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Quantitative shotgun lipidomics: Tracks, tricks and challenges

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Lipids are essential molecules of every living organism. Lipids assemble bilayers, determine the architecture of cellular membranes, and orchestrate numerous biological processes. Every living organism is equipped with metabolic pathways that produce structurally and functionally high diverse lipid species. The manners of regulations in lipid metabolism are poorly illuminated, yet of pivotal importance since imbalance in the lipid metabolism has been linked to pathophysiology of numerous diseases. The lipidome – the lipid repertoire of biological materials – includes species that differ in types of head groups, presence, length, and number of fatty acyl chains, numbers and positions of double bonds, and presence of additional modifications such as glycosylation and hydroxylation etc. Obviously the combination of these gives rise to thousands of lipid species. Lipidomics methodologies enable to monitor lipid metabolism via systematic and quantitative measurements of individual lipid species in complex mixtures. Here, we present the shotgun lipidomics methodology, an advanced mass spectrometry-based approach that enables absolute quantification. Shotgun lipidomics allows in a single setup to identify and quantify hundreds of lipid species belonging to 15-20 lipid classes. In brief, sample lipids are extracted into organic solvents and directly infused into mass spectrometer via electrospray ionization. Lipids are separated and identified based on the unique mass to charge ratios of their ions and fragmentation patterns, and absolutely and accurately quantified against internal standards. The simple and robust setup makes this approach particularly suited for high throughput lipidomics analysis. The typical workflow, challenges, and considerations on the shotgun lipidomics will be highlighted.

Biography

Mesut Bilgin has completed his PhD degree from Christer S. Ejsing's lipidomics lab at University of Southern Denmark in December 2012. Here, he developed quantitative shotgun lipidomics platform for functional studies of yeast and mammalian cells lipidome. Right, after that he joined Andrej Shevchanko's lab MPI-CBG, Dresden Germany. Here, he continued his work on shotgun lipidomics and additionally he developed a LC-MS based platform for quantification and discovery of endocannabinoids, small lipids. In 2015, he got offered to start a lipidomics lab at Danish Cancer Society Research Center (DCRC) and since 2015 he has been the Head of Lipidomics Core Facility (LCF) at DCRC.

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