European School of Molecular Medicine

2025 summer call PhD selections

AVAILABLE POSITIONS

Principal Investigator	Antonio Marra
Affiliation	European Institute of Oncology, Milan
Title of the proposed project	Interception of minimal residual disease in solid malignancies
Short description of the project	Despite recent advances, several challenges continue to limit the routine clinical application of circulating tumor DNA (ctDNA)-based monitoring for minimal residual disease (MRD) in solid tumors. Tumor-informed approaches, where individual tumor mutations are identified through genomic sequencing of resected tissue, have demonstrated superior sensitivity in MRD detection. However, to fully harness the clinical potential of ctDNA analysis, robust detection technologies must be integrated with standardized workflows that consider tumor-specific biology and clinical context. The PhD project is embedded within the IMRD study, a prospective, single-center investigation designed to evaluate ctDNA dynamics in patients with surgically resected solid tumors receiving standard adjuvant therapy. The central hypothesis is that ctDNA persistence, whether detectable shortly after surgery or emerging later after an initial clearance, can act as a biomarker of relapse risk and inform treatment intensification strategies. The study's primary endpoint is the persistence of ctDNA six months after the initiation of adjuvant therapy, evaluated as a surrogate marker for disease radiological relapse. IMRD enrolls adult patients with histologically confirmed solid tumors, including breast cancer, non-small cell lung cancer, high-risk prostate cancer, high-grade serous ovarian cancer, and gastric cancer. All ctDNA analyses employ a personalized, tumor-informed approach, using whole-exome (WES) or whole-genome sequencing (WGS) of resected tumor tissue to identify somatic mutations for the development of bespoke ctDNA panels. This enables highly sensitive and specific longitudinal monitoring of MRD. The ideal candidate will hold a degree in medicine, cancer biology, or a related field, with a strong interest in translational cancer research. A background in molecular diagnostics, genomic data interpretation, or biostatistics is desirable but not essential. The PhD student will be trained in a highly interdisciplinary environment at the interface of clinical oncology, molecular biology, and computational medicine. Under the joint supervision of experienced investigators (Dr. Marra and Prof. Curigliano), including both clinical oncologists and translational scientists, the PhD student will gain comprehensive expertise in ctDNA biology and liquid biopsy technologies, sdata analysis and biomarker discovery, biostatistical modeling of longitudinal molecular and clinical data, study design and implementation in translational oncology. The candidate will have access to a rich dataset of longitudinal clinical and molecular profiles, allowing for in-depth investigation of ctDNA persistence, development of predictive relapse models, and

	stratification of patients based on MRD kinetics. Participation in multidisciplinary lab meetings, journal clubs, and collaborative projects will further support the student's professional development. This project will contribute to refining ctDNA-guided risk assessment and informing future personalized treatment strategies in the adjuvant setting, with potential for high clinical impact.
Main research area for the project	Genomic Medicine
Second research area for the project	Computational biology
3 key words for project:	circulating tumor DNA, precision medicine, translational research
Main topic/s of the lab	Precision medicine, translational research
Short description of the lab activity	The Early Drug Development for Innovative Therapies Department at the European Institute of Oncology (IEO) in Milan, led by Prof. Giuseppe Curigliano, offers a dynamic and collaborative research environment at the intersection of clinical oncology, translational science, and precision medicine. The department is internationally recognized for its commitment to accelerating the translation of basic research discoveries into clinically meaningful interventions for cancer patients. A defining strength of the department lies in its interdisciplinary structure, which brings together medical oncologists, molecular biologists, computational scientists, bioinformaticians, clinical trialists, and regulatory experts. This structure ensures that the entire translational pipeline, from molecular profiling to therapeutic development and clinical implementation. is fully integrated and patient-focused. The department works in close, ongoing collaboration with the Pathology Department and other laboratories at the IEO campus, including molecular diagnostics, genomics, digital pathology, and biobanking facilities. These consolidated partnerships provide seamless access to annotated tumor specimens, histopathological expertise, and state-of-the-art platforms for genomic sequencing, liquid biopsy, and multi-omic profiling. This highly integrated setting fosters a translational workflow in which biological insights can be rapidly linked to clinical outcomes and therapeutic decisions. Under the scientific coordination of Dr. Antonio Marra, the department's translational research group focuses on developing and validating molecular biomarkers through the integration of genomic, transcriptomic, pathological, and imaging data, with a strong emphasis on artificial intelligence and computational oncology. Projects span across multiple tumor types, including breast, lung, ovarian, prostate, and gastrointestinal cancers, with the shared goal of improving risk stratification, treatment selection, and early detection of relapse. PhD students joining

