



European Metrology Research Programme

Health

An overview of the funded projects from the Targeted Programme Health.

The aim of these projects is to support the reliable and efficient exploitation of diagnostic and therapeutic techniques and the development of new technologies to improve healthcare and patient protection, while limiting costs.

Focus is placed on research to address major health-related societal challenges including lifestyle-related health issues, neurodegenerative diseases and global health issues such as anti-microbial resistance and emerging epidemics.

Protecting human hearing

Preventing excessive noise exposure

Excessive noise exposure is a major cause of hearing loss, which costs the EU around 200 billion euros per year and causes severe deterioration in the quality of life of sufferers.

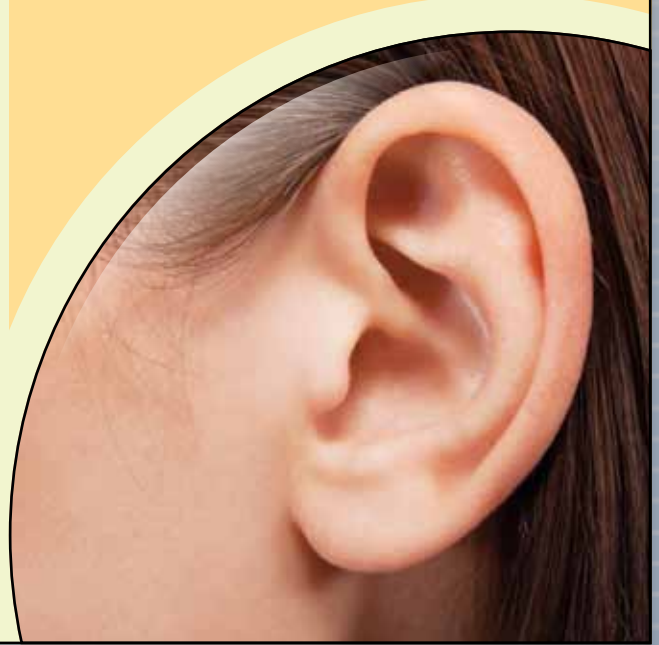
New technologies and industrial processes emit infrasound (low frequency) or airborne ultrasound (high frequency). However, no standards currently exist in these frequency ranges and there are growing concerns that these sounds, which lie outside audible limits, may be hazardous to human hearing.

This project will help to protect hearing by improving our understanding of how we perceive non-audible sound and establishing effective safety criteria. New ear simulators will also be produced to calibrate equipment such as headphones used in routine medical screening, improving the quality and reliability of measurement results.

Project HLT01 Metrology for a universal ear simulator and the perception of non-audible sound

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Microvesicle biomarkers

Early diagnosis of diseases

Microvesicles are present in body fluids such as blood and urine and, because they are different in patients and healthy people, can be used as biomarkers for diseases such as cancer, diabetes and cardiovascular disease.

The use of microvesicles as biomarkers would be less invasive than current techniques and could contribute to the earlier detection of common diseases and a reduction in the cost of healthcare. However, detecting microvesicles is difficult because of their small size and current techniques can only detect around 1–2 % of the total amount present, which is not accurate enough to make a diagnosis.

This project will develop reliable, comparable and quantitative analysis of microvesicles. It will improve methods for collecting body fluids, isolating microvesicles and measuring their size and total population.

Project HLT02 Metrological characterisation of micro-vesicles from body fluids as non-invasive diagnostic biomarkers

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Improving and increasing ultrasound treatment

Standardised dosages for ultrasound

Ultrasound can treat a range of conditions and recent developments include new treatments for cancer, stroke and bone repair.

