



# ANNUAL REVIEW | 2021



Department for  
Business, Energy  
& Industrial Strategy

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## EXECUTIVE SUMMARY

At the National Measurement Laboratory (NML), hosted at LGC, we are proud of our heritage in providing a world-leading measurement infrastructure capable of solving some of the most demanding chemical and biological measurement challenges facing the world today, to support a greener, safer, healthier and more prosperous future.

For everyone, 2021 was a year for restructuring and reorganisation, while continuing to face the evolving challenges of the COVID-19 pandemic. Our work continued to contribute to the global response to the pandemic, providing high accuracy measurements and supporting healthcare providers and industry. We led within the global measurement and standards communities, and helped drive the work mapping the measurement challenges going forward in order to be better prepared for future pandemics.

It was also a year that highlighted the importance of climate action and sustainability. Through our work helping to address emerging measurement needs across areas such as alternative plastics and electronic waste recycling, we are helping to deliver the UK commitment to achieve net zero carbon by 2050.

We continue to work closely with our stakeholders from across a wide variety of sectors to address measurement needs, encourage innovation and develop and leverage skills and expertise for the benefit of the whole of the UK.

Thousands of decisions that affect our everyday lives are based on measurements.

To be able to rely on these decisions, there must be confidence in the measurements themselves.



It is more important than ever to ensure the challenges that affect our society are underpinned by sound measurement science so that we can have confidence in the decisions being made. Sound measurement brings confidence to important societal decisions such as are made for disease diagnosis, therapeutic development, environmental protection and food safety. The NML is supporting measurements across this wide spectrum of application areas including clean energy, carbon capture and environmental monitoring which link directly to the UK Government Net Zero Strategy. We also continue to contribute to the need for fit for purpose diagnostics by, for example, using the experience gathered during the SARS-Cov-2 pandemic to lead the international metrology community approach to standardisation issues to ensure we are better prepared for future pandemics.

Derek Craston  
Chief Scientific Officer



## OUR NATIONAL ROLES

We are the UK's designated institute for chemical and bio-measurement and support the work of the Government Chemist.

We are sponsored by BEIS as part of the National Measurement System group.

We ensure trust and confidence by providing access to the highest quality chemical and bio-measurements in the UK to support government and industry needs.

We address measurement challenges of the future to foster innovation, promoting productivity and economic growth.

**Through improved chemical and bio-measurements we support manufacture and trade, protect consumers, enhance skills and improve quality of life.**



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WE WORK IN **PARTNERSHIP** WITH INDUSTRY, NHS, GOVERNMENT AND ACADEMIA



OUR LEVERAGED INCOME FROM ALL SERVICES WAS **£3.7 MILLION**

### OUR NUMBERS 2021

WE WORK WITH **OVER 900 DIFFERENT ORGANISATIONS**

**43** PEER-REVIEWED PUBLICATIONS

**1** NEW ISO ACCREDITATION

**5** REFERENCE MATERIALS

**29** CONTRIBUTIONS TO ISO STANDARDS  
(9 PUBLISHED)

## OUR STRATEGIC PARTNERSHIPS

Our new partnership structures bring value to communities, industry, academia, the NHS, entrepreneurs, start-ups, and small to medium-sized enterprises through the development of networks of excellence that bring together existing and potentially disparate expertise. These networks have both strong industrial links as well as flexibility and ease of access.



As new technologies for diagnostics and preparedness for future pandemics take centre stage in public policy, the mission of our Centre for Advanced Measurement Research & Health Translation to be a specialist hub in measurements for health translation continues to be highly relevant, for the UK and globally.

The Centre continues to provide expertise in measurement to inform applied research in areas such as the development of quantification methods for effective delivery of nanoparticle-based drug delivery systems for cancer therapeutics. Now with a new LGC Chair in Measurement Science for Health – made possible through contributions from the University of Strathclyde, the Community for Analytical Measurement Science (CAMS) and LGC – our Centre is positioned well for the future of metrology research and innovation translation.

Through our partnership with the National Manufacturing Institute of Scotland (NMIS), we are supporting talent growth within the food and drink sector. Our analytical expertise has fed into the development of food and drink related courses in support of the National Transition Training Fund (NTTF) in Scotland to provide industry with the skilled workers it needs.

## PARTNERSHIPS FOR THE FUTURE



Building on our partnership activities in the North of England, we have structured a partnership with the University of Leeds and Nexus that will become a new Northern Cell Metrology Hub, with launch expected in 2022.

