



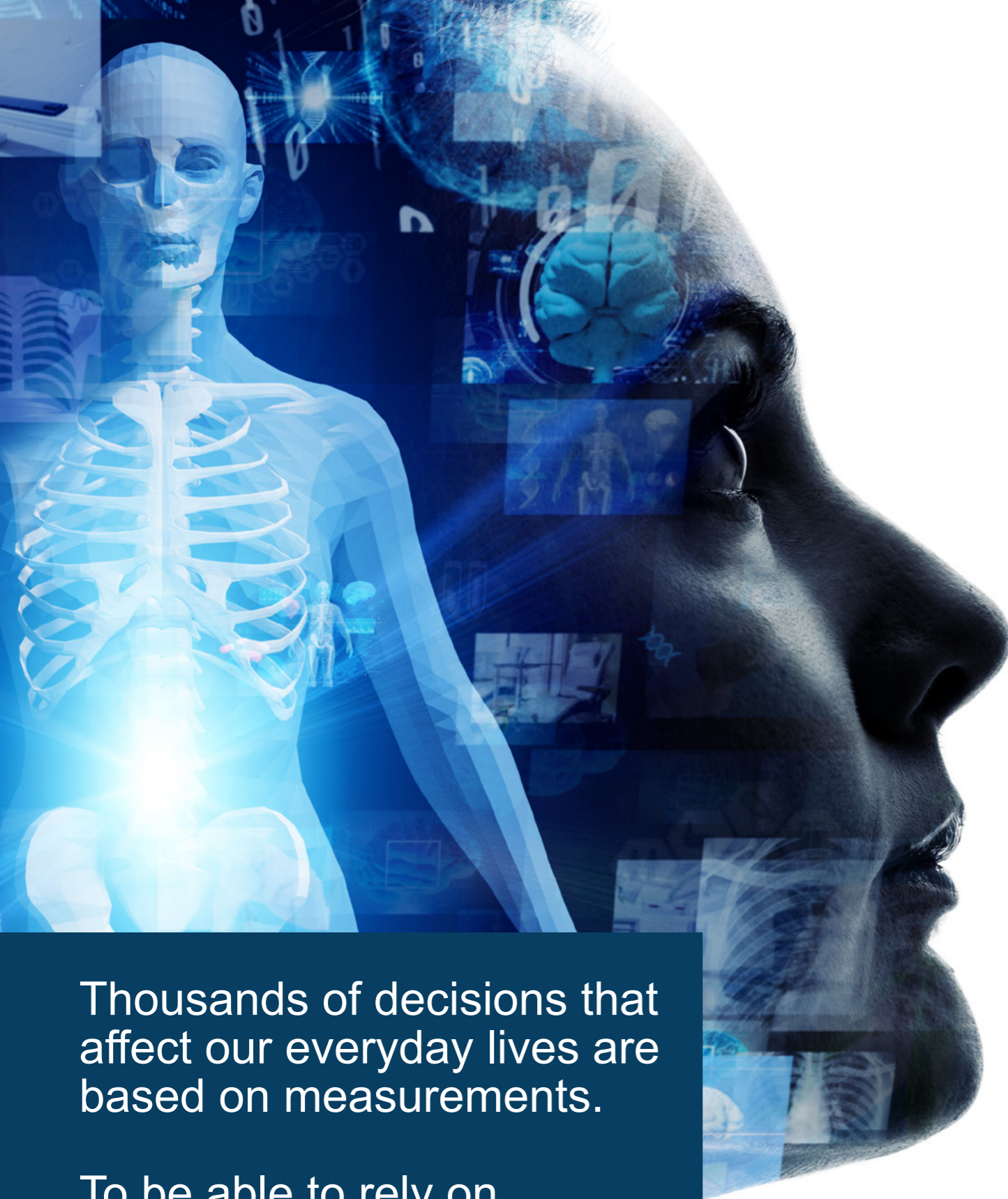
ANNUAL REVIEW | 2019



Department for
Business, Energy
& Industrial Strategy

FUNDED BY BEIS





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.

EXECUTIVE SUMMARY

In 2019 our new DNA Measurement Laboratory was officially opened by Professor Dame Sue Hill, the Chief Scientific Officer for NHS England. This facility, the result of many years of world-leading research, will provide the measurement confidence to underpin innovative diagnostic and therapeutic healthcare solutions for our ageing society, as well as advancing NHS patient care through effective and efficient adoption of current and emerging genomic technologies.

