Catalyst

Spring 2015

Discover the latest news and events from the UK's designated National Measurement Institute for chemical and bio-measurement

As a designated institute, LGC is addressing the UK's chemical and bio-measurement needs, which underpin the development and sustainability of the healthcare, food, environment, security and energy sectors.

The measurement needs of industry drive the direction of our research programmes and the importance of collaboration with innovative organisations is recognised. We hope you find this newsletter informative and we welcome your feedback at nmshelp@lgcgroup.com.

Catalyst Editorial Team

LGC

National Measurement System

What's new?

Alzheimer's disease diagnosis: the end of the guessing game?
LGC scientists are validating a non-invasive diagnostic technique for early detection of Alzheimer's disease.

A new tool for proteomic analysis
LGC scientists have produced a prototype quality assurance material to improve the robustness of protein analysis.

Sports science
A new trackside test kit that could help elite athletes perfect their training regimes was revealed by LGC at the European Bioanalysis Forum Open Symposium in Barcelona (November 2014). The new assays, for detecting both free and total (free and serum-protein bound) cortisol within human serum using a field-based transportable platform technology, provide real time data for cortisol levels produced during exercise. These levels can be used to determine whether the athlete has been overworked and needs to be rested, or can train harder.

Digital PCR and infectious disease detection
The potential that digital PCR could offer for infectious disease detection was outlined by LGC at the qPCR & Digital PCR Congress, which took place in London in October 2014. The current disadvantages with the routine detection and quantification of bacterial and viral pathogens were highlighted and the key advantages of absolute quantification for the detection of pathogenic microbes were described.

Peanut allergen quantification: a tough nut to crack
LGC scientists have developed the first peanut allergen quality control material that will help protect the 500,000 people in the UK suffering with a peanut allergy.

Water pollution: more than just a drop in the ocean?

Water is essential for human life and while 70% of the Earth's surface is covered with water, it is a limited resource. Discover how LGC scientists are using measurement research to help to clean up our water supplies and safeguard the world's rivers and oceans for future generations.

As the world's population continues to grow, the impact we are having on the planet's water resources also increases, with water pollution now a major priority for the EU and the rest of the world.

Fertilizers and pesticides used by the agricultural industry leaching into rivers and groundwater, toxic metals used in industrial processes accumulating in nearby rivers and lakes, and microbial pollutants from sewage entering rivers and oceans can all have a detrimental impact on the quality of our water.

Legislation for protecting water in England and Wales dates back to Victorian times, when Acts of Parliament were passed to give local authorities, statutory boards and companies the powers they needed to provide water and sewerage services to expanding populations. However, it wasn't until the 1960s and the introduction of the Water Resources Act, that the focus began to shift to protecting and preserving water supplies.

Several Acts were introduced in the decades that followed aimed at targeting specific areas for concern, such as the 1972 London (Dumping) Convention which was intended initially to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter, and the 1976 Bathing Water Directive (updated in 2006) which was introduced to ensure the quality of the waters that people use for recreation were of a suitable quality.

Despite this, demand by the public and environmental organisations for cleaner rivers and lakes, groundwater and coastal beaches continued to increase and led to the introduction in the EU of the Water Framework Directive (WFD). The WFD aims to protect, enhance and restore the condition of all water in the natural environment, with ambitious targets set initially for 2015.

Yet as the deadline nears, the majority of water bodies in the UK and in other EU countries are failing to meet this target status. One of the issues is a lack of suitable measurement procedures to allow accurate determination of low-level pollutants. Researchers at LGC are working to address this issue by developing traceable methods for the accurate measurement of the total concentration and partitioning of pollutants listed under the WFD.

Polybrominated diphenyl ethers (PBDEs) have been shown to be carcinogenic in animal studies and have been identified by the WFD as a critical pollutant. PBDEs are now subject to stringent legislation, however they can still be found in many everyday household items such as upholstered furniture, mattresses and other synthetic home textiles with flame retardants, and TV or computer equipment containing plastic casings, cables and circuit boards. These items often end up in landfill where potentially harmful levels of PBDEs could leach into rivers. By providing validated reference methods for PBDEs, these compounds can be monitored in environmental waters to ensure they meet European water quality standards.

