

# Electrochemical detection of diagnostic and predictive biomarkers

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## Summary

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Supervisor: Prof. Dr. Barbara Obermayer-Pietsch  
Availability: This position is available.  
Offered by: Medical University of Graz  
Application deadline: Applications are accepted between July 15, 2019 00:00 and September 15, 2019 23:59 (Europe/Zurich)

## Description

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### Background:

Biomarkers for early disease detection and monitoring are of utmost importance for a number of common metabolic diseases, such as diabetes mellitus (DM) and insulin resistance, but also during pregnancy, e.g. for the risk of preeclampsia. Currently used parameters like blood glucose require mostly invasive or complex diagnostic settings and in disease risk prediction and monitoring, whereas long-term parameters such as HbA1c tests might be too wide-meshed for sufficient disease control.

We developed a new electrochemical measurement approach based on urinary molecules, where biomarkers can be measured in spot urine using new technologies together with our academic and company partners. This non-invasive technique might greatly improve diagnostic and therapy control in patients with less access to specialized facilities, young children or patients in the developing countries.

In addition, several other biomarkers might be measured using this new approach and new detection techniques such as the use of aptameres are subject of this project. Many new pathways, including smad3 in patients at risk for diabetic nephropathy, from the TGF- $\beta$ /Smad signalling or other specific molecules could be detected in DM patients.

Developing a stable device for various urinary measurements in the framework of the biomarker project CBmed ("Center for Biomarker Research in Medicine", [www.cbmed.org](http://www.cbmed.org)) might be beneficial for at-home-testing of DM and other parameters in large groups of patients using innovative mobile phone software in the near future.

### Hypothesis and Objectives:

Based on our recent publications and ongoing studies, we were able to show that measurement of urinary markers such as C-peptide may help to assess individual beta-cell function as a new non-invasive and at-home technology. We aim to develop a reliable and easy-to-access measurement method together with our academic and company partners in CBmed. We will evaluate urinary and serum biomarker measurements in existing biobanking cohorts such as the BioPersMed cohort including baseline and follow-up phenotyping of more than 1000 subjects >45 years with cardiovascular risk factors such as DM based on a large number of clinically relevant laboratory, imaging and anthropometric measurements, but also other cohorts of interest, e.g. in pregnancy monitoring. Potential new biomarkers could be established via metabolomic screening and tested in appropriate in-vitro systems and a label free POC device should be developed to a prototype status.

### Methodology:

The PhD candidate will be involved in study planning, procedures and analysis of the BioPersMed cohort data and material as well as the prospective clinical studies. In a close cooperation with the technicians of the framework partners, practical aspects of the developments for a broad application and further research topics will be generated. Furthermore, new candidate molecules for urinary measurements in risk patients will be established using metabolomic and targeted metabolomic techniques and will be tested in in-vitro models as well as specific candidate molecules e.g. out of new microbiome/metabolome pathways.

### References:

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2. Jainandunsing S, Wattimena JL, Rietveld T, van Miert JN, Sijbrands EJ, de Rooij FW. Post-glucose-load urinary C-peptide and glucose concentration obtained during OGTT do not affect oral minimal model-based plasma indices. *Endocrine.* 2016;52(2):253-62
3. Khashayar P, Amoabediny G, Larijani B, Hosseini M, Verplancke R, De Keersmaecker M, Adriaens A, Goemaere S, Fiers T, Vanfleteren J. A highly sensitive electrochemical biosensor based on AuNP-modified gold electrodes for selective determination of serum levels of crosslaps. *Biotech.* 2017;7(5):312



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