Across our research teams we address a complex set of cross-sector issues to help solve complex global challenges, developing reference methods and materials, setting standards, providing advice and informing legislation. Our fundamental measurement research in advanced therapeutics, diagnostics and safety and security underpins some of the biggest challenges of our time, including cancer, anti-microbial resistance, climate change and food safety.

This year we have further extended our engagement with partners across the UK in academia, healthcare and industry. Working more closely will help leverage national assets, extend expertise and generate the best environment to support and encourage innovation, productivity and prosperity, improving chemical and bio-measurements for the benefit of the public across the UK.



We are entering a period where the vital contribution of chemical and biological measurement to the UK is beyond compare. At the end of 2019 the first occurrence of SARS-COV-2 was reported in China, and as we complete this review it is clear that the ramifications of the ensuing pandemic will have lasting impact on the diagnostics community, driving new rigour and requirements for quality control and standardisation. As the UK prepares for a future outside of the EU, and commits to sustainable economic growth by investing in innovation, the NML will continue to strive hard to support the associated regulatory frameworks and the effective translation of research in to value and societal benefit.

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, the UK measurement infrastructure.

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, and enhance skills and improve quality of life.



JOIN THE MEASUREMENT CONVERSATION:

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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.

-  Centres of excellence
-  Academic collaborations/joint PhDs



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



OUR LEVERAGED INCOME FROM ALL SERVICES WAS **£3.0 MILLION**

OUR NUMBERS 2019

WE WORK WITH **OVER 790 DIFFERENT ORGANISATIONS**

34 PEER-REVIEW PUBLICATIONS

2 NEW ISO ACCREDITATIONS

27 REFERENCE MATERIALS

18 CONTRIBUTIONS TO ISO STANDARDS
(8 PUBLISHED)

LAUNCH OF A NEW CENTRE OF EXCELLENCE IN SCOTLAND

In partnership with the University of Strathclyde, we have launched the new Centre for Advanced Measurement Research and Health Translation in Glasgow to support innovation and economic growth in the medicine, food and drink, and high-value manufacturing sectors.

The centre is part of an ambitious, long-term collaboration that will provide a base for joint research projects and innovation in measurement, supporting industry to improve reliability, safety and productivity. In addition, it will provide Scotland with a more productive future workforce through the education and training of scientists and engineers.

First projects include assessment of quantitative imaging of metallic nanoparticles within single cells to support targeted antibody delivery for improved cancer therapies.



This strategic partnership between Strathclyde and the NML at LGC will provide a powerful platform to engage the SME and start-up community in the health and wellbeing sector, foster new innovations and the development of skilled people for the benefit of society.

Professor Sir Jim McDonald,
Principal of the University of Strathclyde

PARTNERSHIPS FOR THE FUTURE

This year we have established a strategic partnership with the University of Leeds to develop a Centre of Excellence for metrology in clinical sciences for the North of England over the coming years.

THE NML AND THE GLOBAL MEASUREMENT COMMUNITY



WE WORK GLOBALLY TO STANDARDISE MEASUREMENT SCIENCE

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 new CMC claim for high polarity organic compounds with a molecular weight below 500 Da. This broad scope claim underpins components of our organic analysis capabilities, which in turn supports the calibration services we provide, allowing us to address evolving UK industrial, clinical and safety needs.

9
(4 LEADING)

CCQM STUDIES

1

NEW CMC CLAIM



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

EUROPEAN MEASUREMENT RESEARCH FUNDING FOR ENVIRONMENTAL RESEARCH

This year we won additional funding under the European Metrology Programme for Innovation and Research (EMPIR) to enhance our environmental measurement research activities. EMPIR coordinates research projects to address the EU's Grand Challenges, while supporting and developing the SI system of measurement units.

Over the next three years, these two new projects will address measurement challenges associated with mercury monitoring and the attribution of greenhouse gas emissions.

Exposure to mercury can affect the nervous, digestive

and immune systems and is consequently closely regulated. The industrial sector is one of the main causes of mercury pollution, with mercury being released in gaseous form in to the atmosphere. Systems to continuously monitor mercury emissions, including the more reactive species oxidised mercury, Hg(II), are installed in stacks. The standards used to calibrate these are not well-defined. Using our inorganic purity and speciation expertise we will support the development of protocols for certification of the oxidised gas generators used to monitor mercury levels.

