European School of Molecular Medicine

RESEARCH ACTIVITY SHEET

2025 PhD selections

YOUR DETAILS

* Name & Surname: Alberto Bardelli

* Affiliation IFOM

PHD PROJECT DETAILS

* Title of the proposed project

Immune Engagement and Tumor Evolution in Colorectal Cancer: Biomarker Discovery through Liquid Biopsy and Multi-Omics Approaches

* Short description of the project (up to 300 words)

We are offering a PhD position within a multidisciplinary research program focused on uncovering the biological mechanisms that determine immunotherapy responsiveness in colorectal cancer (CRC). While immune checkpoint blockade has shown remarkable success in several tumor types, its efficacy in CRC remains largely restricted to tumors with high microsatellite instability (MSI), leaving most patients with microsatellite-stable (MSS) disease without effective immunotherapy options.

The selected PhD student will contribute to a translational effort combining clinical sample analysis, genomics, immunoprofiling, and liquid biopsy technologies to investigate how immune system activation and tumor evolution interact during and after treatment. The goal is to identify new biomarkers capable of predicting which patients are most likely to benefit from immunotherapy, even among those traditionally considered unresponsive.

The project offers hands-on experience in cutting-edge molecular and computational approaches, including sequencing-based analysis of tumor tissue and blood samples, with potential extensions into bioinformatics (and machine learning if it will be necessary) for biomarker discovery. The student will work within a dynamic and collaborative research environment that bridges clinical and laboratory-based science, with opportunities to interact with academic, hospital, and international research partners.

This PhD project is ideal for candidates with a background in molecular biology, biomedicine, biotechnology, or bioinformatics who are passionate about cancer research and interested in contributing to the development of more precise and inclusive oncology treatments. The scientific insights gained may ultimately support the development of non-invasive diagnostic tools and inform future clinical strategies for patient stratification and monitoring.

* Indicate the main research area for the project described above Genomic Medicine

If needed indicate a second research area for the project described above Computational biology

* Provide up to 3 key words for project:

Genomics, Bioinformatics, Oncology

YOUR LABORATORY ACTIVITIES DETAILS

* Main topic/s of the lab

Colorectal cancer, chemotherapy, computational biology, immunotherapy, preclinical models, exposome, genomic and immunogenomic analyses.

* Short description of the lab activity (up to 500 words)

The research carried out has shown that the heterogeneity of the mismatch repair (MMR) mechanism influences immune surveillance in CRC, and that this phenomenon can be therapeutically exploited using pharmacological agents capable of modulating it. In parallel, the laboratory is conducting translational analyses within several clinical trials (some examples: ARETHUSA, PEGASUS, SAGITTARIUS), investigating multiple aspects of the disease through multi-omic sequencing technologies, including genomics, immunogenomics and transcriptomics. The primary goal of these studies is to understand the evolving interaction between the tumor and the immune system throughout various oncologic treatments, with the aim of developing novel targeted therapeutic strategies.
Research activities over the past year have further explored these areas and initiated new lines of investigation, with a particular focus on multi-omic approaches and sequencing technologies applied to both solid tissue and liquid biopsy samples. These studies aim to identify biomarkers associated with immune system engagement and to characterize the evolutionary dynamics of the tumor–immune system interface across different therapeutic phases.
To support these investigations, in addition to human samples obtained from clinical trials, we leverage a well-established biobank of CRC cell lines, patient-derived organoids (PDOs), and mouse models accumulated over the years. These experimental platforms enable us to dissect the molecular mechanisms underlying tumor evolution and its interaction with the immune system during oncologic treatments.

* Recent bibliography (max 5 references)

1) Crisafulli G, Sartore-Bianchi A, Lazzari L, Pietrantonio F, Amatu A, Macagno M, Barault L, Cassingena A, Bartolini A, Luraghi P, Mauri G, Battuello P, Personeni N, Zampino MG, Pessei V, Vitiello PP, Tosi F, Idotta L, Morano F, Valtorta E, Bonoldi E, Germano G, Di Nicolantonio F, Marsoni S, Siena S, Bardelli A.
Temozolomide treatment alters mismatch repair and boosts mutational burden in tumor and blood of colorectal cancer patients.
Cancer Discov. 2022 Jul 6;12(7):1656-1675.
2) Russo M, Crisafulli G, Sogari A, Reilly NM, Arena S, Lamba S, Bartolini A, Amodio V, Magrì A, Novara L, Sarotto I, Nagel ZD, Piett CG, Amatu A, Sartore-Bianchi A, Siena S, Bertotti A, Trusolino L, Corigliano M, Gherardi M, Cosentino Lagomarsino M, Di Nicolantonio F, Bardelli A
Adaptive mutability of colorectal cancers in response to targeted therapies
Science. 2019 Dec 20;366(6472):1473-1480
3) Germano G, Lamba S, Rospo G, Barault L, Magrì A, Maione F, Russo M, Crisafulli G, Bartolini A, Lerda G, Siravegna G, Mussolin B, Frapolli R, Montone M, Morano F, de Braud F, Amirouchene-Angelozzi N, Marsoni S, D'Incalci M, Orlandi A, Giraudo E, Sartore-Bianchi A, Siena S, Pietrantonio F, Di Nicolantonio F, and Bardelli A
Inactivation of DNA repair triggers neoantigen generation and im-pairs tumor growth
Nature. 2017 Dec 7;552(7683):116-120
4) Siravegna G, Mussolin B, Buscarino M, Corti G, Cassingena A, Crisafulli G, Ponzetti A, Cremolini C, Amatu A, Lauricella C, Lamba S, Hobor S, Avallone A, Valtorta E, Rospo G, Medico E, Motta V, Antoniotti C, Tatangelo F, Bellosillo B, Veronese S, Budillon A, Montagut C, Racca P, Marsoni S, Falcone A, Corcoran RB, Di Nicolantonio F, Loupakis F, Siena S, Sartore-Bianchi A, Bardelli A
Clonal evolution and resistance to EGFR blockade in the blood of colorectal cancer patients
Nat Med. 2015 Jul;21(7):795-801
5) Amodio V, Lamba S, Chilà R, Cattaneo CM, Mussolin B, Corti G, Rospo G, Berrino E, Tripodo C, Pisati F, Bartolini A, Aquilano MC, Marsoni S, Mauri G, Marchiò C, Abrignani S, Di Nicolantonio F, Germano G, Bardelli A.
Genetic and pharmacological modulation of DNA mismatch repair heterogeneous tumors promotes immune surveillance.
Cancer Cell. 2023 Jan 9;41(1):196-209.

* Group composition: total members, and roles distribution (PhD, postdoc, technician, etc.)

Assistant Professor (1)
Giovanni Germano
Staff Scientist (2)
Giovanni Crisafulli
Rosaria Chilà
Postoctoral Fellows (8)
Vito Amodio
Veera Ojala
Flaminia Pedretti
Eleonora Piumatti
Nadia Saoudi Gonzalez
Sharon Scardellato
Pietro Paolo Vitiello
Bianca Pellegrini
PhD student (3)
Vittorio Battaglieri
Federico Lazzarini
Giorgio Patelli
Research Technicians (1)
Alessia Anastasia

Institutional page link

https://www.ifom.eu/it/ricerca-cancro/ricerca-lab/ricerca-lab-bardelli.php

Lab website link, if any

Social media links, if any

If you prepare a video to promote your lab/project, please include the link below