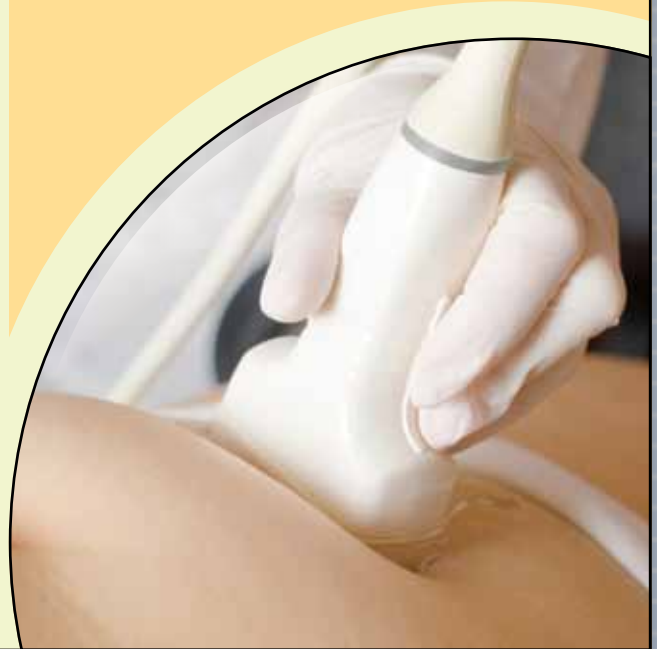
However, the techniques needed to standardise the dosage of ultrasound do not yet exist and this prevents healthcare providers from calculating the amount of ultrasound required for a particular therapy and creating personalised treatment plans. This, in turn, can result in over- or under treatment, causing harm to the patient and preventing the implementation of new techniques.

This project will establish measurements, reference standards and modelling techniques to build traceability for exposure to ultrasound and the dose to tissue. The results will support an increase in the use of ultrasound treatments, help healthcare providers make better treatment plans, improve patient quality of life and benefit the medical manufacturing industry.

Project HLT03 Dosimetry for ultrasound therapy

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Europe's National Measurement Institutes working together

The majority of European countries have a National Measurement Institute (NMI) that ensures national measurement standards are consistent and comparable to international standards. They also investigate new and improved ways to measure, in response to the changing demands of the world. It makes sense for these NMIs to collaborate with one another, and the European Association of National Metrology Institutes (EURAMET) is the body that coordinates collaborative activities in Europe.

EURAMET has implemented the European Metrology Research Programme (EMRP), a project programme organised by 22 NMIs and supported by the European Union, which will have a value of over 400 M€. The EMRP facilitates the formation of joint research projects between different NMIs and other organisations, including businesses, industry and universities. This accelerates innovation in areas where shared resources and decision-making processes are desirable because of economic factors and the distribution of expertise across countries or industrial sectors.

EURAMET wants to involve European industry and universities at all stages of the programme, from proposing Potential Research Topics to hosting researchers funded by grants to accelerate the adoption of the outputs of the projects.

Full details can be found at: www.euramet.org

Improving diagnostic devices

Delivering cost-effective, point-of-care testing

Diagnosing and managing disease is increasingly reliant upon the detection and measurement of biomarkers. This type of *in vitro* diagnostics is vital for cost effective healthcare, point-of-care monitoring and personalised medicine, but can also benefit forensics, food production, ecology and sports science.

In vitro diagnostics use specific molecules called probes that are attached to a surface where they capture the specific 'target' biomarkers. The reliability of this technique depends on the ability to control how the probe molecules are presented at the interface, which is where they come into contact with the biomarkers.

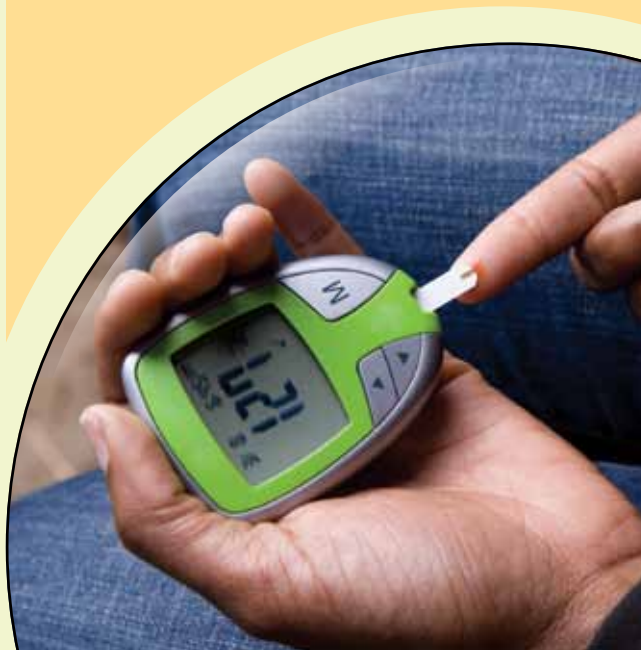
This project will meet the needs of diagnostic device manufacturers in the rapidly growing diagnostic device industry by providing guides, standards and protocols, and by assessing new and emerging techniques capable of targeting many different biomarkers simultaneously.