LGC scientists have developed a gas chromatography-inductively coupled plasma-mass spectrometry (GC-ICP-MS) method to quantify the six target PBDE congeners (28, 47, 100, 99, 154 and 153) at ng/kg levels. The method has been validated and a full uncertainty budget provided.

Panayot Petrov, Science Leader from the Inorganic Analysis team at LGC, explained: "The accurate determination of critical pollutants in water samples is still challenging for many laboratories due to the extremely low limits of quantification required. There is an urgent need to develop a reference method which can provide reference values to help field laboratories to validate their water quality monitoring methods."

Methods to extract the target PBDEs from water samples, based on liquid/liquid extraction, were optimised using a model water system containing a high amount of organic colloids (humic acid) and PBDEs at the low levels specified by the WFD. The method was applied successfully to environmental samples (lake and river waters), spiked with PBDE concentrations ranging from 0.099 to 0.135 ng/kg. The spike recoveries ranged from 91% to 129% with measurement uncertainties between 22% and 41%, which are better than the 50% required by the WFD.

In a separate project, LGC scientists are undertaking a study aimed at identifying links between microbial communities and different anthropogenic pressures on aquatic systems, which can be used to develop bioassays that provide rapid indicators of water quality.

Water is exposed, directly and indirectly, to different anthropogenic pressures which impacts on water quality. Direct effects include chemical pollutants, nutrient loading and accidental waterborne contamination. Indirect consequences of human activities, such as climate change, can result in favourable habitats for pathogens (mainly bacteria and viruses) or increase the frequency of algal blooms, thus reducing the water quality.

Microbial communities encompass a broad spectrum of microorganisms, such as bacteria, fungi, viruses and algae, which exert a strong influence on global processes such as the carbon, nitrogen and sulphur biogeochemical cycles. Their quick response to environmental changes and rapid reproductive capacity provide a sensitive measure of the state of the environment, and make them an ideal bioindicator for water quality.

Through an EU Marie Curie project, a secondee from the European Commission's Joint Research Centre (JRC) is working with LGC's Molecular Biology team to develop a kit, including a ready-to-use plate containing defined primers for quantitative real time PCR, to target microbial community bioindicators.

Carole Foy, Principal Scientist, Molecular and Cell Biology, said: "So far, methods for water quality assessment under the Water Framework Directive are only focused on analytical methods for chemical monitoring, microscopic analysis to monitor the ecological quality status and classical microbial methods for pathogen detection. These approaches are time consuming, require highly skilled technicians and provide fragmented and partial information of water quality, which are not enough to prevent and mitigate the impact of anthropogenic pressures and their consequences.

"This research will develop tools to enable microbial communities to be used as rapid bioindicators for water quality, taking into account biological, chemical and physical parameters."

Samples have been collected from several sites along the River Tiber in Italy. The river was chosen for the study as it is affected in different areas by several sources of pollution and due to the availability of historical water quality data.

These two projects are examples of the work LGC undertakes to support enforcement of regulations and demonstrate how we use science for a safer world.

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Training courses

Helping laboratories produce valid analytical results

LGC has developed a programme of training courses focused on providing analysts with the best tools to ensure the validity of their measurements.

Using Excel for data analysis

Due to its widespread availability, relative ease of use and potential to handle large data sets, Excel is often used in laboratories to handle and analyse data. LGC offers a one-day course covering the main Excel functions commonly applied to data analysis. The course focuses on the practical application of Excel to present and analyse data in a clear and efficient way.

Experimental design

LGC also offers a course on experimental design, a tool that can have a very positive effect in reducing the cost and time of method development and validation processes.

Training abroad

Our training programme also includes courses on method validation and measurement uncertainty. Whilst these courses have run mainly in the UK for over 15 years, LGC is increasingly delivering training in other territories, having recently run courses in Indonesia, Saudi Arabia and China.

