Functional omics data and precision medicine laboratory

General description of the activities

The Functional omics data and precision medicine laboratory is located at the Department of Experimental Medicine Sapienza University of Rome, conducts research focused on the identification, assay, and characterization of therapeutic targets and diagnostic, prognostic, and monitoring biomarkers in various diseases including solid tumors and metabolic diseases.
Different types of samples are analyzed: tissues (fresh frozen and Formalin fixed and embedded in paraffin - FFPE), liquid biopsy samples (e.g., blood, plasma, serum, saliva, urine, CSF), cells and microvesicles/exosomes.
Transcripts, noncoding RNAs, proteins, and DNA are evaluated in the samples by omics profiling and/or specific assays.
Omics profiling studies are conducted with library preparation for sequencing using state-of-the-art platforms including spatial transcriptomics. The laboratory not only profiles samples using omics technologies, but also processes and integrates the data.
Validation and biological function investigation of therapeutic targets and molecular biomarkers is conducted using preclinical models such as 2D, 3D, co-cultures, organoids and organotypic cultures.
All activities are conducted following Standard Operating Procedures (SOPs) from literature or that have been developed in the laboratory.

Role	Name	Position	E-mail	Publications	Keywords
Lab head	Prof. Elisabetta Ferretti	Full professor	elisabetta.ferretti@uniroma1.it	PubMed Scopus	Precision medicine Omics Biomarkers Molecular targets Nanoparticles
Lab members	Prof. Alessandra Vacca	Full professor	alessandra.vacca@uniroma1.it	PubMed Scopus	Signaling pathways Preclinical models Microenvironment
	Prof. Zein Mersini Besharat	Tenure Track Researcher (RTT)	zeinmersini.besharat@uniroma1.it	PubMed Scopus	Molecular networks Omics data integration microRNAs
	Dr. Zaira Spinello	Researcher (RTDA)	zaira.spinello@uniroma1.it	Scopus	Molecular targets Co-culture models
	Dr. Anna Citarella	Post-doc Researcher	anna.citarella@uniroma1.it	Scopus	Organoids Tumor microenvironment Breast cancer
	Dr. Elena Splendiani	Post-doc Researcher	elena.splendiani@uniroma1.it	Scopus	Spatial transcriptomics Melanoma
	Dr. Sofia Trocchianesi	Post-doc Researcher	sofia.trocchianesi@uniroma1.it	Scopus	Novel therapies Thyroid cancer
	Dr. Tiziana Raia	Post-doc Researcher	tiziana.raia@uniroma1.it	Scopus	Epigenetics
	Tanja Milena Autilio	PhD student	tanjamilena.autilio@uniroma1.it	PubMed	Head and neck cancer
	Nicole Feverati	PhD student	nicole.feverati@uniroma1.it		Small RNA sequencing
	Sara Cassandro	PhD student	sara.cassandro@uniroma1.it		Primary cell cultures

Previous and current research

Prof. Ferretti's laboratory research in fields of precision medicine have been and are focused on:
Discovery and characterization of molecular targets involved in tumorigenesis mainly focusing on solid tumors and dysregulated signaling pathways (e.g. Hedgehog/Gli).
Characterization of the noncoding RNA, mainly focusing on microRNAs, involved in the deregulation of signaling pathway sustaining tumors and metabolic diseases.
Isolation and cryopreservation of primary cancer cells including stem cells.
Identification of novel molecules as oncosuppressors or oncogenes and investigation of their biological function in vitro and in vivo.
Development of innovative approaches for large-scale analysis of gene expression and epigenetic networks including microRNAs.
Analysis and discovery of tissue and circulating biomarkers (e.g. microRNAs and cfDNA) in cancer and in metabolic diseases.
Identification of new molecular markers of diseases susceptible to become therapeutic targets in precision medicine.
Proteomic analysis with particular interest in post-translation modifications of proteins, such as phosphorylation and acetylation.
Development of preclinical 3D models and mouse models for the study of solid tumors.
Development of personalized therapeutic approach (e.g. microRNA loaded nanoparticles).
Pathologies of interest include solid tumors (prostate, brain, lung, breast, head and neck, colorectal, melanoma, thyroid, neuroendocrine and biliary tract) and metabolic diseases (diabetes mellitus and obesity).