This collaboration will build on our leadership in international cell metrology and documentary standards initiatives. It will create a world-leading cell metrology hub, for the benefit of our mutual research interests in cancer diagnostics, flow cytometry and bio-imaging. In addition, this partnership will support regional innovation opportunities.

## THE NML ACROSS THE UK

We work with partners across the UK to maximise expertise and generate the best environment to support and encourage innovation, improving chemical and bio-measurements for the benefit of the public.



# THE NML AND THE GLOBAL MEASUREMENT COMMUNITY

As part of our role representing the UK to ensure international standardisation, we regularly coordinate and participate in inter-comparison studies with other countries' National Measurement Institutes, under the auspices of the Consultative Committee for Amount of Substance: Metrology in Chemistry and Biology (CCQM). We are regarded as one of the top institutes for our designation within the global measurement community. Successful participation in these studies supports our Calibration and Measurement Capabilities (CMCs) claims which underpin our measurement services.

Excellent performance at CCQM this year has led to a record number of 24 new CMC claims. The CMC claims are all for inorganic capabilities, and eight are for different elements in tissues, biological fluids and food. These claims support both calibration services and reference material production activities, which will ultimately contribute to improved food safety and better healthcare services.

**6**  
(2 LEADING) | **CCQM STUDIES**

**24** | **NEW CMC CLAIMS**



**WE WORK GLOBALLY TO STANDARDISE MEASUREMENT SCIENCE**

## EUROPEAN MEASUREMENT RESEARCH FUNDING FOR HEALTH

The European Metrology Programme for Innovation and Research (EMPIR) coordinates research projects to address grand challenges while supporting and developing the International System of Units (SI). This year we were part of 5 new EMPIR projects that cover areas from pollution monitoring to food safety, health to electronic waste recycling.

## STANDARDS FOR IMPACT IN INFECTIOUS DISEASES

We are leading a project to develop new underpinning standards for improved bio-analytical measurement in infectious diseases (Bio-stand 2). Building on our previous work on the development of methodology and guidelines for achieving traceability and comparability in the measurement and diagnosis of infectious diseases, this project aims to ensure the greatest impact, end user engagement and uptake of the measurement research.

## INDEPENDENT VALIDATION OF QUANTITATIVE MAGNETIC RESONANCE IMAGING (MRI)

The EMPIR project 'IMET-MRI' – Improved metrology for quantitative MRI (qMRI) – aims to support the clinical uptake of qMRI methods by providing a metrological foundation that enables independent validation of qMRI measurements. The NML will apply our Inductively coupled plasma mass spectrometry (ICP-MS) and quantitative Nuclear Magnetic Resonance (qNMR) capability to characterise test materials for the production of phantom quality controls suitable for metrological assessment of qMRI measurements.



The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

## IMPROVING IN VITRO DIAGNOSTICS ACROSS EUROPE

Laboratory testing is at the heart of healthcare: an estimated 70% of medical decisions depend on in vitro diagnostics (IVDs). The availability of robust and metrologically traceable IVDs enables accurate test results irrespective of the laboratory, the IVD provider, or the instrumentation used for testing. This in turn ensures greater confidence in diagnostics for healthcare providers and ultimately patients.

Through the European Metrology Network for Traceability in Laboratory

Medicine (EMN-TLM), we are supporting the development of a European infrastructure that will improve the capability of the measurement community to respond with greater efficiency to the needs of reference laboratories, European quality assurance providers and the In Vitro diagnostic industry through a coordinated and sustainable approach.

In 2021, a survey was circulated to reference laboratories and European quality assurance providers to define their measurement

needs. Alongside work to determine the full extent of the current European measurement capabilities, the outcomes will help shape activities of the Network, prioritise analytes for which standardisation is a requirement and ultimately deliver the reference methods and materials needed to help improve patient diagnoses.



## STANDARDS FOR DIAGNOSTICS AND THERAPEUTICS

Documentary standards provide an agreed “best way of doing things”, based on expert knowledge and best practice from across the world. They can cover almost anything, from protecting the safety of our food, to producing reference materials, to medical devices. The availability of standards helps

increase competition and foster innovation, supporting confidence in data and the decisions that they are based on. At the NML, we contribute to over 20 ISO Standards each year, providing our advice and chemical and bio-measurement expertise across a range of sectors.

In the molecular biology area in particular, where new technologies are rapidly evolving, standards are playing an increasingly important role by ensuring the quality and consistency of data, and supporting quality assurance.