Bespoke courses

The courses in LGC's analytical quality training programme can also be customised to meet specific training requirements.
For more information visit
www.lgcgroup.com/training

The NMS website is moving

The Chemical and Biological Metrology website has moved from www.nmschembio.org.uk to www.lgcgroup.com/nmi. We have migrated key content including:

- Good practice guides
- Case studies
- Newsletters
- Technical papers
- Technical reports
- Posters and presentations
- Books
- Software

Keep up to date on our research projects and learn more about what we could do for you and the impact we have at www.lgcgroup.com/nmi.

Read all about it

Recent peer-reviewed papers co-authored by LGC scientists

- **Heroult J et al, The potential of asymmetric flow field-flow fractionation hyphenated to multiple detectors for the quantification and size estimation of silica nanoparticles in a food matrix, Anal. Bioanal. Chem., 2014, 406(16), 3919-27**
- **Devonshire A et al, Towards standardisation of cell-free DNA measurement in plasma: controls for extraction efficiency, fragment size bias and quantification, Anal. Bioanal. Chem., 2014, 406(26), 6499-512**
- **Sanders R et al, Considerations for accurate gene expression measurement by reverse transcription quantitative PCR when analysing clinical samples, Anal. Bioanal. Chem., 2014, 406(26), 6471-83**
- **Dunn P, Malinovsky D, Goenaga-Infante H, Calibration strategies for the determination of stable carbon absolute isotope ratios in a glycine candidate reference material by elemental analyser-isotope ratio mass spectrometry, Anal. Bioanal. Chem., 2014, DOI: 10.1007/s00216-014-7926-1**
- **Malinovsky D et al, Investigation of mass dependence effects for the accurate determination of molybdenum isotope amount ratios by MC-ICP-MS using synthetic isotope mixtures, Anal. Bioanal. Chem., 2014, DOI: 10.1007/s00216-014-8112-1**
- **Chisholm M, Hopkins D, Process modeling and optimization of a cell therapy manufacturing operation, Regen. Med., 2014, 9(4), 427-30**
- **Pritchard C et al, Quantification of human growth hormone in serum with a labeled protein as an internal standard: essential considerations, Anal. Chem., 2014, 86(13), 6525-32**
- **A special issue of Analytical and Bioanalytical Chemistry, Volume 406/16, the topical collection 'Characterisation of Nanomaterials in Biological Samples' edited by Heidi-Goenaga Infante, is available online.**

For the latest papers, posters and publications by LGC scientists visit the LGC website www.lgcgroup.com/nmi/publications

Is DNA sequencing the solution in the fight against drug resistant diseases?

Barely a year passes without a new epidemic hitting the headlines, with SARS, influenza and the current Ebola epidemic all having dominated UK headlines. Media reports of rising death tolls with each new epidemic strikes fear in many and yet there are other prevalent infectious diseases within our communities causing morbidity and mortality that don't even make the news. Many of these diseases are becoming resistant to the drugs used to treat them.

Antimicrobial resistance is a big problem. The development of antibiotics has been vital to modern medicine – making many clinical interventions possible and adding a predicted extra 20 years to our life expectancy. Yet the rise of antimicrobial resistance is threatening to make them ineffective in the future, shortening lives and stopping other medical advances that are dependent on them.

In the 80 years since the discovery of penicillin, our overuse of antibiotics has put pressure on bacteria to evolve resistance, leading to the emergence of untreatable superbugs that threaten the basis of modern medicine.

Infectious diseases, including pneumonia and sepsis, are big killers in the UK and yet the drugs used to treat them are becoming increasingly ineffective. We have one of the highest rates of tuberculosis (TB) in Western Europe, with nearly 8,000 cases reported in 2013[1], which is of growing concern to the UK and is complicated further by potential drug resistance.

Accurate and rapid diagnosis of these diseases is vital to protect public health. Scientists believe that advances in technology for next generation sequencing (NGS), together with the development of reference databases, could hold the answer.

Clinically, the capacity of NGS methods to generate large data sets offers new strategies for typing and tracking pathogens and identifying drug resistance, thus enabling the rapid identification of emerging infectious diseases and monitoring of outbreaks. LGC is leading on a global project to investigate the ability of NGS techniques to analyse drug resistance in diseases like TB.

