



Master project 2021-2022

Personal Information

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Group	Cardiovascular Epidemiology and Genetics (PI: Roberto Elosua)

Project

Computational genomics

Project Title:

Diet quality, DNA methylation and transcriptomics: an integrated translational approach

Keywords:

Nutrition; Epigenetics; DNA methylation; EWAS; Mendelian Randomization

Summary:

The aim of this project is to discover novel epigenetic biomarkers modified by lifestyle, that can identify patients at elevated cardiovascular disease (CVD) risk and act as new therapeutic targets. CVD is a major cause of death worldwide and cost the European Union economy over €210 billion per year. Prevention strategies are targeted at patients at increased risk of future CVD, imperfectly identified by CVD risk prediction algorithms that need improvement. Furthermore, the biological mechanisms through which diet and physical activity act on cardiometabolic health (obesity, diabetes, dyslipidemia) are not fully understood. The epigenome, which controls the differential expression of genes, is both heritable and modifiable by the environment, but little is known on how diet influences epigenetic mechanisms. In this project, we will use independent discovery and validation population cohorts from different countries (Spain, USA) with dietary, lifestyle and clinical data, as well as cutting-edge multi-omics data: GWAS, epigenome-wide DNA methylation, and transcriptomic (gene expression). Using an epigenome-wide association study (EWAS) design, we will assess the effects of food, nutrients and overall dietary patterns on DNA methylation, discovering novel diet-related methylated loci (CpG sites). We will then evaluate the impact on gene expression, and if diet- and physical activity-related CpGs causally relate with CVD and risk factors, in particular obesity, dyslipidemia and diabetes. Finally, the added predictive value of these biomarkers over established CVD risk prediction scores will be evaluated. Complex novel analytical approaches will be used, including integration of multi-omics data through meta-dimensional and multi-staged analysis, and Mendelian Randomization to assess causality. This multidisciplinary project, combining epidemiology, nutrition, genetics and omics, will provide new insight in the aetiology of CVD and identify novel predictors to improve CVD precision medicine.

Expected skills::

Advanced R programming; basic knowledge in epidemiology; interest in nutrition

Possibility of funding::

Yes

Possible continuity with PhD :

Yes

Comments:

Co-supervision with Dr Elosua