“ Patient specimens can significantly alter after collection from the body, e.g. during transport, storage and processing. This is a major error source for incorrect diagnostic test results. Standards ensuring good quality patient specimens are therefore key enablers for improving diagnostics, biobanking and biomedical research.

**Dr. Uwe Oelmüller**  
Project coordinator - SPIDIA4P

### CELLULAR THERAPEUTICS

Cell therapy products have the potential to revolutionise medical care. We were instrumental in the preparation of a new standard providing guidance on the characterisation and testing of novel cell therapy products (advanced therapy products), including approaches to

selecting and designing cell based assays that are fit for purpose (ISO 23033:2021, Biotechnology – Analytical methods – General requirements and considerations for the testing and characterization of cellular therapeutic products). This standard

will help enable cell therapy products to capitalise fully on their potential as therapies for chronic diseases such as cancer and neurodegenerative diseases.

### PRECISION MEDICINE AND IN VITRO DIAGNOSTICS

Personalised medicine is the diagnosis and treatment of disease at the individual level. The way biological samples are treated after being taken from a patient can have a significant impact on the subsequent diagnostic results.

We are a partner in SPIDIA4P, a project that is focused on standardising the way in which clinical samples are collected and handled to enable correct disease diagnosis.

The project is advancing the provision of standards for generic pre-analytical tools and procedures for in vitro diagnostics and has led to the development of 16 new ISO standards over the past four years.

The impact of SPIDIA4P was recognised in the CEN-CENELAC Standards + Innovation Awards 2021 for its important contribution of research and innovation to

standardisation where it won in the ‘Projects’ category. The standards developed as part of this project allow healthcare providers, in vitro diagnostic (IVD) users and manufacturers, and R&D laboratories to develop high quality workflows to mitigate against use of inaccurate and unreliable tests.

### GENETIC SEQUENCING OF MICROORGANISMS

New genetic tools have revolutionised the analysis of genetic information, but they create complex measurement challenges, as each laboratory may use a different approach. We are leading a project that aims to improve the

quality of the genetic sequencing specifically for infectious diseases. The standards we are helping to develop provide guidance on best practice, covering the whole process, from sample collection and processing, isolation and

sequencing of nucleic acids, to the analysis of the data and the reporting by the clinician. The standards will allow laboratories to provide more accurate and comparable results, ultimately leading to better diagnostics for patients.

# SUPPORTING METROLOGY TO REACH UK'S NET ZERO CARBON TARGET

## SMART AND ADVANCED MATERIALS

The UK Government was the first global economy to set a target to reach net zero carbon emissions by 2050, upgrading the previous target of delivering an 80% cut in emissions.

We are working with measurement scientists, materials specialists and industrial partners from across the UK to develop the underpinning measurement