Project HLT04

Metrology for the characterisation of biomolecular interfaces for diagnostic devices

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projects.npl.co.uk/HLT04-BioSurf



Diagnosis and treatment using metalloproteins

Identifying and quantifying metalloproteins

A metalloprotein is a protein containing a metal ion within its structure, e.g. haemoglobin, which contains iron and carries oxygen in the blood. Metalloproteins are important markers for conditions ranging from deficiency diseases to Down's syndrome. They are also used in cancer treatment but, for many of them, there are no traceable measurement methods available.

This project will address this problem by creating methods for quantifying the many different types of metalloprotein. It will also improve the quality of measurement results obtained from patient samples, by developing new methods for separating, identifying and quantifying the proteins. The project will also provide reference values for clinical trials.

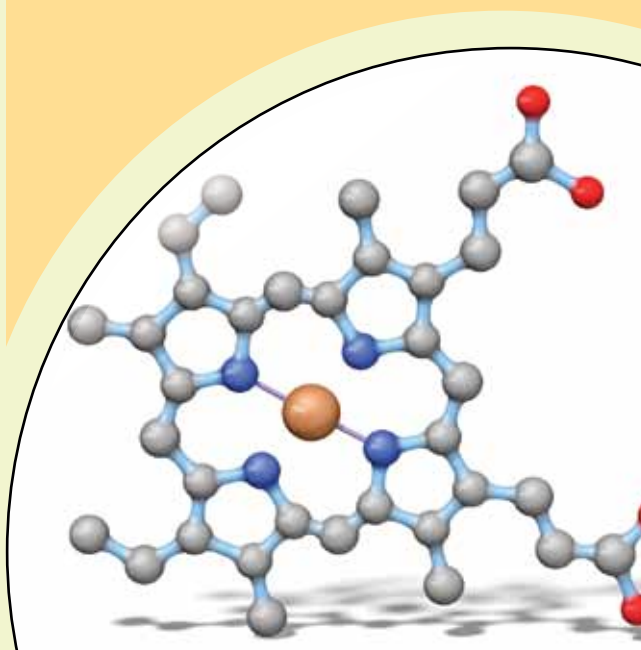
Such results will help meet EU regulations, improve diagnosis and improve the quality of patient care.

Project HLT05

Metrology for metalloproteins

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MRI safety

Improving safety and widening the use of MRI

Magnetic Resonance Imaging (MRI) is an indispensable tool in modern medicine with around 30 million patient exams in the EU each year and an excellent safety record. However, some new advances in MRI scanning have not yet made it into hospitals because of unresolved safety issues for both patients and medical staff.

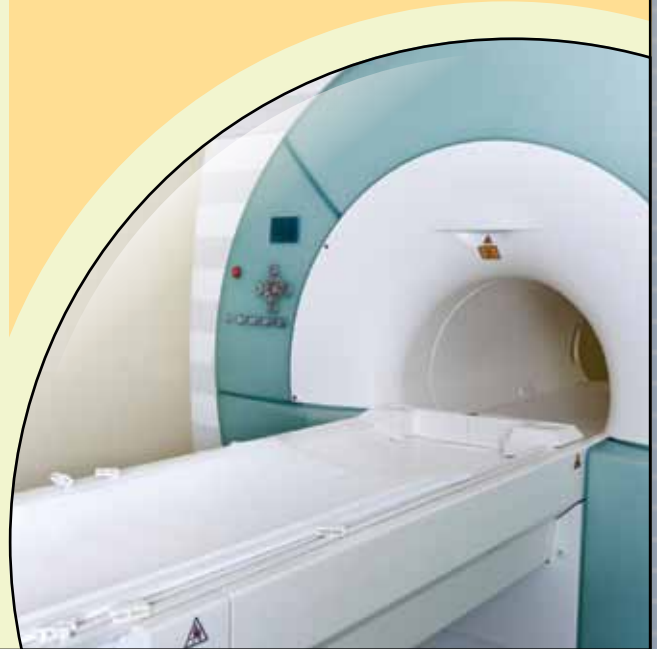
For example, approximately 10 % of the population are excluded from MRI because they have medical implants, simply because the risk to such patients cannot currently be quantified.

