

Over the past decade, Gerstein Lab has significantly contributed to the study of extracellular RNA (exRNA) across various disciplines, including cancer research. Our research has highlighted the many roles of exRNA in cancer biology, unveiling new opportunities for targeted therapies and establishing exRNA as a promising class of minimally invasive liquid biopsy biomarkers.

One notable example is our study in glioblastoma (GBM), where we discovered that vascular growth factors and extracellular miRNA transferred from glioblastoma stem cells (GSCs) into endothelial cells via extracellular vesicles stimulate distinct gene regulatory responses that converge on angiogenesis. This work provided insights into the failure of anti-VEGF therapy for glioblastoma, the prognostic value of miR-9, and a potentially novel targetable angiogenesis pathway.

Our team has developed several key tools and platforms to advance exRNA research:

- **exceRpt pipeline:** A comprehensive exRNA analysis pipeline for processing RNA-seq profiles of exRNA.
- **exRNA Atlas:** A platform for coordinating and disseminating exRNA data and metadata.
- **XDec deconvolution:** A tool for computationally deconvoluting EV/NVEP carriers of exRNA.
- **NanoFlow Repository:** A nano-cytometry platform for profiling EV/NVEP carriers of exRNA.
- **exRNA Explorer:** A tool for integrative analysis and visualization of exRNAs.
- **exRNA WikiPathways:** A knowledge base for interpreting exRNA profiling experiments.
- **CTD algorithm:** An algorithm and tool to interpret exRNA sets in network/pathway contexts.

These tools have been integral in advancing exRNA research. For instance, the exceRpt pipeline has become a widely used solution for exRNA-seq analysis, and the exRNA Atlas has empowered data sharing across the research community with over 12,000 small RNA-seq profiles. Additionally, our XDec deconvolution method has provided new insights into tumor biology and the mapping of EV and NVEP carriers of exRNAs in human biofluids.

Our efforts have also focused on community engagement and collaboration to enhance the impact of our research. We have engaged numerous early adopters in cancer research and implemented a comprehensive outreach strategy to sustain and broaden adoption of our tools and platforms. This collaborative approach has helped uncover the role of exRNA communication in tumor biology, identify actionable exRNA biomarkers, and pave the way toward precise and adaptive cancer therapies.