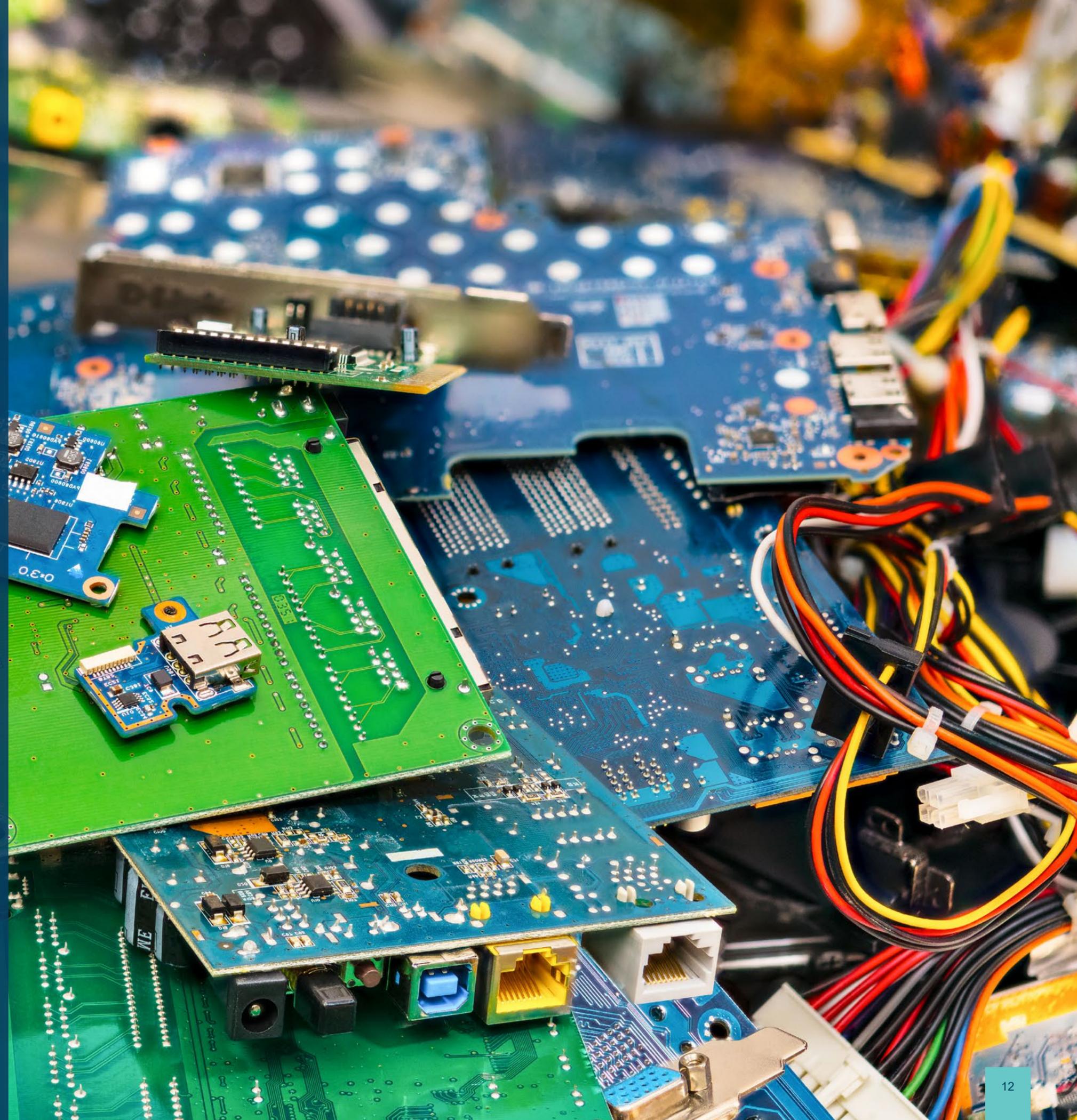
science required to develop and validate methods for the characterisation of advanced (smart) materials to help meet these targets. This will help produce safer and more efficacious materials, promoting the circular economy, and driving up productivity within the UK's world-class energy sector.

## METROLOGY FOR RECYCLING OF ELECTRONIC WASTE

Over the last decade, the volume of electronic waste (computers and mobile phones) generated globally has been steadily rising. In 2021 the amount of electronic waste reached over 53.6 million metric tonnes but less than 18% was collected and properly recycled. Electronic waste can be very complex, leading to high costs and challenges within the recycling sector.

We are working with stakeholders from across Europe on a new project (MetroCylceEU) that will

provide reliable and SI-traceable measurements of Technology Critical Elements (TCE) in urban waste material in order to increase the efficiency of recovery of those elements during recycling. This work will provide standardisation bodies with a more robust framework for improved analytical data. It will support the recycling industry, leading to informed decision-making for waste management and sustainable reuse of these important elements to reduce future supply risks.



# NML RESPONSE TO THE COVID-19 PANDEMIC

Throughout the pandemic, we were involved in many aspects of the global response, providing support to healthcare providers, industry and universities within the UK as well as leading within the global measurement and standards communities.

## INTERNATIONAL LEADERSHIP FOR INFECTIOUS DISEASES AND FUTURE PANDEMIC READINESS

We are leading on the development of a roadmap for the international metrology community to support measurements associated with infectious disease and future pandemic readiness. In close collaboration with the measurement community, global policy

and healthcare officials who were on the front line of managing national responses to Covid-19, and the wider community, we will be developing a set of recommendations for measurement specific interventions that could enable a more rapid response and enhance

clinical outcome in a future pandemic. This will ensure that the metrology community is sufficiently prepared to support the key measurements that are needed, and at sufficient pace, to face the challenges posed by infectious disease outbreaks in the future.

## SUPPORTING NATIONAL SARS-COV-2 DIAGNOSTIC TESTING

When the pandemic hit, diagnostic manufacturers needed guidance on technical requirements to develop in vitro diagnostic tests for the detection of SARS-CoV-2 infection as part of the UK government national testing programmes or accredited private testing services. The Medicines and Healthcare products Regulatory Agency (MHRA)'s Target Product Profiles (TPP) are guidance

documents which aim to support and accelerate the development and evaluation of new medical technologies to address specific high priority unmet clinical or public health needs for the UK population. Requirements can vary significantly depending on the specific use or location of testing and whether the results are being used for contact tracing or release from isolation. We worked with the MHRA

to write TPPs based on laboratory-based SARS-CoV-2 viral detection tests. Our measurement and standardisation expertise was fundamental to ensure appropriate terminology, descriptions and technical direction were explained in the documents. This ensured that the emerging tests were fit for purpose and SARS-CoV-2 diagnostics in the UK was informed by sound measurement science.



