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

Selected Research Topic number: **SRT-h01**
Version: 1.0

Title: Metrology for monitoring infectious diseases, antimicrobial resistance, and harmful micro-organisms

Abstract

Infectious diseases, caused by viruses and micro-organisms, are a major cause of death and illness. Many diseases are caused by multiple pathogens which constantly evolve, making accurate measurement challenging. Monitoring levels of infection, via diagnostic methods, is vital for public health protection, however, metrological support for these methods is lacking, with issues concerning sensitivity, specificity, and comparability. Further to this, the development and validation of new and emerging molecular approaches for detecting infectious agents and antimicrobial resistance is required.

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 21, 22 and 41.

Keywords

Infectious diseases, respiratory tract infections, antimicrobial resistance, molecular diagnostics, micro-organisms, air sampling; PCR

Background to the Metrological Challenges

Infectious diseases remain one of the world's biggest killers; they account for more than 14 million deaths a year and are behind only cardiovascular disease in terms of causing death. Within these 14 million deaths, respiratory tract infections account for almost half of all infectious diseases.

The protection of human health is an obligation under Article 152 of the EC Treaty. In a Union where millions of people cross borders each day, tackling health threats, requires close collaboration between Member States and the European Commission, in co-operation with the World Health Organisation (WHO).

The rapid increase in the spread of drug-resistant microbes over the past decade has undermined efforts to control infectious diseases. The WHO report: Priority Medicines for Europe and the World (2004) identifies threats to public health such as antibacterial or multidrug resistance or pandemic influenza, for which present treatments or preventive measures are unlikely to be effective in the future, as requiring immediate action. In addition, as the effort to control infectious diseases continues, new threats are emerging. Micro-organisms can adapt themselves, resulting in new strains of infection, e.g. HIV/AIDS in the 1980s, SARS in 2003 and H1N1 influenza pandemic in 2009.

The 2010 annual report by the European Centre for Disease Prevention and Control stated that although the EU has improved the harmonisation of systems, definitions, protocols and data, the basic epidemiological data from Member States still contains inconsistencies in the quality and comparability of data. Respiratory tract infections, in particular, remain difficult to accurately diagnose due to the lack of sensitivity/specificity of laboratory diagnostic tests and the comparability and traceabilty of measurements. Many diagnosis techniques are also lengthy and time consuming.

To address these issues research is needed to develop the accurate detection of pathogens (using methods such as PCR and air sampling), to develop methodologies for accurately quantifying the performance of diagnostic assays and to develop low-cost, rapid diagnostic tests to improve the accuracy and speed of diagnosis (all diagnostic devices should comply with IVD Directive 98/79/EC). Further to this, the basic

metrology underlining the measurement of infectious agents, is urgently needed to ensure that methods are appropriately used and that data generated is accurate, traceable and comparable.

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 traceable measurement and characterisation for monitoring infectious diseases, with particular focus on respiratory tract infections and harmful micro-organisms.

The specific objectives are:

1. To develop quantitative, validated and highly accurate methodologies for the measurement of respiratory tract infectious agents, such as viruses and micro-organisms (e.g. bacteria). Methods should include PCR (e.g. real-time quantitative PCR) and air sampling.
2. To develop methodologies for accurately quantifying the performance of commercially available diagnostic assays, 'in-house' clinical assays and novel emerging approaches. Major sources of uncertainty should be identified and methods should include, real-time quantitative PCR, digital PCR and sequencing, as well as single molecule fluorescence detection.
3. To quantitatively and comparatively evaluate new and emerging molecular approaches for the surveillance and monitoring of infectious disease load and detection of antimicrobial resistance mutations. Critical performance criteria and the limitations of the multi-parametric approaches should be identified. Methods should include:
    - molecular screening approaches; capable of identifying multiple pathogens and mutations within pathogens that may lead to anti-microbial resistance.
    - next generation sequencing,
    - mass spectrometry,
    - microarrays and
    - high throughput microfluidic PCR.
4. To quantitatively and comparatively evaluate new and emerging diagnostic technologies for the rapid detection of infectious agents. Assessment criteria should include matrix effects, rapid detection using PCR, extraction, isothermal amplification, direct detection approaches, signal generation, interpretation and integration.

For all objectives, proposers should consider current regulatory requirements. Input from end-users and key stakeholders, such as the World Health Organisation, national health protection agencies and major hospitals across Europe, should also be included at all stages of the JRP.

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 around 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.