	the lab will receive comprehensive training in translational oncology, including next-generation sequencing technologies (WES/WGS, RNA-seq, ctDNA profiling), data analysis pipelines for genomic and transcriptomic datasets, integration of pathology and digital image analysis with molecular data, use of AI models for biomarker discovery and prediction, and exposure to early-phase clinical trials and real-world data interpretation The research culture strongly emphasizes mentorship, scientific rigor, and collaboration. Students are encouraged to present their work regularly in departmental seminars, journal clubs, and national/international conferences, and to engage in collaborative projects across IEO departments and with external partners.
Recent bibliography	• Gupta A, Gazzo A, …, Marra A*, Chandarlapaty S*. APOBEC3 mutagenesis drives therapy resistance in breast cancer. Nat Genet. 2025 Jun;57(6):1452-1462. doi: 10.1038/s41588-025-02187-1. (*co-corresponding) • Boehm KM*, El Nahhas OSM*, Marra A* et al. Multimodal histopathologic models stratify hormone receptor-positive early breast cancer. Nat Commun. 2025 Mar 2;16(1):2106. doi: 10.1038/s41467-025-57283-x. (*co-authorship) • Marra A, Morganti S, Pareja F et al. Artificial intelligence entering the pathology arena in oncology: current applications and future perspectives. Ann Oncol. 2025 Jul;36(7):712-725. doi: 10.1016/j.annonc.2025.03.006. • Boscolo Bielo L, Guerini Rocco E, …, Marra A*, Curigliano G*. Genomic and clinical landscape of metastatic hormone receptors-positive breast cancers carrying ESR1 alterations. ESMO Open. 2024 Oct;9(10):103731. doi: 10.1016/j.esmoop.2024.103731. (*co-last autorship) • Morganti S*, Marra A*, De Angelis C et al. PARP Inhibitors for Breast Cancer Treatment: A Review. JAMA Oncol. 2024 May 1;10(5):658-670. doi: 10.1001/jamaoncol.2023.7322. (*co-authorship)
Group composition	The Early Drug Development for Innovative Therapies group at IEO is a multidisciplinary team designed to foster excellence in translational oncology and patient-centered research. The group brings together a unique mix of clinical and scientific expertise, creating an ideal environment for PhD students to thrive within high-impact, collaborative projects. The team includes eight medical oncologists, all of whom are actively engaged in the design and implementation of early-phase clinical trials. These physician-investigators play a central role in integrating clinical observations with translational research questions, ensuring that benchside discoveries are directly informed by real-world clinical needs. A physician-scientist serves as a critical link between clinical care and laboratory research, facilitating the bidirectional flow of insights

	between patients and science. This role is particularly valuable for PhD students, who benefit from exposure to both the clinical decision-making process and the molecular basis of disease. The group is further supported by a dynamic cohort of fifteen clinical fellows, who contribute to all stages of research and patient care. Their involvement ranges from trial design and patient enrollment to sample collection, molecular analysis coordination, and clinical data interpretation. This active clinical-research interface enriches the collaborative learning environment and provides PhD students with continuous opportunities for cross-disciplinary exchange. On the academic side, the team currently includes two PhD students, both engaged in projects at the intersection of genomics, artificial intelligence, and digital pathology, aimed at identifying novel biomarkers and refining predictive models for treatment response and recurrence. The new PhD candidate will join this growing academic cohort, benefiting from peer interaction, joint training activities, and the intellectual stimulation of a team deeply invested in innovation. To ensure smooth execution of complex clinical and translational studies, the team is also supported by three research nurses, who coordinate trial-related patient care and procedures, and three dedicated study coordinators, who manage regulatory documentation, ethics submissions, and logistical oversight of ongoing projects. This tightly integrated team structure provides PhD students with a rich, supportive ecosystem in which clinicians, scientists, and support staff work side by side. The collaborative culture encourages shared problem-solving, continuous learning, and active participation in all phases of translational research, from hypothesis generation and study design to data analysis and publication. PhD candidates joining the group will be immersed in a real-world, multidisciplinary translational research setting, with access to high-quality mentorship, clinical exposure, and cutting-edge scientific infrastructure.
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