Biomolecules carbonylation in oxidative stress related human diseases

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Keywords
- Oxidative stress related human disorders
- Protein and lipid oxidation
- Carbonyl stress

Carbonyl stress
Oxidative stress (OS) related human disorders, such as diabetes, obesity, metabolic syndrome and neurodegeneration, are characterized by elevated levels of oxidatively modified biomolecules (protein, lipids and DNA). Oxidation of biomolecules results in numerous functional dysfunctions associated with disease progression. One of the most abundant and hazardous class of modifications are reactive carbonyls (aldehydes, ketones), which are considered as a major hallmark of OS-related diseases. Accumulation of reactive aldehydes and ketones leads to carbonyl stress, which is characterized by high in vivo toxicity due to protein aggregation, membrane disruption and mutagenesis. Sensitive and specific detection of carbonyls as well as determination of pathological threshold (control vs disease) will facilitate identification of prognostic biomarkers and development of preventive therapies.

Lipid carbonylation
Lipid derived reactive carbonyls are characterized by large variety of species with different physicochemical properties. New high throughput analytical methods for sensitive and specific detection of lipid peroxidation products were developed and allowed simultaneous detection of different types of carbonyls using shotgun- and LC-MS-based lipidomics approach.

Protein carbonylation
Protein carbonylation results either from direct oxidation of amino acid residues or from the reaction between proteins and secondary products of glycation and lipid-peroxidation. Detection of carbonylated proteins in vivo is challenged by their extremely low abundance. New method utilizing MS-based enrichment was developed and tested for specific detection of carbonylated proteins in complex biological samples. Additionally combination of oxolipidomics and proteomics techniques allow to map adducts between proteins and lipid peroxidation products.