

Dr. Nunzia Iaccarino

Course title: *Introduction to metabolomics*

Language: English

Level of course: PhD course

No. of hours: 26 hours (13 lessons)

Course content

Metabolomics is the systematic study of metabolic profiles in biological samples, tissues and food matrices. It is the newest *omics* science, and a complementary tool to genomics and proteomics in nutraceutical sciences. The course gives an introduction to the use of metabolomics and its methods. In fact, the main theoretical and practical aspects of design of experiments, sample preparation, data acquisition, and data analysis will be discussed. The course will also cover advanced NMR and GC-MS techniques, including hands-on experience with analysis, processing, and identification of metabolites in such data.

Learning outcome

After completing the course, the student should: (1) Understand the principles of metabolomics. (2) Be able to evaluate and apply the appropriate experimental design in a given metabolomics research question (including sample processing and analytical strategies). (3) Be able to apply NMR and MS methods in metabolomics experiments. (4) Be able to analyze and interpret NMR and MS data. (5) Be able to critically evaluate metabolomics results and publications.

Lesson 1 (2 hours)

Introduction to omics sciences – Overview of metabolomics applications.

Lesson 2 (2 hours)

Metabolomics principles and approaches (targeted and untargeted) – Metabolomics workflow.

Lesson 3 (2 hours)

Design of experiments - Sample preparation for different foods and biofluids.

Lesson 4 (2 hours)

Basic principles and technical aspects of GC-MS.

Lesson 5 (2 hours)

Metabolite detection and identification in GC-MS – Laboratory experience.

Lesson 5 (2 hours)

Basic principles and technical aspects of NMR.

Lesson 6 (2 hours)

NMR metabolite assignment – Laboratory experience.

Lesson 7 (2 hours)

Introduction to multivariate data analysis – Basic principles of Principal Component Analysis and Partial Least Square Discriminant Analysis.

Lesson 8 (2 hours)

Data preprocessing (alignment, normalization, scaling).

Lesson 9 (2 hours)

Introduction to Matlab.

Lesson 10 (2 hours)

Hands-on experience with data preprocessing.

Lesson 11 (2 hours)

Hands-on experience with Principal Component Analysis and data interpretation.

Lesson 12 (2 hours)

Hands-on experience with Partial Least Square Discriminant Analysis and data interpretation.

Lesson 13 (2 hours)

Case study to solve.