TB is classed as multi-drug resistant (MDR) when the bacteria are resistant to the two core antibiotics (Rifampicin and Isoniazid) of the four drug treatments used to treat the infection. Drug resistant TB can emerge during a sensitive infection or be caused by transmission of already resistant strains (primary resistance) in the same way that drug susceptible (regular) TB is transmitted, that is via droplets released from the lungs of people with the active respiratory disease and passed from person to person by, for example, speaking, coughing or sneezing.

It can also be caused by the development of resistance mutations during inadequate therapy (secondary resistance). This can lead to the development of further resistances such as extensively drug-resistant (XDR) TB, a less common type of MDR TB. XDR-TB is resistant to almost all drugs used to treat TB, together with the best second-line medications and at least one of three injectable drugs.

Dr Denise O'Sullivan, a researcher in LGC's Molecular Biology team, explained that LGC has been investigating sources of error in methods for identifying drug resistance mutations in respiratory infections such as TB.

"Working with University College London's Centre for Clinical Microbiology, we have sequenced the DNA extracted from clinical samples of drug resistant TB to assess the ability of current methods to reliably identify unique mutations which are conferring the drug resistance," she said. "This included XDR-TB samples, which were sequenced multiple times on the Illumina® HiSeq™ - a powerful ultra-high-throughput sequencing system."

[1]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/360335/TB_Annual_report__4_0_300914.pdf

All stages of the sequencing, from the first step of library preparation right through to sequencing and the analysis of the data, were performed separately. The findings informed the identification of a single nucleotide polymorphism (SNP) – a DNA sequence variation occurring commonly within a population (e.g. 1%) in which a single nucleotide in the genome (or other shared sequence) differs between members of a biological species or paired chromosomes. The SNP can reveal the particular strain of TB which, when paired with knowledge of the risk of transmission within communities and association with multiple drug resistance, means effective treatment strategies can be developed.

The team is also investigating the ability of the molecular (PCR) methods currently used in clinical laboratories to accurately diagnose TB. Samples containing safe versions of *M. tuberculosis* are being sent to different laboratories around the world for analysis to compare results and assess laboratory performance.

Dr O'Sullivan added: "Overall this should improve methods currently used for the monitoring of *M. tuberculosis* and drug resistance. The ultimate aim is to establish routes for improving the accuracy, robustness, comparability and traceability of measurements within the metrology and diagnostics/epidemiological communities across Europe and link these into international standardisation initiatives through the Centres for Disease Control and Prevention, and World Health Organisation."

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Join the discussion

Are you missing out on discussions on microbial molecular profiling? If so, join the LinkedIn 'Targeted Molecular Microbial Analysis Forum'.

SI traceable absolute carbon isotope ratios

LGC scientists have produced the first material certified for carbon isotope ratios traceable to the SI (International System of Units),which will facilitate improved instrumental calibration for measurements in drug testing, forensic analysis and research in the field.

Although the relative abundance of isotopes such as ^{13}C and ^{12}C was fixed when the earth was formed – and on a global scale has not changed since – the isotopic composition of a material can be affected subtly by its geographical origin, or how it has been processed or manufactured. For example ^{13}C is more abundant in marine carbonates than it is in hydrocarbons in crude oil.

Measurement of the small differences in isotope ratios can provide information on the origin of materials and has been used extensively in food authenticity testing, forensics and environmental analysis. To establish an 'isotopic profile' for a material, the ratios of the stable isotopes of a range of elements such as $^{2}H/^{1}H$, $^{18}O/^{16}O$, $^{13}C/^{12}C$, $^{15}N/^{14}N$ and $^{34}S/^{32}S$ can be determined using mass spectrometry.

For example, Florida orange juice will have an isotopic signature consistent with water from Florida. By analysing the hydrogen and oxygen isotope ratios, it is possible to tell if the orange juice is fresh juice bottled in Florida or if it has been made from a concentrate and hydrated from water sourced elsewhere.

