

Dr. Leonardo Tenori, Ph.D., has got the doctorate in Structural Biology in 2008, with a thesis on the solution structures of protein complexes using NMR techniques. Now he is a researcher of the FiorGen Foundation and he is working in the field of metabolomics, especially in its applications in medicine and pharmacology. He is competent in high-field magnetic resonance techniques both mono- and bi-dimensional. Recently he has acquired considerable experience in the statistical treatment of metabolomics multivariate data.

NMR Metabolomics and its application to disease fingerprinting.

Leonardo Tenori

Metabonomics is a further “omic” science that is now emerging with the purpose of elaborating a comprehensive analysis of the metabolome, which is the complete set of metabolites in a biofluid, cell or tissue. Statistical analyses performed on NMR spectra of human urine samples reveal an invariant part characteristic of each person¹. This individual phenotype is relatively stable over a 2-3 years period². This finding provides evidence that individual metabolic phenotypes (metabotypes) exist and opens new perspectives for biomedicine.

For example, using a combination of statistical techniques we are able to discriminate celiac disease (CD) patients from healthy controls with high accuracy³. Interestingly after 12 months of gluten free diet all but one patients were classified as healthy, with metabolic profiles reverting to normal. Potential CD patients largely share the metabonomic signature of overt CD⁴, allowing us to hypothesize that CD exists as such before intestinal damage occurs.

In another study, a metabolic discrimination between early and metastatic breast cancer is also apparent⁵, and serum metabolic profiles of third line colorectal cancer patients indicate that NMR metabonomics can predict the overall survival of these patients better than any other biochemical and clinical prognostic tool⁶.

In summary, metabonomics may be the basis for a future new paradigm in personalized medicine and prevention, allowing us to really switch from classical reactive medicine to a true predictive and preventive medicine.

[1] Assfalg M et al. PNAS 2008 Feb 5;105(5):1420-4.

[2] Bernini P et al. J Prot Res. 2009 Sep;8(9):4264-71.

[3] Bertini I et al. J Prot Res. 2009 Jan;8(1):170-7.

[4] Bernini P et al. J Prot Res. 2011 Feb 4;10(2):714-21.

[5] Oakman C et al. Ann Oncol. 2011 Jun;22(6):1295-301

[6] Bertini I et al. Cancer Res. 2012 Jan 1;72(1):356-64.