This project will improve risk assessments for MRI scans and provide more complete and robust safety data for both patients and medical staff. It will also remove any unnecessary safety margins due to insufficient knowledge, leading to better image quality, improved diagnoses and shorter scan times.

Project HLT06 Metrology for next-generation safety standards and equipment in MRI

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Measuring drug flow rate

Improving the safety and efficiency of drug delivery

One of the most important aspects of drug delivery is the amount of drug delivered, but knowing the flow rate – how fast a quantity of drug is delivered – is also vital for safe and efficient health care treatment.

Currently, drug delivery at low flow rates cannot be set with sufficient accuracy as the measurements required have either not been validated or do not exist. In addition, accuracy is further reduced if multi-pump infusion is involved; where more than one pump delivers a drug.

This project will develop measurement services for low flow rates, e.g. between 1 nanolitre per minute and 100 millilitres per minute, and assess the performance of commercial flow meters and drug delivery devices. It will also make drug delivery more reliable by improving calibration services for drug delivery devices and by producing best practice guides.

Project HLT07 Metrology for drug delivery

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Detecting and monitoring infectious disease

Improving disease management

Infectious diseases account for over 20 % of human deaths globally and 25 % of all morbidity. Accurate and rapid diagnosis, alongside methods for monitoring transmission and spread in the community and resistance to medicines, are therefore vital to protect public health.

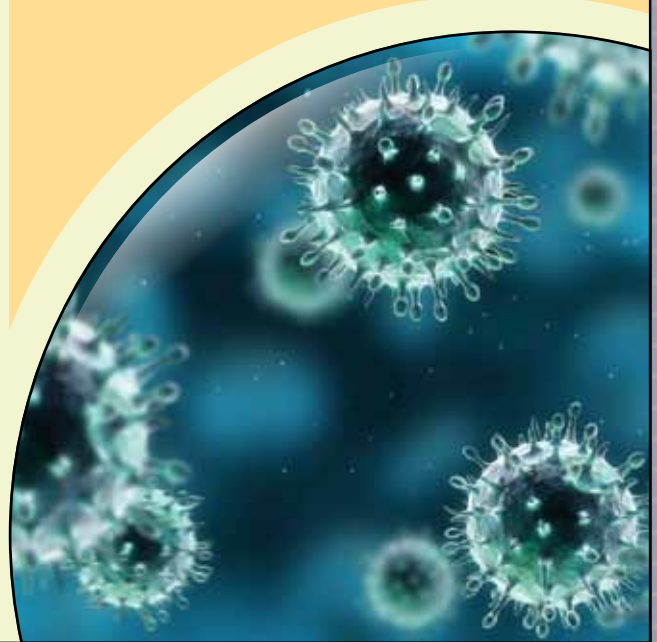
Molecular approaches such as qPCR and sequence analysis offer the potential to improve management of infectious diseases through increased speed, accuracy and sensitivity over conventional microbiological methods. However, the measurement infrastructure for such molecular approaches is lacking, with issues concerning quality, comparability and traceability of measurements.

This project will address these issues by developing high accuracy methods for the detection of infectious agents. It will also evaluate new and emerging molecular approaches for the surveillance and monitoring of infectious disease load and detection of antimicrobial resistance mutations.

Project HLT08 Metrology for monitoring infectious diseases, antimicrobial resistance, and harmful micro-organisms

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Improving radiotherapy dose

Ensuring radiotherapy treatment meets International requirements

Modern radiotherapy treatments aim to deliver the highest possible dose to the smallest possible area to limit the damage to healthy tissues.

They do this by using complex radiation fields that deliver intense doses to areas of only a few millimetres across. However, the methods to measure such doses are currently not accurate enough and absorbed dose to water primary standards are needed to bridge the gap between the standard reference and clinical conditions. There is also a lack of standardisation for the measurement of doses and, therefore, treatment may not meet the requirements set out by the International Commission on Radiation Units and Measurements.

This project will develop new standards to improve dose measurements and support the updating of international codes of practice.

Project HLT09 Metrology for radiotherapy using complex radiation fields

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Measurements in molecular medicine

First design principles for molecular medicine

In order for molecular medicine to address global health issues such as viral epidemics, anti-microbial resistance and metastatic cancers, a better measurement infrastructure is required. Central to this is an understanding of how the structure of a molecule (a protein) dictates its activity, or how it behaves.

