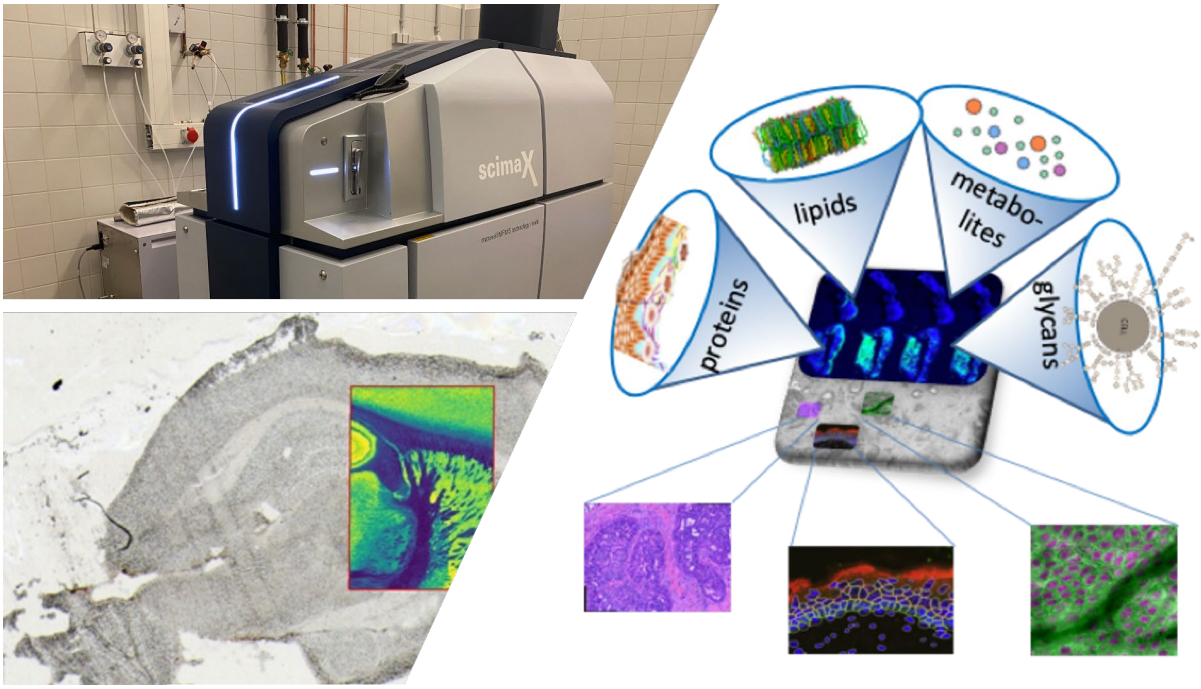
MULTIMODAL IMAGING – A PICTURE SAYS MORE THAN A THOUSAND DATAPOINTS



Supervisory Team[1]

Primary Supervisor: *Martina Marchetti-Deschmann, Technical Chemistry, Institute of Chemical Technologies and Analytics*

TU Wien project partners: *Philipp Thurner, Hannes Mikula, Ruth Birner-Grünberger, Aleksander Ovsianikov*

External academic partners: *Florian Gruber, Medical University Vienna, Austria*

External industry partners: *Dror Fixler, Bar Ilan Institute, Israel*

Project Description

With our collaborator at the Medical University and the Bar Ilan Institute in Israel, we aim for a better understanding of localized UV damage in skin after UV exposure (cellular damage including DNA damage) by using different analytical imaging methods. In this context we also strive for standardized material (skin phantoms) and methods to compare the potential of different imaging technologies.

[1] The Early Stage Researchers (ESRs) will be accompanied during their thesis by an individual "Thesis Advisory Committee" (TAC), which will guide the ESR through the graduate studies. The TAC will consist of the thesis primary supervisor, and two additional members of the Supervisory Team selected by the ESR.

This PhD project focuses on the combination of imaging approaches which allow to bridge the gap between different resolutions, from the nano to the macro scale, and approaches looking for already known analytes (targeted analysis) or visualizes structures by highlighting the distributions of yet unknowns (untargeted). With a strong emphasis on imaging mass spectrometry, we will look for lipid, metabolite, (glycol)protein changes in fixed and unfixed skin equivalents. New molecular probes will be developed for in vivo labelling not only to increase sensitivity but also specificity of detection to innovatively combine imaging techniques like mass spectrometry with Raman/IR, high-resolution fluorescence microscopy, atomic force microscopy, electron microscopy and other MS-based methods (SIMS, LAICP) to ultimately get a better understanding of biological events relevant for UV induced skin aging.

Key Goals and Tasks

The primary aim of this PhD thesis is to determine UV effects on epidermal keratinocytes and the extracellular matrix (mainly collagen) by using different analytical imaging modalities in order to achieve holistic information on UV damage in the tissue context upon correlation of generated data.

Skin equivalent model systems provided by our collaborators will be used to develop multimodal detection of damaged cells within a tissue. This organotypic model system contains human cells. In this model the state of the cells can manipulated via UV exposure prior to assembly of the model system, or it can be applied after assembly, in a setting very closely reflecting irradiation of human skin *in vivo*.

We expect to observe in a spatially resolved manner differences in cell death, apoptosis, aberrant or premature differentiation of cells, organelle changes and DNA damage. On a biomolecular level we expect to observe the adaptation of metabolism leading to the production of reactive oxygen species and changes of metabolite levels in close vicinity of senescent cells. We will evaluate specific lipids, their modification and adductome changes. All analysis will be carried out in comparison to control samples. We will target the UV induced release of microvesicle particles and the detection of such vesicles in tissue by imaging techniques.

Project-specific Requirements

- Completed master studies in chemistry, (bio-) physics, biochemistry, biotechnology, computer science, biomedical engineering or an equivalent degree
- Knowledge on handling of biological material, analytical chemistry and mass spectrometry (MS) in particular is of advantage
- Experience with imaging methods, dealing with large data sets and software solutions for the comprehensive analysis and presentation of data is an advantage but a basic understanding of statistical data analysis is necessary
- Interest in working in the field of instrumental analytical (bio-)chemistry and in particular in working with different mass spectrometers (FT ICR, ToF, Ion Mobility) to develop innovative instrumental combinations
- Enthusiasm for bringing different areas of research together and applying new methodologies
- Affinity for interdisciplinary work and working with students
- Willingness to travel to project meetings and scientific conferences
- Excellent English language skills in scientific field

- Personal skills: dissemination of research results, independence, problem solving skills, high team and communication skills