MENNA ARAFAT

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EDUCATION

Bachelor of Medicine and Surgery Degree (M.B.B. Ch), 2014 Sep – 2021 Feb
Faculty of Medicine, Mansoura university. GPA [**81%, 3.5/4**].

WORK EXPERIENCE

Remote Collaborations & Free Lance Current
Conducted various computational analyses on genomic, transcriptomic, epigenomic and proteomic datasets in oncology projects.
Built multi-omics framework for TNBC drug target prioritization, pathway crosstalk analysis, and drug synergy prediction (CMAP, network-based).
Validated targets using survival and gene essentiality analyses from DepMap, generating prioritized therapeutic combinations.

Bioinformatician & Statistician at El-Beltagy Therapeutics Company 2024 May – 2025 Apr
Modeled temporal proteomics in rat gingival mesenchymal stem cells with MEFISTO, inferred key transcription factors (decoupleR), explored pathway crosstalk, and mapped protein dynamics to cell types using CIBERSORT.
Supported grant applications and research proposals.

Bioinformatics Research Assistant at 57357 Children Cancer Hospital 2023 May – 2024 Apr
Performed CRC metabolomic profiling with PQN normalization, differential expression, and WGCNA; identified hub metabolites and discriminative features via module eigengene analysis, PCA, and PLS-DA.
Contributed to two peer-reviewed publications with multi-omics integration, functional enrichment, and data visualization

Intern House Officer, Mansoura University Hospitals 2021 Mar – 2022 Feb
Collected and curated clinical data for a breast cancer retrospective study focused on sentinel lymph node biopsy outcomes and prognostic factors.
Collaborated with surgical teams to document tumor characteristics, surgical approaches, lymph node status, and post-operative follow-up data.

PUBLICATIONS

1. **Metabolomic Analysis of Gut Metabolites in Colorectal Cancer Patients (CRC)**
   Performed data preprocessing of metabolomic profiling of colorectal cancer (CRC), PQN normalization, differential expression, and WGCNA to identify phenotype-associated modules and hub metabolites. Applied eigengene differentiation and dimensionality reduction (PCA, PLS-DA) to extract discriminative features, highlighting biomarkers and network-level metabolic dysregulation.
2. **Integrative Multi-Omics Profiling of Rhabdomyosarcoma Subtypes Reveals Distinct Molecular Pathways and Biomarker Signatures**

Applied WGCNA on metabolomics and proteomics data to identify RMS subtype-specific modules; integrated hub proteins with DEPs into PPI networks and used centrality analysis to reveal key molecular drivers.

3. **CrosstalkX: A Mutual Information-Based Framework for Pathway Interaction Inference**
   Developed *CrosstalkX*, an R package using mutual information to detect nonlinear pathway interactions and prioritize core signaling pathways.
4. **A Multi-Omics and Mutual Information Framework to Decode Pathway Crosstalk and Therapeutic Vulnerabilities in TNBC**
   Developed a multi-omics framework for drug target prioritization and repurposing in TNBC, integrating MOFA-based analysis, pathway crosstalk, CMAP connectivity, network-based synergy modeling and DepMap validation to identify therapeutic combinations.
5. **Enhanced Bone Regeneration in Rat Gingival Mesenchymal Stem Cells: A Comparative Study of Inductive Media, Polycaprolactone Nano Scaffold, and Low-Level Laser Therapy**
   Analyzed temporal proteomic data in rat gingival mesenchymal stem cells using MEFISTO for time-resolved multi-omics patterns, decoupleR to infer key transcriptional regulators, pathway crosstalk analysis to identify regulatory interactions, and CIBERSORT to map protein dynamics to cell-type contributions during bone regeneration.
6. **Integrative Analysis of Extracellular Vesicle miRNAs Reveals Molecular Signatures and Regulatory Networks in Breast Cancer**
   Integrated multiple breast cancer miRNA datasets using MINT-sPLS-DA to identify discriminative miRNA signatures; constructed miRNA–target networks and performed pathway enrichment to reveal subtype-specific regulatory mechanisms and biomarkers.
7. **Proteomic Profiling of Pancreatic Cancer Patients: Time Series Study Before and After Whipple Surgery**
   Led network-based analysis of temporal proteomics using WGCNA and generalized additive model (GAM) to identify co-expressed modules associated with temporal progression; integrated PPI networks, modularity clustering with the Louvain algorithm and enrichment analysis, revealing pathway modules with crosstalk and coordinated biological activity.

SKILLS

- Advanced R (WGCNA, PCA/PLS-DA, GAMs), Python, command-line scripting, and Linux for high-throughput bioinformatics workflows; multi-omics analysis and integration (metabolomics, proteomics, transcriptomics, genomics, methylome) using MOFA2 and MINT-sPLS-DA; time-series modeling (GAM, GLMM), single-sample and single-cell analyses (CIBERSORT, niche detection, CCC, lineage analysis); network and pathway analysis including PPI networks, hub detection, modularity clustering, mutual information-based crosstalk, and functional enrichment (clusterProfiler, STRING, KEGG); downstream integration with public databases (TCGA, cBioPortal, CMAP, DepMap); advanced statistical modeling (including regression, confounder detection, and effect modification); machine learning for supervised and unsupervised analyses; reproducible reporting with R Markdown and bookdown.

Courses

- Deep Learning Architecture for Single-Cell Genomics Data – Abdelrahman Mahmoud.
- Integrative Systems Biology – Mohamed Maysara (Nile University).
- CS224W: Machine Learning with Graphs – Jure Leskovec.
- Applied Computational Genomics – Aaron Quinlan.
- Advanced Bioconductor – Kasper Hansen.
- Statistics for Genomics – Rafael Irizarry.
- Statistics and R Programming – Mike Marin.
- Systems Biology and Systems Medicine – Uri Alon.
- Design and Interpretation of Clinical Trials – Coursera.
- Writing in the Sciences – Kristin Sainani (Coursera).

Volunteering

- Coordinator of Foundation Year Conference- Pathways after graduation held in Mansura University founded by European council for continuing medical Education.
- Campaign assistant for raising awareness of covid19 and administering vaccines to patients in MUH.

Languages

- Arabic (Mother Language)
- English (IELTS: **7**)

References

- **Nouran Al-Shehaby**, *Junior Scientist, Basic Research Unit, Children's Cancer Hospital 57357, Egypt, nouran.alshehaby@57357.org*
- Mohamed Helmy, *PI, Vaccine and Infectious Disease Organization, Canda, helmy.sfc@gmail.com*
- **Islam M. Saadeldin**, *Senior Scientist King Faisal Specialist Hospital and Research Center, Saudia Arabia, imohamed@kfshrc.efu.sa*
- **Mustafa Nematallah**, *Professor of Molecular Genetics and Biochemistry, Mansoura Faculty of Medicine, Egypt, mneamatallah@mans.edu.eg*
- **Abdelrahman Mahmoud**, *Post doc at Broad Institute, MIT, mohameda@broadinstitute.org*