Carbon dioxide and methane released into the atmosphere by human activity are major contributors to climate change. Understanding where they come from will be critical in supporting governments in making informed policy decisions for the future and demonstrating compliance with national reduction targets. Using our isotope ratio expertise we will support the development of SI-traceable isotope ratio gas standards for carbon dioxide.

These projects will help meet environmental legislation obligations, guide reduction strategies and protect human health.

LEADING ON A EUROPEAN MEASUREMENT PROJECT FOR SEPSIS MANAGEMENT

We are leading on a new European project (SEPTIMET) to develop the underpinning measurement science required to improve sepsis management and treatment. Sepsis is a life-threatening condition that results when the body's immune system overreacts to an infection and starts to damage your body's own tissues and organs. It is one of the most preventable causes of death and disability in Europe, affecting about 30 million people a year and causing

6 million deaths worldwide. Sepsis must be detected and treated within the first six hours as every additional hour of delayed diagnosis increases the risk of multiple organ failure and death.

Currently, medical staff rely on non-specific clinical signs to predict a patient's condition. Blood culture methods are simply not fast enough to provide a definitive treatment plan. Quick, accurate and reproducible tests to diagnose and manage

the condition are urgently needed and next generation diagnostic methodologies could potentially deliver the necessary point of care solutions. However, they require support for robust evaluation to ensure they can meet regulatory needs (EU Directive 98/79/EC) and be quickly translated in to the clinic.

We are working closely with hospital partners and In Vitro Diagnostics manufacturers to address these needs for the benefit of patients.

INTERNATIONAL STANDARDS FOR MEASUREMENT

We were involved in the development of eight new written standards that were released by ISO (International Standards Organisation) in 2019. These standards are developed by international experts to help encourage innovation

and provide solutions to global challenges.

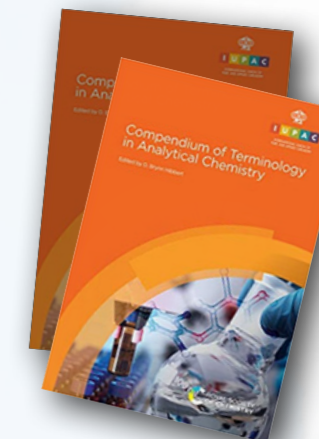
This work included leading on developing the new standard for quantification of nucleic acids (ISO20395:2019) and leading on the major

revision of the standard for the statistical determination of repeatability and reproducibility of results for inter-laboratory comparison studies (ISO5275-2:2019).

DEFINING TERMINOLOGY FOR ANALYTICAL SCIENTISTS ACROSS THE WORLD

We co-authored the chapter on spectroscopy in the Compendium of Terminology in Analytical Chemistry (4th Edition), developed through IUPAC (International Union for Pure and Applied Chemistry) and published by the Royal Society of Chemistry. The so-called 'Orange Book', updated for the first time since 1998, provides a consensus in

terminology for analytical scientists. We provided particular technical expertise on the techniques of nuclear magnetic resonance (NMR) and mass spectrometry, methods which are widely used and have developed significantly over the last two decades.



REFERENCE MATERIALS AND UNDERPINNING MEASUREMENTS

Reference materials (RMs) are the cornerstone of accurate and traceable measurements – they are measurement standards which can be used to validate analytical methods, establish traceability and support quality control.

We have a portfolio of over 130 materials covering high purity standards, carbon isotope ratios, food, environmental and clinical materials, and alcohol standards. This year we released materials to support the identification of allergens in foods and underpin regulation for nanomaterials in consumer products to protect consumers.



OUR QUALITY ACCREDITED TO
ISO17025
ISO17034
ISO9001

NEW MATERIALS

LGCQC5050	colloidal gold nanoparticles certified for particle number concentration
LGC746-KT	allergen kit - milk, egg, almond, hazelnut and walnut certified for allergen protein content
LGC7421	skimmed milk powder certified for nitrogen and water
LGC7422	egg white powder certified for nitrogen and water
LGC7424	almond powder certified for nitrogen and water
LGC7425	hazelnut powder certified for nitrogen and water
LGC7426	walnut powder certified for nitrogen and water

REPLACEMENT MATERIALS

LGC5000	brandy certified for density and alcoholic strength
LGC5401	70 % ABV for alcohol concentration
LGC5421	40 % ABV for alcohol concentration
LGC1801	nicotine certified for purity
LGC5409	aqueous ethanol for forensic applications, 20 mg/100 mL
LGC5401	aqueous ethanol for forensic applications, 80 mg/100 mL
LGC7155	processed meat certified for proximates, chloride, hydroxyproline and metals
LGC7173	poultry feed
LGC6026	hard drinking water for metals
LGC5407	70 % ABV certified for alcohol concentration

10 meat authenticity materials, including beef, pork, sheep, chicken, turkey and goat at 100 % and 1 % levels

ACCREDITATION FOR PEPTIDE QUANTIFICATION

We have been awarded extension to scope for our ISO/IEC 17025 accreditation for the quantification of peptides using amino acid analysis by the United Kingdom Accreditation Service (UKAS).