The adulteration of honey with high fructose corn syrup can be detected using carbon isotope ratios and counterfeit whiskeys can be identified using hydrogen and oxygen isotope ratios. Other applications include the determination of the source of pollution such as an oil spill, identification of counterfeit drugs and money, and identification of murder victims.

Traditionally, results of carbon isotope ratio measurements are not traceable to the SI. Instead they are reported using the Vienna Pee Dee Belemnite (VPDB) scale – defined using a sample of fossilised shells of an extinct organism called a belemnite (something like a shelled squid) collected decades ago from the banks of the Pee Dee River in South Carolina. As the availability of this material reduced, so other reference standards were calibrated to the original sample and data is normalised to the values of that standard. Results are reported as $\delta^{13}C$ values (expressed in parts per thousand, ‰), relative to the VPDB standard which, by definition, has a $\delta^{13}C$ of 0 ‰. Existing reference materials are certified only in terms of $\delta^{13}C$ values on the VPDB scale.

Development of a reference standard with assigned absolute carbon isotope ratios, i.e. the ratios of abundances of carbon-13 and carbon-12 isotopes, was a priority for the science community to improve the accuracy of their measurements and enable comparison of carbon isotope ratio data obtained by different instrumental techniques. The result of a 3-year measurement research project is an amino acid (glycine) reference material certified for absolute carbon isotope ratios.

LGC scientists successfully developed a novel calibration strategy based on the use of gravimetrically prepared synthetic isotope mixtures from enriched carbon isotopes for the determination of absolute carbon isotope ratios by multi-collector inductively coupled plasma mass spectrometry (MC-ICPMS). The calibration procedure was published recently in the Journal of Analytical Atomic Spectrometry[1]. This validated method was used to produce the glycine certified reference material.

Dmitriy Malinovskiy, Science Leader in isotope ratio analysis, explains: "Glycine was selected as a reference material due to its relevance to both the food and forensic sectors, and its relative simplicity in preparation. Glycine is used as a sweetener/taste enhancer and can also be used in certain drug formulations to improve gastric absorption of the drug."

Dmitriy says: "Measurements using a reference material certified for absolute isotope ratios have particular benefit in that mass balance calculations for measurement results are significantly more accurate. Use of the reference material will therefore enhance the quality of measurements in laboratories, enabling analysts to produce traceable, comparable and reliable results."

Glycine with certified $^{13}C/^{12}C$ isotope amount ratio traceable to the SI has now been approved by the European Reference Materials (ERM®) consortium and is the first reference material produced with SI traceable absolute carbon isotope ratios. The material, ERM® AE672a, is available from LGC Standards (www.lgcstandards.com).

The validation of methodologies for absolute carbon isotope ratio measurements builds on a growing key platform capability established within LGC through its designated institute role for chemical and bio-measurement.

[1]Malinovskiy D, Dunn P and Goenaga-Infante H, Anal J. At. Spectrom., 2013, 28, 1760-71

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New reference materials available from LGC Standards

New materials

ERM-AE672a	Glycine characterised for absolute carbon isotope ratio
LGCQC101-KT	A kit containing two chocolate dessert quality control materials for use in the measurement of peanut protein
LGC7249	5% w/w beef in sheep meat
LGC7248	1% w/w beef in sheep meat
LGC7247	5% w/w turkey in sheep meat
LGC7246	1% w/w turkey in sheep meat
LGC7245	5% w/w chicken in sheep meat
LGC7244	1% w/w chicken in sheep meat

Replacement materials

LGC2601	Indium certified for enthalpy of fusion and melting temperature
ERM-AC401g	80 mg/100 mL ethanol solution certified for ethanol content
ERM-AC409b	20 mg/100 mL ethanol solution certified for ethanol content
ERM-BB501b	Processed meat certified for proximates, hydroxyproline and elements
ERM-BA003a	Wine (nominal 15 % alcohol) certified for alcohol content
LGC7223	Sheep meat authenticity standard for meat species work
LGC7224	Chicken meat authenticity standard for meat species work
LGC7225	Turkey meat authenticity standard for meat species work

Sharing the knowledge

Phil Dunn, a researcher from the Inorganic Analysis team at LGC, discussed the challenging measurements involved in the certification of the new isotope ratio reference material at the Government Chemist conference in November.

