of solid tumors is a major clinical challenge. While conventional biopsies are invasive and prone to sampling bias, diffusion Magnetic Resonance Imaging (MRI) probes tissue microstructure non-invasively. However, decoding macroscopic MRI signals to map cellular properties, tumor microenvironments, or microvascular networks remains highly complex. This project bridges this gap by combining biophysical simulations with artificial intelligence. By simulating molecular diffusion in realistic virtual cancer tissues reconstructed from digital histology, we will generate accurate ground-truth datasets to train physics-informed deep learning networks, resolving cell-specific properties directly from new diffusion MRI scans.

Preclinical 9.4T MRI and histology of mouse breast tumours



BSc / MSc Thesis Proposal We offer a TFG or TFM thesis project (final BSc or MSc project) using existing datasets, including advanced diffusion MRI in glioma patients or 9.4T scans of mouse breast tumors with matched histology. Tasks include: **(1)** generating virtual tissue environments from digital histology; **(2)** simulating molecular water diffusion within these structures; **(3)** developing and training a deep learning model to predict cellular features from simulated signals; and **(4)** validating predictions against real experimental MRI and histology data.

References

Grigoriou A et al, and Grussu F. Histology-informed microstructural diffusion simulations for MRI cancer characterisation-the Histo- μ Sim framework. *Communications Biology* 2025, 8(1):1695. <https://doi.org/10.1038/s42003-025-09096-3>.

TFG/TFM supervisors: Francesco Grussu, Christian Mata, Clara Prats

Candidate's profile: For TFG, last year's students of the BSc in Data Science and Engineering, Engineering Physics, Biomedical Engineering, or similar at UPC. For the TFM, students of the MSc in Health Data Science, Biomedical Engineering, Artificial Intelligence, Engineering Physics or similar at UPC.

Centre: Escola d'Enginyeria de Barcelona Est (EEBE), Campus Diagonal Besòs (Barcelona).

Application: Please send your CV (including the full Academic Transcript/Expedient Acadèmic) and a motivation letter to Clara Prats (clara.prats@upc.edu) **before November 22nd 2026**. For more information on the project, feel free to contact Francesco Grussu (francegrussu@gmail.com).

Funding opportunities: The BLOCOM-SC research group will award a studentship to the top three applications for the completion of the Bachelor's Thesis (BSc thesis, TFG).