This capability allows us to provide independent and authoritative quantitative measurements of peptides to assign values to reference standards and quality assurance schemes for healthcare and food safety stakeholders to support biomarker validation and facilitate the implementation of legislation and accreditation to improve diagnostics.

STANDARDS GROUP ESTABLISHED TO SUPPORT CELL THERAPIES

We have established the UK Standards Liaison Group for Advanced Therapies (UK SLGAT) to collaboratively identify, create and influence the documentary and reference standards landscape required for end-to-end product and process development of cell therapy and gene-modified cell therapies. The unified viewpoint of UK industry that is developing with the support of the UK Bioindustry Association will help regulatory efforts in this space.

STAKEHOLDERS INCLUDE

- Cell and Gene Therapy Catapult
- NIBSC
- UKRI - Innovate UK
- British Pharmacopoeia (observers)
- MHRA (observers)

NANO-PARTICLE MATERIAL FOR SAFER FOODS AND COSMETICS

We have released the first ever nanoparticle quality control material with a value assigned for nanoparticle number concentration (number of particles/gram of sample). The presence of nanoparticles must now be clearly indicated on the label of food and cosmetic products marketed in the European Union. Despite the regulatory requirements around the definition of a nanoparticle (2011/696/EU), no reference materials or quality control materials with a value assigned to number concentration have been available before.

The measurements on this new colloidal gold material were performed using single particle inductively coupled plasma mass spectrometry (spICP-MS). This material is already being used by instrument manufacturers, standards producers and government laboratories to support calibration.

'BEST MEASUREMENT' FOR CARBON ISOTOPE RATIOS

Our work on stable isotope ratio analysis for carbon has been recognised by the Commission on Isotopic Abundance and Atomic Weights (CIAAW) as a 'IUPAC Best Measurement'.

Stable isotope ratio analysis provides valuable information across a wide variety of fields, including environmental studies, food analysis, forensics, carbon-dating and geochemistry. The isotopic composition provides information about its biological or geographical origin and how it has been processed or manufactured. However, the relative scale that is used for carbon isotope ratios is defined by reference standards that have changed over time and one of which has recently been shown to be unstable. We have developed an independent reference method and appropriate reference materials traceable to the SI (International System of Units) to ensure that small variations in how replacement materials behave, or how they are measured, do not impact the comparability of isotope ratio results across time and space. This work will now play a significant role in setting the standard atomic weight of carbon.

SUPPORTING THE NHS

Measurement plays a fundamental part in providing safe and effective patient care; underpinning quality, enabling innovation and supporting the development of new treatments and diagnostics.



Measurement is critical to transform outcomes for the patient. In opening this laboratory, with its calibration facility, it is such a privilege to be part of something unique not only to the UK, but also globally.

Professor Dame Sue Hill, CSO NHS England, at the official opening and launch of the new DNA Measurement Laboratory, November 2019



PARTNERING WITH NHS ENGLAND

The NML is proud to be one of the partners in the NHS Chief Scientific Officer's Knowledge Transfer Partnership (KTP) programme, a joint initiative between NHS England, the laboratories and organisations that deliver the UK's National Measurement Strategy and the United Kingdom Accreditation Service (UKAS).

The programme provides healthcare scientists with the opportunity to work alongside leading measurement scientists, building long-term collaborations and exchanging skills and expertise to improve and enhance the quality of patient care within the NHS, in line with NHS England's Long Term Plan.

We are working with clinical scientists from across the country to address measurement challenges including antimicrobial resistance, cancer diagnosis and genetic testing.

APPLYING UNCERTAINTY TO CLINICAL GENOMIC TESTING

Clinical genomic laboratories perform hundreds of tests that help inform patients of the likely cause of their symptoms or predict the severity of disease to inform treatment. As genomic testing becomes part of mainstream medicine, the requirement for improved test quality and comparability is increasing.

