



## RESEARCH TOPIC DASMEN6

# Methods and tools for the integration of clinical/epidemiological data and multi-omics data

## Curriculum DASMEN Standard

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### Abstract

The project is aimed to develop methods and tools for the integration of clinical/epidemiological data with genomic, transcriptomic, proteomic, radiomic, metabolomic, and microbiome data (i.e. multi-omics data).

In particular, the following topics will be considered:

- (i) integration of genomic and phylogenetic data;
- (ii) application of machine-learning and deep-learning methods for the development of prognostic and predictive clinical models, based on the integration of multi-omics data;
- (iii) design and analysis of epidemiological studies integrating clinical or population registers and multi-omics data.

A candidate could choose one of the proposed topics, though it is desirable to have candidates whose interests overlap on more than one.

### Main technical approaches

- Machine learning
- Deep learning
- Statistical methods for prognostic and predictive modeling in precision medicine
- Survival analysis
- Record linkage
- Computer science algorithms
- Epidemiology
- Meta-analysis



### **Scientific references**

1. Hasin, Y., Seldin, M. & Lusis, A. Multi-omics approaches to disease. *Genome Biol* 18, 83 (2017).
2. Buyse, M., & Michiels, S. Omics-based clinical trial designs. *Current opinion in oncology*, 25, 289-295 (2013)
3. Vineis, P., van Veldhoven, K., Chadeau-Hyam, M., & Athersuch, T. J. Advancing the application of omics-based biomarkers in environmental epidemiology. *Environmental and molecular mutagenesis*, 54, 461-467. (2013)
4. Grapov, D., Fahrman, J., Wanichthanarak, K., & Khoomrung, S. Rise of deep learning for genomic, proteomic, and metabolomic data integration in precision medicine. *Omics: a journal of integrative biology*, 22(10), 630-636. (2018)

### **Type of contract**

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