During the presentation, Phil explained how variations in isotope ratios can be applied to food authenticity and origin discrimination. He explained how isotope ratios are measured using Elemental Analysis Isotope Ratio Mass Spectrometry before outlining how LGC scientists developed the new isotope ratio reference material for absolute carbon isotope ratio traceable to the SI.

The conference, 'Beating the cheats: Quality, safety and authenticity in the food chain' was designed to demonstrate the importance of measurement in the fight against fraud, and ensuring food authenticity and safety.

A recording of the presentation and slides is available to download from the Government Chemist website. Visit www.gov.uk and enter "Government Chemist conference presentations" into the search box.

Nanomaterials – studying the bigger picture

Is there a big cost hidden behind the benefits that nanoparticles offer? LGC scientists research the metrology that is essential in ensuring the safety of nanotechnology.

Nanotechnologies are increasingly being used in everyday life, from the medicines we take to the food that we eat, but the potential effects when they come into contact with biological systems are not yet fully understood.

Nanotechnology operates on a scale that is difficult to imagine. A nanoparticle is generally considered to be a particle measuring between one nanometre and 100 nanometres. One nanometre is one billionth of a metre; less than half the diameter of the DNA double helix. A single strand of human hair is around 80,000 nanometres in width.

Hundreds of consumer goods now contain nanomaterials including cosmetics, such as make-up, antibacterial creams, sunscreen, soaps and shampoos; food additives and packaging; paints; sportswear; and medicines. The global market for nanomaterials is estimated at 11 million tonnes at a market value of €20 billion and products underpinned by nanotechnology are forecast to grow from a global volume of €200 billion in 2009 to €2 trillion by 2015[1].

As the impact of nanotechnologies on human life becomes more prevalent, it is becoming increasingly important to be able to characterise nanomaterials for their potential effects when they contact biological systems, whether through accidental exposure or intended applications.

In 2009, the European Scientific Committee on Emerging and Newly Identified Health Risks published a report highlighting concerns about the methods for evaluating the potential risks of nanomaterials[2]. It highlighted the need for further research to develop validated and standardised methodology for assessing risks associated with nanomaterials. The UK Nanotechnologies Strategy[3] was launched in 2010 with the challenge of ensuring that society can benefit from novel applications of nanotechnology, whilst a high level of protection of health, safety and the environment is maintained.

The REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) Regulation (EC No. 1907/2006) provides an over-arching legislation applicable to the manufacture, placing on the market and use of substances on their own, in preparations or in articles. Nanomaterials are covered by the definition of a “substance” in REACH, even though there is no explicit reference to nanomaterials.

The definition of a nanomaterial presents particular measurement difficulties. Although there has been an EU recommendation (2011/696/EU) which sets criteria for the number of nanoparticles that need to be present in a material for it to classify as a nanomaterial, the EU Commission ruled that it needed more clarity. It has asked the Joint Research Centre (JRC) – the European Commission’s in-house science service – to see how this definition could be modified to improve its clarity, effectiveness and application. The JRC has already published two reports on definitions and measurement of nanoparticles and the conclusion of its complete review was expected to be published in a third report[4,5] in late 2014.

However, due to concerns expressed in literature reports indicating nanoparticle toxicity *in vitro* using human primary and immortalised cell lines, as well as *in vivo* in animal models, some regulations have already been introduced despite limited data available on human occupational exposure. These regulations incorporate restrictions on the use of nanomaterials based on the EU recommended definition. Cosmetic Regulation EU No 1223/2009 – one of the first to be introduced – states that all ingredients present as nanomaterials must be clearly indicted with the term ‘nano’ in the ingredients list on the product packaging. Other areas of legislation where there are currently proposals for controlling the use of nanomaterials include food ingredients and medical devices.