In collaboration with Dr Isabelle Delon FRCPATH, Registered Clinical Scientist at the NHS East Midland and East of England Genomic Laboratory Hub, we have established a group comprising healthcare genomic scientists, measurement

and accreditation experts. With this group we are developing a reference document offering accessible background information and practical guidance for comprehensive evaluation of measurement uncertainty in genomic laboratory tests.

We organised a workshop on the application of measurement uncertainty in clinical genomic testing to inform and engage with the clinical community. The workshop, attended by over 70 scientists from the UK and Europe working in genomics testing, discussed the needs and drivers for

establishing a coherent and unified approach. A proposed framework was presented and its application demonstrated for two different tests for cancer developed under a second NHS KTP based at the North West Genomics Laboratory Hub.

As a result of this partnership, the reference document will offer expert practical guidance for clinical genomic laboratories to comply with regulatory requirements and help improve clinical genomics measurements.



The framework that we developed with our KTP partners provides a standardised way to address measurement uncertainty evaluation, which is much needed to provide technical guidance and insure that all tests are evaluated to a suitable standard. The use of the framework in clinical practice will support the implementation of new tests and continuous evaluation of existing tests.

Isabelle Delon PhD FRCPATH, Clinical Scientist, East Midlands and East of England NHS Genomic Laboratory Hub

MEASUREMENTS TO IMPROVE ANTIMICROBIAL RESISTANCE MONITORING

Antibiotic resistance is becoming an increasingly serious threat to global public health, putting at risk our ability to treat common infections. Within the next 35 years, antimicrobial resistance is estimated to account for a staggering 45% of global deaths, potentially as many as 1 every 3 seconds. We have been working on two projects to support the standardisation of measurements and the validation of novel technologies to support the fight to reduce antimicrobial resistance.

VALIDATING NOVEL TECHNOLOGIES FOR ROUTINE ANTIBIOTIC RESISTANCE SCREENING

Carbapenems are a class of highly effective antibiotics typically used for treatment of severe or high-risk bacterial infections.

We worked with Dr Kathryn Harris, Clinical Scientist, Great Ormond Street Hospital (GOSH), to develop a next generation sequencing assay to detect carbapenem resistant bacteria using a rapid portable sequencing technology platform (Nanopore MinION). We investigated the feasibility of using the MinION platform for testing patient samples for the presence of carbapenem resistance.

Results from this work supported a new NIHR AMR infrastructure grant. The grant will fund a new sequencing facility where this novel technology will be embedded into routine service for patients. In addition, we are continuing to work with GOSH on applying this sequencing technology in clinical scenarios within our new EMPIR project to support acute management of sepsis.



IMPROVING STANDARDISATION IN DIAGNOSING DRUG RESISTANCE

MRSA is a highly contagious and very common bacteria which causes infections in hospitals and care homes that can lead to serious or sometimes fatal disease. MRSA is antibiotic resistant and therefore requires careful treatment selection.

Currently patients are screened in hospitals through a combination of swabs followed by culture tests in order to identify which treatments can be used but these tests can take up to 4

days for the result. Molecular methods could provide a quick and accurate way to determine if patients are carrying or are infected with MRSA but validation and standardisation of these approaches is required.

At the NML we have developed a reference method and prototype quality assurance material for MRSA analysis using digital PCR. A small inter-laboratory study was run between

measurement institutes with results compared with conventional culture tests performed by partners at Great Ormond Street Hospital (GOSH). This work will help better understand and inform what is needed from quality assurance schemes and reference materials to support routine and novel molecular screening in clinical practice.

SUPPORTING INDUSTRY

ANALYSIS FOR INNOVATORS

A4I Analysis for Innovators

The NML is 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.

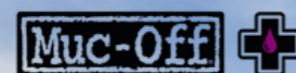
This year we have been working with 13 UK companies, in addition to starting projects with 6 new companies towards the end of the year. These projects address challenges in healthcare, food, agriculture, energy, sport, security and bioscience development.



Fleet Bioprocessing develop immunoassays for use in in vitro diagnostic (IVD) products, and reagents for use in these products.

There is currently a technology knowledge gap with respect to fast, cheap bioanalytical techniques for the analysis of the antibody-based conjugates which form the basis of all immunoassays. Utilising our

structural protein capabilities (HDX-MS, HRLC-MS) these techniques were assessed and shortlisted as potential techniques to help tackle the knowledge gap. We continue to collaborate with Fleet Bioprocessing in a further round of the A4I programme with the aim to deliver improvements in their productivity and competitiveness.



