**EMRP Call 2011 - Health, SI Broader Scope & New Technologies**

Selected Research Topic number: **SRT-h19**
Version: 1.0

# Title: Continuous glucose measurement methods and systems for medical surveillance


## Abstract

Currently, there are a large number of commercially available glucose measurement systems. However, these systems are not able to fulfil the necessary metrological criteria required by legislation, e.g. the European *in vitro* device (IVD) Directive 98/79/EC.

An automated, continuous glucose calibration and measurement system, which can meet this legislation and provide reliable and continuous monitoring of glucose content in physiological liquids such as whole blood or serum samples, is needed for the monitoring of critically ill patients. Blood glucose content is considered to be one of the most important parameters for medical surveillance and such a system would improve patient care whilst avoiding the disadvantages of current glucose monitoring methodologies.


## Conformity with the Work Programme

This Call for JRPs conforms to the EMRP Outline 2008, section on “Grand Challenges” related to Health on pages 7 and 8 and in the sections on page 22 and 41.


## Keywords

glucose measurement, calibration methods, glucose sensors, physiology, medical diagnostics, medical monitoring


## Background to the Metrological Challenges

Of the large number of glucose measurement systems (e.g. electrochemical sensors, amperometric sensors, optical enzyme-based biosensors, and fluorescence biosensors) built and marketed, none is currently able to fulfil the necessary metrological criteria required by legislation e.g. IVD Directive 98/79/EC [1]. New devices are required which can meet this legislation and can achieve the required performance in terms of analytical and diagnostic sensitivity, accuracy, repeatability, reproducibility, and limits of detection.

Continuous glucose monitoring systems for patients, such as haemodialysis patients and diabetics, require much improvement. So called ‘hand held glucometers’ cannot be considered to supply SI-traceable values, are not made to monitor glucose continuously and are not suitable for online measurements. They also cannot measure continuously and have no calibration ability. In addition to this, there are no devices for non-invasive continuous blood glucose monitoring for diabetes patients.

Validated methodologies for the calibration of continuous glucose monitoring systems are required, including established reference measurements to ensure traceability. The traceability of values assigned to calibrators and/or control materials need to be assured through reference measurement procedures and reference materials. Methods for characterising the reference materials could include precision titration, coulometric Karl-Fischer methods, gas and liquid chromatography, and mass spectrometry.

The goal should be to produce SI-traceable values from a continuously monitoring measurement system, which is self-calibrating and able to correct for deviations according to body status.


**EURAMET, EMRP-MSU**
National Physical Laboratory
Hampton Road, Teddington,
Middlesex, TW11 0LW, UK

Phone: +44 20 8943 6666
emrpA169@npl.co.uk
www.euramet.org



EMRP
European Metrology Research Programme
Programme of EURAMET

The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union

## Scientific and Technological Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the JRP-Protocol.

The JRP shall focus on the measurement and characterisation of continuous glucose calibration and measurement systems, to provide reliable and continuous monitoring of glucose content in physiological liquids such as whole blood or serum samples.

The specific objectives are:

1. To develop new methodologies for accurate, continuous glucose monitoring, including non-invasive monitoring and establish validated methodologies for traceability. Performance abilities such as:
   - selectivity,
   - sensitivity (the target for the combined measurement uncertainty of the glucose level is < 5 %, relative to a glucose level of 3 mmol/L) and
   - acquisition frequency (the target for the measurement acquisition frequency is once per second).

   should be addressed.
2. To develop stable reference materials for the repeatable calibration of the continuous glucose monitoring systems. Flow relevant properties such as kinematic viscosity, osmotic properties and freezing point depression should be characterised for the reference materials.

For all objectives, proposers should consider current standards and legislation (e.g. IVD Directive 98/79/EC). This JRP will require close co-operation with experts and practitioners from relevant medical areas.

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes, and it is expected that multidisciplinary teams will be required. To enhance the impact of the research, the involvement of the appropriate user community such as medical practitioners and industry is strongly recommended, both prior to and during methodology development.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this.

The total eligible cost of any proposal received for this SRT is expected to be significantly below the 2.7 M€ guideline for proposals in this call.

## Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (eg letters of support) is encouraged.

You should detail other impacts of your proposed JRP as detailed in the document “Guide 4: Writing a Joint Research Project”

You should detail how your JRP results are going to:

- feed into the development of urgent documentary standards through appropriate standards bodies
- transfer knowledge to the medical community.

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research organisations other than NMIs and DIs to be involved in the work

## Time-scale

The project should be of up to 3 years duration.

## Additional information

The references were provided by PRT submitters; proposers should therefore establish the relevance of any references.

[1] *In vitro* device (IVD) Directive 98/79/EC