## REFERENCE MATERIALS AND UNDERPINNING MEASUREMENTS

Reference materials are the cornerstone of accurate and traceable measurements – they are measurement standards which can be used for many purposes including validation of analytical methods, establishing metrological traceability and to support quality control.

We currently have a portfolio of 142 materials covering high purity standards, carbon isotope ratios, food, environmental and clinical materials, and alcohol standards. This year we released materials to help ensure more accurate metal analysis for the clinical sector and for improving consumer safety in the water industry.

### NEW MATERIALS

LGC8276 Blood – Hip replacement wear metals – Cr and Co

LGC6028 Hard drinking water - metals lower levels

### REPLACEMENT MATERIALS

LGC5405 15 % Alcohol by volume – density and alcohol concentration

### RECHARACTERISED REFERENCE MATERIALS

LGC6145 Contaminated clay loam soil

ERM-DA345a Frozen human serum – testosterone, high level

## SUPPORTING PATIENTS WITH METAL-ON-METAL IMPLANTS

This year we expanded our portfolio of reference materials to include a new material for metals in blood, with values traceable to the International System of Units (SI). Approximately 71,000 people in the UK have metal-on-metal hip implants. The daily wear on these implants can, over time, lead to an increase of chromium and/or cobalt in the blood and may cause soft tissue reactions.

The UK's MHRA issued a medical device alert in 2012 stating that patients with a metal-on-metal hip implant should have regular annual checks. In collaboration with TEQAS (Trace Elements External Quality Assessment Scheme), we produced a whole blood certified reference material (LGC8276), characterised for both chromium and cobalt at the level determined by the MHRA

to require intervention, under the scope of LGC's ISO 17034:2016 accreditation.

This material can be used by laboratories as part of their quality assurance system and will ultimately improve the quality of the measurements of chromium and cobalt in blood performed both within and outside the UK, thus improving patients' quality of life.

## USING MEASUREMENT TO SUPPORT SAFER DRINKING WATER

The permitted levels of certain elements in drinking water are defined by regulations that establish limits to ensure the water is safe for the consumer. It is important for the drinking water industry to be confident that they meet these standards. We have produced drinking

water reference materials for many years, but in 2021 we released a new hard drinking water reference standard (LGC6028), characterised for 26 elements at levels lower than the regulatory limits, which more closely resemble the samples laboratories see in routine testing.

The new reference material was produced within LGC's scope of accreditation to ISO 17034:2016, and will be of use to laboratories as part of their quality assurance system when measuring elements in water at these more challenging low levels, ultimately ensuring safer products for consumers.



OUR QUALITY ACCREDITED TO  
ISO/IEC 17025  
ISO 17034  
CERTIFIED TO  
ISO 9001

## SUPPORTING THE NHS



A new round of the NHS Chief Scientific Officer's Knowledge Transfer Partnerships (KTP) programme was launched this year. The partnership between NHS England, the UK's National Measurement System (NMS) and the United Kingdom Accreditation Service (UKAS) is designed to enable senior healthcare scientists to remain in clinical service whilst exchanging skills and expertise with NMS scientists to create, expand, test or implement innovative ideas to improve patient care as set out in the NHS Long Term Plan.

Through facilitating early interaction and knowledge

exchange, the programme helps increase efficiencies within the NHS, speeds up the identification and dissemination of healthcare innovations and improves patient outcomes.

Five new Associates were awarded KTPs in the latest round of the programme, with their work covering areas such as genomic methodologies, residual disease measurements and point of care testing. We are excited to support the successful development of these projects.

## BRIDGING THE GAP BETWEEN TECHNOLOGICAL ADVANCES AND STANDARDISED CLINICAL IMPLEMENTATION

New genomic technologies such as long read sequencing or copy number variant analysis have the potential to bring unique benefits to patient outcomes. However, a critical aspect inherent to these technologies is the lack of quality metrics and control materials to minimise false negatives. The lack of quality control and standardisation

often prevents more rapid clinical adoption.