In 2012 the Biocidal Products Regulation EU No 528/2012 was adopted, which regulates products such as disinfectants for home and industrial use, preservatives and pest control products. The regulation was the first to include a formal definition of nanomaterials and also highlighted the need for scientific testing to ensure the safety of the nanomaterials[6].

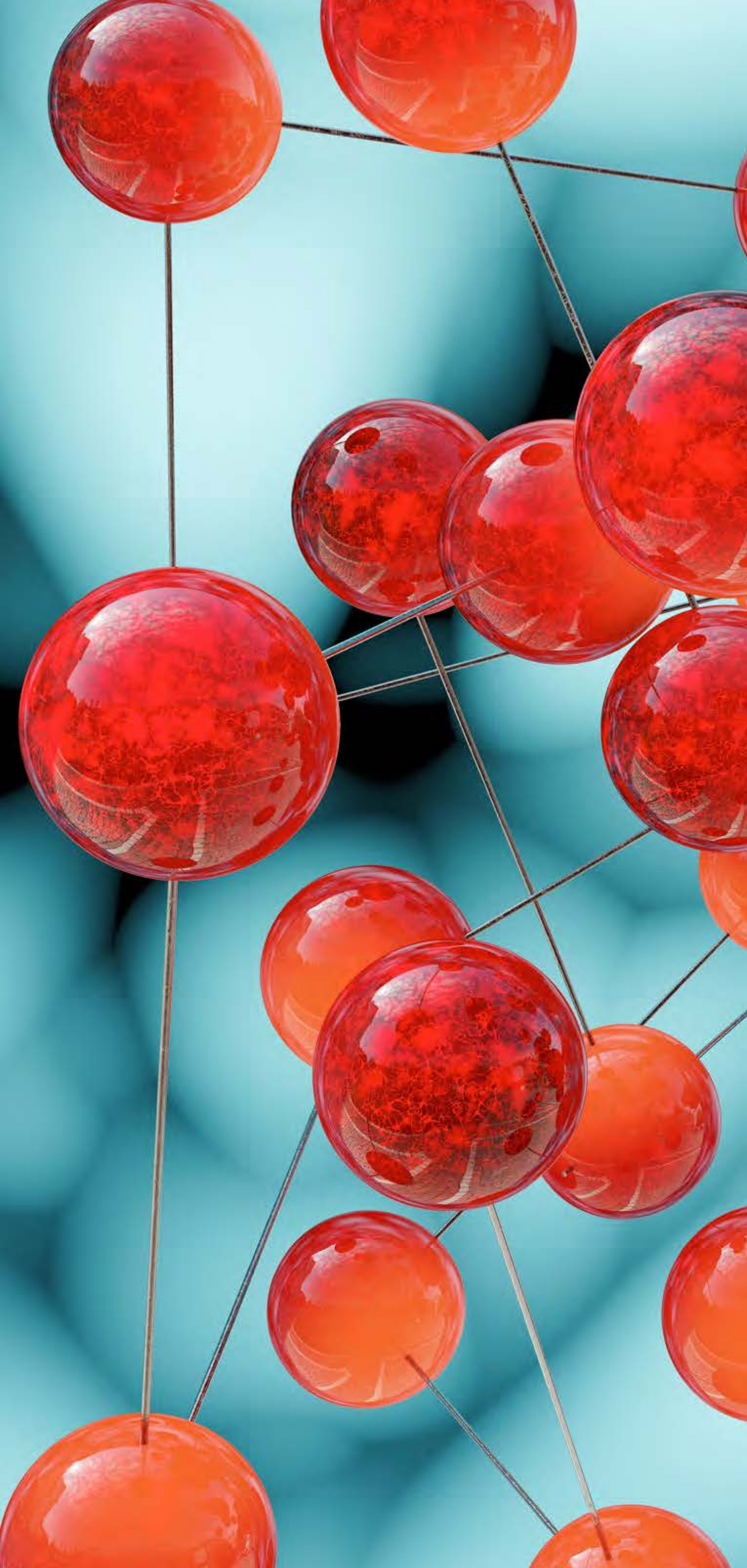
So far, measurement research has largely been focused on the development of methods to characterise nanomaterials for their physical properties in their native monodispersed powder forms or in idealised simple matrices. As a consequence, ability to accurately and reliably measure changes in nanomaterial physico-chemical and optical properties when they are dispersed in the more complex biological matrices that they naturally encounter is severely lacking. This limits understanding of the functional properties of nanomaterials.

