HOSTING GROUPS FOR INTERNATIONAL MOBILITY

Genetics & Epigenetics Group (Dr. Barra)

From DNA methylation and chromatin dynamics to RNA editing therapies.

Our research group explores how DNA methylation contributes to human diseases—such as cancer—and aging, with a special focus on the regulation of the maintenance methyltransferase DNMT1. We are particularly interested in how loss of methylation at repetitive elements, like centromeric DNA, drives genomic instability. To address this, we use a multidisciplinary approach that combines genetics, molecular biology, cell biology, and advanced microscopy. We study chromosomal abnormalities and chromatin organization in the nucleus, alongside effects on cell cycle, viability, and mobility.

In parallel, we are developing innovative RNA editing tools for therapeutic applications. We harness the deaminase activity of ADAR enzymes to correct, at the mRNA level, point mutations causing diseases, such as nonsense mutations involved in genetic disorders like Cystic Fibrosis. Our strategies involve both CRISPR/Cas13-based systems and a variety of RNA tools—including antisense oligonucleotides—designed to guide ADAR precisely to target site within the transcript. By combining molecular precision with flexible delivery approaches, we aim to expand the potential of RNA editing for future gene therapy applications.

Team members:

-Viviana Barra, Assistant Professor of Genetic and Cytogenetic Methodologies (RTT BIOS-14/A)

-Salvatore Martino, PhD Student

-Serena Gargano, PhD Student

Selected publications:

1) Martino S, Gargano S, Carollo PS, Di Leonardo A, Barra V.

DNMT1 prolonged absence is a tunable cellular stress that triggers cell proliferation arrest to protect from major DNA methylation loss. Cell Mol Life Sci. (2025) 82:7 (https://doi.org/10.1007/s00018-024-05547-y)

2) Titoli S, Barra V, Gargano S, Di Leonardo A, Melfi R.*

RNA editing applied to cystic fibrosis: RESTORE can target G542X CFTR mRNA and revert the nonsense mutation. Gene (2025) 951:149384 (https://doi.org/10.1016/j.gene.2025.149384)

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3) Carollo PS, Barra V.

Chromatin epigenetics and nuclear lamina keep the nucleus in shape: Examples from natural and accelerated aging. Biol Cell. (2023) 115(1):e2200023 (https://doi.org/10.1111/boc.202200023)

4) Pappalardo XG, Barra V.

Losing DNA methylation at repetitive elements and breaking bad. Epigenetics Chromatin (2021) 14(1):25 (https://doi.org/10.1186/s13072-021-00400-z)

5) Barra V, Fachinetti D.

The dark side of centromeres: types, causes and consequences of structural abnormalities implicating centromeric DNA. Nat Commun. (2018) 9(1):4340 (https://doi.org/10.1038/s41467-018-06545-y)