We are partnering with Mary Alikian, Principal Clinical Scientist, Birmingham Children's and Women's NHS Trust, to bridge the gap between the technical advances and their standardised implementation into clinical service. Working alongside the MHRA's National Institute

for Biological Standards and Control (NIBSC) and UKAS, we will scope the quality-related culture across the network of seven Genomic Laboratory Hubs (GLHs). This will ultimately lead to the creation of a collaborative community that encourages knowledge transfer, training, and cross-GLH standardisation of novel technologies to enable their rapid adoption.

## STANDARDISATION TO ASSESS EFFECTIVENESS OF CANCER TREATMENT

Measurable residual disease testing allows the detection of extremely low levels of malignant cells remaining after cancer treatment. It can be used to predict which patients will relapse and which will maintain their remission. There are several exciting new treatments becoming available

for patients with acute myeloid leukemia (AML).

To assess the effectiveness of these treatments within clinical trials, highly accurate measurable residual testing is required which is comparable between laboratories. In partnership with Stuart Scott, Centre Manager,

Sheffield Teaching Hospitals NHS Foundation Trust, and alongside NIBSC-MHRA and UKAS, we will assess the need for standardisation of measurable residual disease testing for AML, ultimately improving testing and the accuracy of clinical trials and facilitating better patient management.

## SUPPORTING INDUSTRY

### A4I Analysis for Innovators

We are a partner in the Innovate UK programme 'Analysis for Innovators' (A4I). A4I provides companies with access to state-of-the-art measurement and analytical technologies. It focuses on solving measurement problems within existing businesses to improve competitiveness and productivity.

Round 6 was launched this year and we are involved in 3 successful projects with UK companies in the areas of nanotherapeutics, synthetic biology and pharmaceuticals.



Lipid nanoparticles and liposomes offer a revolutionary method of delivering therapeutics in a controlled manner for more effective treatment. These nanomaterials allow for increased penetration into target tissues and have potential for improved targeting within the body. Exploiting these characteristics offers huge promise in terms of improved patient outcomes while minimising harsh side-effects.

Currently it is difficult to rapidly measure the drug-load distribution and drug-release profiles of nanomedicines and as a consequence there is poor

reproducibility and reliability at the drug-screening level. Oxford HighQ have developed a novel instrument that can accurately measure these parameters, however performance data is required in terms of resolution and limit of detection to support the use of Oxford HighQ's instrument in QA/QC testing of advanced therapies.

Using our nanoparticle characterisation expertise we will develop a novel method, based on Asymmetric-Field-Flow-Fractionation (A4F) to separate the nanoparticles as a function of their size and then characterise the drug-loading in each size fraction using a range of

techniques (MALS/UV-vis, (MA)DLS, PTA, ICP-MS). The data generated will provide evidence for the use of Oxford HighQ's technology for quantitative measurements of nanotherapeutics which is a key requirement for potential pharmaceutical customers and regulators. The data will help to secure strategic partnerships for Oxford HighQ and ultimately help improve patient outcomes by optimising the dosing and performance of these highly-targeted nanotherapeutics.



BiologIC's ambition is to build a world leading UK biocomputing industry to unleash the full potential of synthetic biology. The outcome would be a paradigm shift in the detection and mitigation of diseases, the production of foods, the development of new biofuels and biomaterials and DNA data processing.

BiologIC's digital hardware architecture uses multi-material 3D-printing to fabricate fluidics, electronics, thermals, optics and pneumatic circuits into

integrated bioprocessors. These bioprocessors are assembled within biocomputing devices that increase the power of synthetic biology. The materials used for BiologIC's bioprocessors are categorised as biocompatible, however they are not amenable to molecular or cellular biology applications due to reactivity of the materials surface.

Using our mass spectrometry expertise (LC-MSMS, LC-HRMS), we will develop methods

to analyse the 3D-printed materials integrated into bioprocessors and provide characterisation data to improve understanding of their reactivity and support further product development for safe and effective biocomputing. This will provide post-processing improvements that will support further development with commercial partners.



Aqdot develops and manufactures at tonne-scale a novel set of molecules (cucurbit[n]urils, CBs) that are very effective supramolecular hosts. The molecules have excellent odour capture performance and may be used to optimise performance of fragrances. CBs are being included in an increasing number of commercially available products and show great

promise in deactivation of common viruses and common allergens with pharmaceutical applications being developed for drug delivery and gene delivery.