To overcome this, LGC scientists are leading on a joint research project, *‘Chemical and Optical Characterisation of Nanomaterials in Biological Systems’*, funded by the European Metrology Research Programme (EMRP). This ‘NanoChOp’ project, which was launched in 2012, focuses on the development of methods to characterise nanomaterials for their physical, chemical and optical properties in biological matrices in support of research aiming to understand how nanoparticles interact with biological systems. It involves National Measurement Institutes, academics and industry from across Europe.

Dr Dorota Bartczak, researcher, explains: “We know that when nanomaterials interact with biological systems and, for example, become coated with serum proteins, their physical and chemical properties can change, significantly affecting the functionality and behaviour of the material. Therefore, in order to understand the evolution of nanomaterials, it is important to be able to measure their physicochemical properties not only in a simple idealised water environment but also within more complex biological matrices. This is a particularly challenging task, since matrix components are likely to interfere with numerous techniques and assays, leading to ambiguous readouts.”

The NanoChOp project team is developing quantitative measurements, traceable to appropriate reference systems, which can be applied to a range of biological matrices of differing complexity. The project brings

[1] http://ec.europa.eu/nanotechnology/index_en.html
[2] http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_023.pdf
[3] https://www.gov.uk/government/groups/nanotechnology-strategy-forum
[4] http://publications.jrc.ec.europa.eu/repository/handle/111111111/31515
[5] http://publications.jrc.ec.europa.eu/repository/handle/111111111/32544



together a consortium of institutes which have established world-leading expertise in physical analysis, chemical analysis, optical analysis, material characterisation and biotechnology in order to pool their capabilities to address this challenge.

LGC scientists provide expertise in chemical characterisation. They have developed methods for the separation and detection of nanomaterials in complex matrices using field flow fractionation combined on-line with multi-angle light scattering and inductively coupled plasma mass spectrometry. LGC also has expertise in characterising cellular models and has developed approaches for label free analysis of cell responses to nanomaterials.

Other project partner laboratories are comparing different techniques for measuring the physicochemical and extrinsic properties of nanomaterials in aqueous and biological media using dispersion protocols developed by LGC.

Dr Heidi Goenaga-Infante, Principal Scientist, says: “Ultimately, the NanoChOp project will help to alleviate public concern regarding the safety of many applications of nanoparticles by providing the nanobiotechnology and nanomedicine sectors with validated protocols to perform their analysis. In turn, this will lead to regulatory and legislative bodies being equipped with coherent and reliable data to make informed decisions.”

For more information about the ‘*Chemical and Optical Characterisation of Nanomaterials in Biological Systems*’ project, visit http://nanochop.lgcgroup.com/

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[6] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2012.167.01.0001.01.ENG

Getting more out of your NMS

Access our experts

The National Measurement System Helpdesk at LGC provides organisations with access to experts in a range of analytical, chemical and biological measurement technologies and related topics such as analytical quality assurance, method validation, measurement uncertainty, reference materials and proficiency testing.

Advice is normally provided free of charge, but occasionally it may be necessary to charge fees to cover the costs of dealing with more complex enquiries.

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Good practice guides

The NMI publications area of the LGC website provides access to a range of technical guides, including:

- **Good practice guide for the application of quantitative PCR**
  A guide for individuals who are starting to use qPCR. The guide provides 'tried and tested' approaches and offers troubleshooting for common issues.
- **Guide to achieving reliable quantitative LC-MS measurements**
  The RSC Analytical Methods Committee (AMC) guide provides practical advice to assist users of liquid chromatography-mass spectrometry (LC-MS) in avoiding many common problems and in developing reliable, quantitative applications as quickly and cheaply as possible.

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