Selected Publications

Pedace L, Pizzi S, Abballe L, Vinci M, Antonacci C, Patrizi S, Nardini C, Del Bufalo F, Rossi S, Pericoli G, Gianno F. Evaluating cell culture reliability in pediatric brain tumor primary cells through DNA methylation profiling. NPJ Precision Oncology. 2024 Apr 18;8(1):92. doi: 10.1038/s41698-024-00578-x

Splendiani E, Besharat ZM, Covre A, Maio M, Di Giacomo AM, Ferretti E. Immunotherapy in melanoma: Can we predict response to treatment with circulating biomarkers?. Pharmacology & Therapeutics. 2024 Feb 16:108613. doi: 10.1016/j.pharmthera.2024.108613

Pecoraro M, Catanzaro G, Conte F, Besharat ZM, Messina E, Laschena L, Trocchianesi S, Splendiani E, Sciarra A, Catalano C, Paci P. Prospective validation study of a novel integrated pathway based on clinical features, MRI biomarkers and microRNAs for early detection of prostate cancer. EUROPEAN UROLOGY ONCOLOGY. 2023. doi: 10.1016/j.euo.2023.05.008

Citarella A, Besharat ZM, Trocchianesi S, Autilio TM, Verrienti A, Catanzaro G, Splendiani E, Spinello Z, Cantara S, Zavattari P, Loi E. Circulating cell-free DNA (cfDNA) in patients with medullary thyroid carcinoma is characterized by specific fragmentation and methylation changes with diagnostic value. Biomarker Research. 2023 Sep 19;11(1):82. doi: 10.1186/s40364-023-00522-4

Díaz Méndez AB, Sacconi A, Tremante E, Lulli V, Caprara V, Rosanò L, Goeman F, Carosi M, Di Giuliani M, Vari G, Silvani A. A diagnostic circulating miRNA signature as orchestrator of cell invasion via TKS4/TKS5/EFHD2 modulation in human gliomas. Journal of Experimental & Clinical Cancer Research. 2023 Mar 17;42(1):66. doi: 10.1186/s13046-023-02639-8

Besharat ZM, Trocchianesi S, Verrienti A, Ciampi R, Cantara S, Romei C, Sabato C, Noviello TM, Po A, Citarella A, Caruso FP. Circulating miR-26b-5p and miR-451a as diagnostic biomarkers in medullary thyroid carcinoma patients. Journal of Endocrinological Investigation. 2023 Dec;46(12):2583-99. doi: 10.1007/s40618-023-02115-2

Grants/Projects/Open Positions/Conferences

Grants
2017: Agenzia Italiana del Farmaco (AIFA) Call AIFA 2016. Proposal code: TRS-2016-00001141. "Circulating microRNAs and DNA (cfDNA) as novel biomarkers for diagnostic, prognostic and therapeutic use in Medullary Thyroid Carcinoma". Duration: 3 years. Euro: 983.497,87. Principal Investigator (PI): Ferretti Elisabetta.
2017: Regione Lazio. Title: "Caratterizzazione di microRNA circolanti come sensibili e precoci biomarcatori di alterazioni metaboliche nell'obesità: sviluppo di nuove piattaforme diagnostiche nelle patologie metaboliche croniche" Duration 2 years. Euro: 149.912,00
2018: Sapienza University Research Grants. Title: "Protein Kinase Inhibitor treatment in Advanced Thyroid Cancer: evaluation of liquid biopsy as a tool for prediction of response to therapy" Duration 1 year. Euro: 32.000,00
2018: Istituto Pasteur – Fondazione Cenci Bolognetti. Title: "Hedgehog/GLI signaling regulatory networks in colorectal cancer stem cells" Duration 3 years. Euro 60.000,00
2019: Ministry for Instruction, University and Research (MIUR) PRIN. Title: "Metabolic therapy of immuno-inflammation: in search for the best strategy to counteract type 2 diabetes and its complications". Duration 3 years. Euro 676.286,00 PI: Elisabetta Ferretti.
2022: "Rome Technopole" project co-funded by the European Union - Next Generation EU, Mission 4 Component 2 Investment 1.5, code ECS 00000024. Euro 359.750,00.
2022: "National Centre for Gene Therapy and Drugs based on RNA Technology" co-funded by the European Union - The National Recovery Plan, Mission 4 Component 2 Investment 1.4 - Next Generation EU project CN3 - code CN_00000041. Euro 765.040,00 co-PI: Elisabetta Ferretti.

Links
Functional Omics Data and Precision Medicine Ricerc@Sapienza - link: https://research.uniroma1.it/laboratorio/163821#/0
Dottorato in Network Oncology and Precision Medicine - link: https://phd.uniroma1.it/web/NETWORK-ONCOLOGY-AND-PRECISION-MEDICINE_nD3663_IT.aspx