To increase production volumes, characterisation of the generated low-level impurities is required to provide information as to how the manufacturing and separation processes

affect composition. We used our mass spectrometry expertise to help identify the low-level impurities and enable composition monitoring to ensure consistency of product quality over time. This will be critical to realise the pharmaceutical applications of CBs which promise major societal benefits.



In response to the COVID-19 pandemic, Measurement for Recovery (M4R) was launched to help support businesses recovery and drive growth for UK industry. Along with the other UK

National Measurement System laboratories, we are a partner in this programme, providing companies with access to our world class measurement research, expert advice and facilities

free of charge. Working with companies across the UK, we are helping them address measurement problems in innovative ways to boost resilience and competitiveness.



PolyBaric has demonstrated a process which rapidly denatures and 'dissolves' or liquifies most plastic materials cleanly, and without using organic solvents or other materials which might pose an environmental hazard. This provides a clean and economically profitable method to address the plastic waste environmental crisis, particularly for hard-to-tackle plastic waste streams.

However, the product streams are complex mixtures which, combined with batch variation, present a significant analytical challenge and a barrier to further development.

Using our mass spectrometry expertise (ASAP, MALDI) we monitored the degree of degradation of different plastic products and evaluated the effect of

temperature and pressure on them. The generated data was used for verifying the chemical process and served as evidence for developing a capability to characterise their products. This achievement will attract further investment and will ensure that the environmental and economic benefits of this sustainable technology are realised.

# SKILLS FOR INDUSTRY

## ANALYTICAL QUALITY TRAINING PROGRAMME

For more than 20 years we have provided a programme of courses focused on laboratory quality assurance to support skills development and ensure laboratories across the world meet accreditation and regulatory requirements.

Since the start of the pandemic our Knowledge and Skills Exchange activities have embraced virtual learning with all our courses successfully delivered live online since June 2020. Moving online has allowed the continued delivery of our Analytical Quality Training Programme throughout the global pandemic and supported the delivery of bespoke training requests from industry, academia and government in the UK and overseas. While we plan to return to face-to-face training as soon as COVID guidance permits, we will continue to offer online courses to provide maximum flexibility for our customers.

Our courses cover the core topics that support laboratory quality assurance, including method validation, evaluating measurement uncertainty and statistical tools for analytical scientists. We have a high level of repeat customers and the feedback on our online courses has been very positive.

## SECTORS

CLINICAL, ENVIRONMENT, PHARMACEUTICALS, CHEMICALS, FOOD AND BEVERAGES, FORENSICS, UTILITY SERVICES, ACADEMIA

## DELEGATES TRAINED

**223 DELEGATES**  
**45 ORGANISATIONS**  
**24 COURSES**

## OVER 95%

OF RESPONDENTS FEEL OUR TRAINING COURSES MEET THEIR EXPECTATIONS

Details of all our training programmes are available at [www.lgcgroup.com/training](http://www.lgcgroup.com/training).



The course delivery was incredibly good and the content was perfect so all in all I thought this was a very good course.

Online measurement validation course delegate



Really good delivery of a complicated subject. Very well-structured course with good examples. I would definitely recommend this course to others.

Online measurement uncertainty course delegate

## MICROLEARNING MODULES FOR TESTING LABORATORIES

During 2021 we expanded our knowledge and skills exchange activities to include the development of app-based microlearning that is available anywhere, anytime across a range of devices. Our initial pilot – ‘CannLearn’ – has been developed in collaboration with Dr Ehrenstorfer to support cannabis testing laboratories. This highly interactive content is available via an intuitive app and covers key topics related to the testing of cannabis

plants and products, and laboratory quality assurance. Highly gamified, learning points are reinforced by quizzes and competitions to deliver an engaging learning experience. This new approach can be extended to a wide range of content to support skills development for the UK.



## CAMS

Community for Analytical Measurement Science

The Community for Analytical Measurement Science is a virtual network aimed at promoting world-class analytical measurement science training, research and innovation by bringing together a network of industrial and academic

partners with interests in these fields.

To date, thanks to funding contributions from the Analytical Chemistry Trust Fund, the Department for Business, Energy & Industrial Strategy and the Community's industry and academic members, CAMS has committed funding for 7 Lectureships, 7 PostDocs, 19 Fellowships and 4 PhDs.