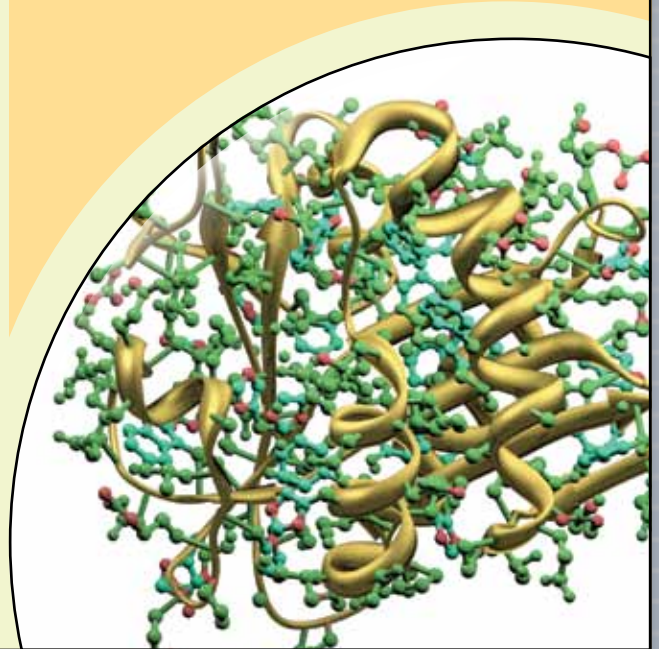
This project will focus on a set of peptides (the building blocks of proteins) chosen for their relation to global health issues.

The project will then use a combination of low and high-resolution measurements and molecular dynamic simulations to increase our understanding of the structure-activity relationship for these peptides and to produce a set of first design principles for the prediction of a molecule's behaviour from its sequence or structure.

Project HLT10 Metrology for biomolecular origin of disease

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projects.npl.co.uk/HLT10-BiOrigin



Controlling molecular radiotherapy

Validating the methods used for more targeted therapies

Molecular radiotherapy, also known as nuclear medicine therapy, specifically targets cancerous cells through the use of 'carrier' molecules that attach themselves to tumours or accumulate in specific parts of the body, e.g. the thyroid gland. Currently, molecular radiotherapy is not universally used, but it has the potential to become an important weapon in the fight against cancer.

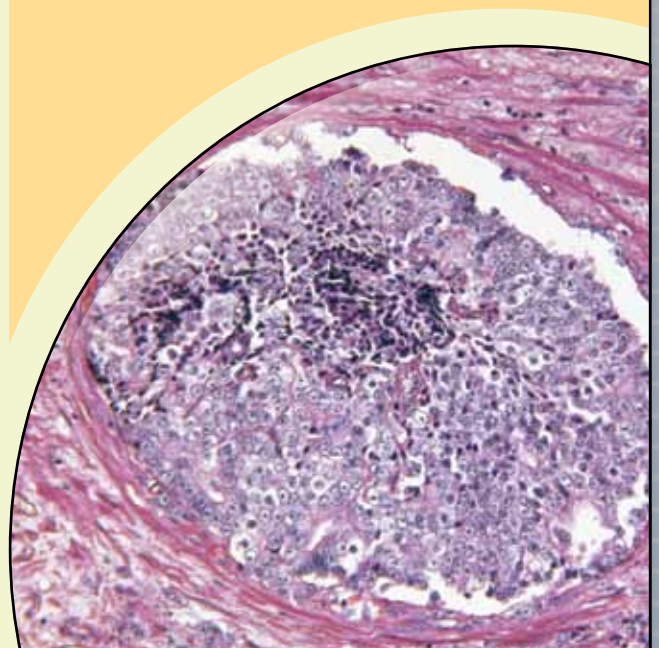
Molecular radiotherapy treatments are based on the measured activity of the radioactive material administered, but as different patients take up different amounts of radiation, it means that they receive different dosages.

This project will validate the methods and analyse the uncertainties involved in molecular radiotherapy procedures. This will support the use of individualised patient treatments based on the absorbed dose, and lead to more effective targeted therapy and treatments.

Project HLT11 Metrology for molecular radiotherapy

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EMRP

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