An introduction to predicting exposures and outcomes using omic biomarkers

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Dr Matthew Suderman

Originally from: Abbotsford, Canada
Interested in: using epigenetic data to identify associations with environment and lifestyle in order to better understand how they affect long-term health

Dr Paul Yousefi

Originally from: San Jose, California, USA
Interested in: impact of the social factors and environmental chemical exposures on the DNA methylome, particularly during susceptible periods of development
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Thomas Battram

Originally from: Isle of Wight, UK

Interested in: applying methods developed in genetics to inform us about epigenetic architecture of complex traits

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Nancy McBride

Originally from: North of England

Interested in: how omics can be used to better predict and understand adverse pregnancy outcomes

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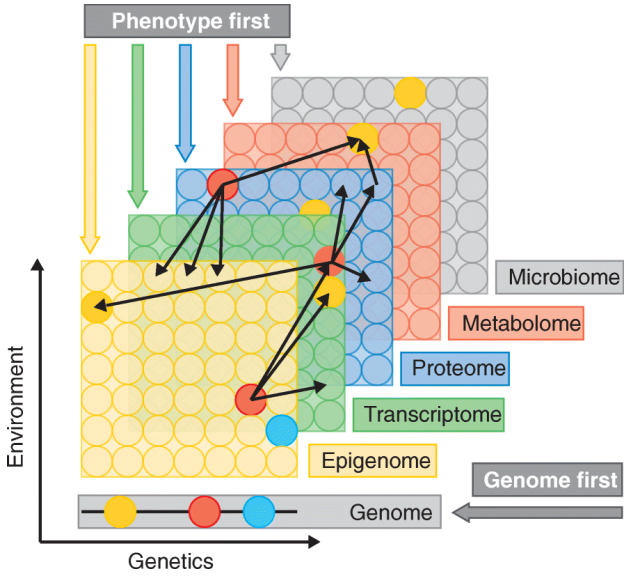
Introduction to the omics

- Omics = technologies used to detect genes and biological molecules such as proteins and metabolites in a biological sample
- Used to explore their roles, relationships and actions in cells

Metabolome	→	**Metabolomics**
Proteome	→	Proteomics
Transcriptome	→	Transcriptomics
Epigenome	→	**Epigenomics**
Genome	→	**Genomics**

Integration of the omics

- Understanding the relations between various omics data and phenotype = **one of the current major challenges in biology**
- Can be addressed by using joint observations to predict phenotype value from the omics
- Complex interactions of many functional elements and the environment produces the phenotype
- **This is increasingly essential in understanding non-communicable disease**



Layers depict different types of omics. Circles = molecules. Thin arrows = potential interactions or correlations detected between molecules in different layers. Thick arrows = different potential starting for consolidating multiple omics data to understand disease.
https://doi.org/10.1186/s13059-017-1215-1

Omics for prediction

- The omics data generated from these technologies are high-dimensional and correlated
- Different computational and statistical analyses of these data can be used to identify risk factors for different diseases or to build autonomous disease prediction models
- However, few studies show enough predictive ability to be implemented into clinics or public health domains

Workshop outline

- Introduction
- Omic data – genetic, epigenetic and metabolite
- Prediction – methodology
- Prediction – demonstration
- Examples and case studies