**15** INDUSTRY MEMBERS

**22** ACADEMIC MEMBERS

**>£850K** AWARDED TO 14 NEW PROGRAMMES OF RESEARCH

## SELECTED PUBLICATIONS

The quality and credibility of our science is demonstrated in part through our publications in peer reviewed journals. In 2021 our scientists published 43 peer review publications. Here is a short selection:

**Cheung M** et al. Current trends in flow cytometry automated data analysis software. *Cytometry Part A*. 99 (10): 1007-1021. DOI: 10.1002/cyto.a.24320

**Milavec M** et al. The performance of human cytomegalovirus digital PCR reference measurement procedure in seven external quality assessment schemes over four years. *Methods*. 198: 1046-2023. DOI: 10.1016/j.ymeth.2021.03.016

**Billimoria K** et al. Investigating the effect of species-specific calibration on the quantitative imaging of iron at  $\text{mg kg}^{-1}$  and selenium at  $\mu\text{g kg}^{-1}$  in tissue using laser ablation with ICP-QQQ-MS. *Journal of Analytical Atomic Spectrometry*. 36:1047-1054. DOI: 10.1039/D1JA00042J

**Taboada-López MV** et al. AF4-UV-ICP-MS for detection and quantification of silver nanoparticles in seafood after enzymatic hydrolysis. *Talanta*. 232:122504. DOI: 10.1016/j.talanta.2021.122504

**Abad-Alvaro I** et al. An insight into the determination of size and number concentration of silver nanoparticles in blood using single particle ICP-MS (splICP-MS): feasibility of application to samples relevant to in vivo toxicology studies. *Journal of Analytical Atomic Spectrometry*. 36(6): 1180-1192. DOI: 10.1039/D1JA00068C

**Groves K** et al. Reference protocol to assess analytical performance of higher order structural analysis measurements: results from an inter-laboratory comparison. *Analytical Chemistry*. 93(26): 9041-9048. DOI: 10.1021/acs.analchem.0c04625

**David CAW** et al. Assessment of changes in autophagic vesicles in human immune cell lines exposed to nano particles. *Cell & Bioscience*. 11: 133. DOI: 10.1186/s13578-021-00648-8

**Mampunye L** et al. Pioneering BRCA1/2 point of care testing for integration of germline and tumor genetics in breast cancer risk management: a vision for the future of translational pharmacogenomics. *Frontiers in Oncology*. 11:619817. DOI: 10.3389/fonc.2021.619817

**Spick M** et al. Systematic review with meta-analysis of diagnostic test accuracy for COVID-19 by mass spectrometry. *Metabolism*. 126: 154922. DOI: 10.1016/j.metabol.2021.154922

**Evans D** et al. The dangers of using Cq to quantify nucleic acid in biological samples; a lesson from COVID19. *Clinical Chemistry*. 68 (1):153-162. DOI: 10.1093/clinchem/hvab219

**Riemann L** et al. Assessment of measurement precision in single-voxel spectroscopy at 7 T: Towards minimal detectable changes of metabolite concentrations in the human brain in vitro. *Magnetic Resonance in Medicine*. 87(3):1119-1135. DOI: 10.1002/mrm.29034.

**Jim Huggett** became LGC's fourth Science Fellow, recognising his significant scientific contribution to the business.

## OUR PEOPLE

**Malcolm Burns** was formally acknowledged as an independent international scientific expert by the European Commission, in recognition of his international input to the field of GMO analysis.

**Victoria Moore** and David French were shortlisted for the 2020 Newton Prize for Innovation and Impact in South Africa for an Innovate UK/ Newton Fund project relating to the development of a paraDNA kit for improved clinical management of patients with breast cancer and clinical comorbidities.

**Jim Huggett** became LGC's fourth Science Fellow, recognising his significant scientific contribution to the business.

**Dorota Bartczak** was elected Vice Chair of the BSI NT1/001 Nanotechnologies Committee based on her expertise.

**Aristea Leventi** won first prize for her poster exploring the use of gold nanoparticles to deliver anticancer drug cisplatin to attack cancer cells at the Royal Society of Chemistry's Analytical Research Forum 2021.

**Selvarani Elahi** was appointed as the UK Co-Chair by Defra and FSA for the Codex Committee on Food Import and Export Certification and Inspection's electronic working group on food fraud definitions.

**Jim Huggett** has been appointed to the Editorial Board for Clinical Chemistry.

80 SCIENTISTS  
75% PhD



DO YOU HAVE A MEASUREMENT-RELATED QUESTION?

ARE YOU LOOKING FOR MEASUREMENT SUPPORT TO ADDRESS YOUR MEASUREMENT CHALLENGES?

Contact us to access expertise in a range of chemical and biological measurement technologies and related topics such as analytical quality assurance, method validation, measurement uncertainty, reference materials and proficiency testing.

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