Advanced Proteomics and Metabolomics Resources

Challenges

The fields of proteomics and metabolomics face significant challenges in large-scale data integration, reproducibility, and standardization. Key obstacles include:

- Harmonizing heterogeneous datasets across laboratories and technologies.
- Ensuring reproducible identification and quantification of peptides, proteins and small molecules/metabolites.
- Integrating proteomic and metabolomic data (potentially with other omics data types) for systems-level understanding of human health and disease.
- Providing accessible tools and resources to both academic and industry researchers.

Keywords

Proteomics # Metabolomics # Multi-omics # Biomarkers # Data Integration # FAIR Data # Open data standards # Human Health # Systems Biology

Technology

Dr. Juan Antonio Vizcaíno and his team at EMBL-EBI have developed an extensive suite of proteomics and metabolomics resources, including:

- **Public datasets and repositories**: Curated, high-quality proteomics and metabolomics datasets accessible via the EMBL-EBI resources PRIDE (for proteomics data) and MetaboLights (for metabolomics data).
- Additionally, **harmonised/reanalysed proteomics data** (e.g. quantitative proteomics or datasets enriched for PTMs) from PRIDE is made available through other EMBL-EBI data resources such as UniProt, Expression Atlas and the Open Targets Platform, among others.
- **Open data standards and open pipelines**: Open data standards and related software (developed under the umbrella of the Proteomics Standards Initiative), and standardized workflows for data submission, analysis, and data sharing to ensure reproducibility.
- **Integration frameworks**: Approaches enabling multi-omics data integration for biomarker discovery and functional analysis.
- **Collaborative platforms**: Resources designed to facilitate cross-lab and cross-sector collaborations.

These resources leverage EMBL-EBI's computational infrastructure to support large-scale, high-throughput studies while adhering to the FAIR data principles.

Internal EMBLEM Reference

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Key Inventor

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Applications

- Biomarker discovery for disease diagnosis and prognosis.
- Drug target identification and validation.
- Comparative proteomics and metabolomics studies across human tissues, model organisms or environmental samples.
- Multi-omics systems biology research.
- Training and capacity building in proteomics/metabolomics data management and data analysis.

Commercial Opportunity

- **Pharmaceutical and biotechnology companies** can utilize standardized datasets for drug target discovery and biomarker identification.
- **Harmonised/reanalysed datasets** can be used as AI-ready data.
- **Clinical research organizations** benefit from reproducible multi-omics data workflows.
- **Bioinformatics service providers** can integrate EMBL-EBI pipelines into commercial analysis offerings.
- Opportunities exist for collaborative research.

Benefits

- **Standardization**: Reliable, reproducible open data formats and analysis pipelines.
- **Accessibility**: Open-access resources suitable for academia and industry (e.g. PRIDE and MetaboLights).
- **Data Integration**: Supports multi-omics approaches for comprehensive biological insights.
- **Scalability**: Resources handle large-scale datasets efficiently.
- **Collaboration-ready**: Designed for cross-institutional and cross-sector partnerships.

Resources

- **EMBL-EBI facilities**: High-performance computing infrastructure for data analysis.
- **Datasets**: Curated human and non-human proteomics/metabolomics datasets.
- **Collaborative networks**: Partnerships with academic and industry groups for multi-omics research.

Intellectual Property

- The technologies are primarily disseminated as open-access resources, enabling broad usage by the scientific community.
- EMBL-EBI retains institutional stewardship of data pipelines and analysis frameworks.
- Specific patent applications or proprietary methods, if applicable, are not publicly listed.

Seeking

- **Industry partnerships** for translational research, data integration and tool development.
- **Collaborations** for expanding metabolomics and proteomics datasets across human populations and model organisms.
- **Research consortia membership** to advance multi-omics data integration and standardization.

Further Reading

[1] Proteomics & Metabolomics Team – EMBL-EBI

[2] Proteomics & Metabolomics Publications – EMBL-EBI

[3] Metabolomics at EMBL – Human Ecosystems Project

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