



RESEARCH TOPIC MECM8

Bioinformatic approaches to analyze the tumor microenvironment and identify mechanisms of therapeutic resistance in cancer

MECM Data Science

Research Area

Immunology

Laboratory name

Tumor Microenvironment Unit

Research Supervisor

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Abstract

The complexity of the tumor microenvironment (TME) plays a critical role in shaping the response to cancer immunotherapies. This PhD project aims to apply and develop bioinformatic pipelines to analyze single-cell RNA sequencing (scRNA-seq), spatial transcriptomics, and other high-dimensional datasets derived from tumor tissues of cancer patients at different stages of disease progression and treatment response. The same strategies will be applied to murine tumor models to validate human findings and explore mechanistic insights. The goal is to dissect the composition and activation states of the TME to identify pathways and cellular phenotypes associated with resistance to therapy. The project will be integrated with a parallel wet-lab research line that will functionally test the most promising candidates emerging from bioinformatic analyses. The candidate will receive training in advanced computational biology, learning how to analyze and integrate data from diverse platforms.

Main technical approaches

The project will employ state-of-the-art computational approaches for the analysis of high-dimensional datasets, including single-cell RNA sequencing, spatial transcriptomics, and bulk RNA-seq data. The candidate will develop and implement bioinformatic pipelines for data analysis. A background in bioinformatics or data science is required.

Scientific references

1. Primary, Adaptive, and Acquired Resistance to Cancer Immunotherapy. Padmanee Sharma, Siwen Hu-Lieskovan, Jennifer A Wargo, Antoni Ribas Cell 2017. PMID: 28187290
2. Hugo, W. et al. Genomic and Transcriptomic Features of Response to Anti-PD-1 Therapy in Metastatic Melanoma. Cell 168, 542 (2017).



3. Gavish, A. et al. Hallmarks of transcriptional intratumour heterogeneity across a thousand tumours. *Nature* 618, 598–606 (2023).

Type of contract

PhD scholarship of € 21.000 gross per year awarded by Humanitas University. This sum is exempt from IRPEF income tax according to the provisions of art. 4 of Law no. 476 of 13th August 1984, and is subject to social security contributions according to the provisions of art. 2, section 26 and subsequent sections, of Law no. 335 of 8th August 1995 and subsequent modifications.

Borsa di dottorato pari a € 21.000 annui lordi erogata da Humanitas University. Importo non soggetto a tassazione IRPEF a norma dell'art. 4 della L. 13 agosto 1984 n. 476 e soggetto, in materia previdenziale, alle norme di cui all'art. 2, commi 26 e segg., della L. 8 agosto 1995, n. 335 e successive modificazioni.