Muc-Off, Europe's leading bicycle lubricant and cleaning manufacturer, increasingly rely on chemical analysis for the development of the next generation of lubricants to improve cycling performance for their customers.

Using our organic mass spectrometry expertise, the NML conducted analysis to support the development of new lubricants and a series

of prototype lubricants were characterised using a range of analytical chemistry methods. The chemical data was then used in conjunction with lubricant performance data to enable a better understanding of how composition affects performance. This work will support faster product development and more targeted performance gains for Muc-Off.

“ The A4I research project with NML allowed us to develop the blueprint we needed to set a new level of testing for future chemical analysis and development of lubrication for bicycles.

Dr Martin Mathias, Research and Development Manager



Nanoparticles are used in numerous food and cosmetic products and increasingly in healthcare. Accurate and reliable methods to identify and quantify nanoparticles are crucial to support research and compliance with regulatory requirements to ensure safety.

Malvern Panalytical have developed a range of instruments (Nanosight series) that rely on particle tracking analysis (PTA) to count and size nanoparticles. However,

accurate measurements of particle concentration require calibration. In collaboration with the NML, a novel calibration strategy using our new quality control material (LGCQC5050) was investigated to improve the technique's repeatability. This has opened up the possibility for Malvern to enter highly regulated fields where improved precision and traceability in particle concentration measurements are required, for example in biotherapeutics.

“ The direction we have taken with our partners thanks to the A4I project generated an output from this study which will enable us to provide an enhanced offering to companies and academia across the world.

Pauline Carnell-Morris, Group Product Manager Nano-Materials



Cell therapies offer the potential to treat genetic or chronic conditions that are currently untreatable, but producing the cells with the required quality and at scale is often a lengthy and difficult to reproduce process.

Bit Bio (formerly Elpis Biomed) are a biomedical company who engineer pluripotent stem cells to produce mature human cells such as muscle, neuronal or immune cells using a technique called cellular reprogramming allowing unprecedented scalability and unique opportunities for democratising human cells in the research and medical sectors.

Using our quantitative single cell analysis capabilities (next generation sequencing), we are working with Bit Bio to provide enhanced product development to allow quicker release of new cell products. We developed and validated two custom RNA-sequencing panels to specific cell types and applied these to one of Bit Bio's current product pipelines. This will help Bit Bio in their cell product development and may provide a novel approach for product quality control by using targeted single cell expression analysis with an associated reduction in sequencing costs.



Accessing single cell sequencing technologies is key for the building and characterisation of Bit Bio's cell portfolio: our collaboration with the NML at LGC has set up bases for exciting development in this area!

Bit Bio

DEVELOPING NEW TECHNOLOGY FOR RAPID DRUG SEIZURE IDENTIFICATION

Accurate and reliable testing at the point of need, e.g. at a police station, can ensure police time is used more effectively and prevent extended waiting time while samples are being transported to specialised laboratories for screening. This requires robust, cheap and easy-to-use instrumentation. Mass spectrometry provides an accurate identification technique, recent advances in technology now mean mass spectrometry does not need to be restricted to the laboratory.

We are working with the instrument manufacturer

Waters and the forensic science provider Eurofins to develop and evaluate a novel approach to rapidly screen and identify the major components in drug seizures.

The Waters QDa instrument is a miniaturised and easy-to-use mass spectrometer with a very small footprint. A prototype ambient ionisation source (atmospheric solids analysis probe (ASAP)) has been developed for this instrument which allows for the direct analysis of solid and liquid samples with little or no sample preparation. At the NML, we have developed procedures to identify the

main components of bulk drug seizures in less than a minute. This approach has successfully been applied to a range of sample types, including powders, pills and plant materials.

The instrument has now been provided to Eurofins to evaluate its potential for use in routine bulk drug seizure analysis within their testing facility. Throughout the evaluation stage, the NML is providing support and methods for use of the instrument.

Waters



The use of a rapid and robust analytical technique to aid and improve controlled drug identification has been a long term goal for Eurofins Forensic Services and this aim is now within reach thanks to the equipment developed by Waters and the R&D knowledge of the NML team.

Eurofins

SUPPORTING SKILLS DEVELOPMENT

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

The courses help develop the analytical measurement science skills required within the UK and support industry and healthcare to address evolving regulatory and accreditation requirements.

They include topics such as evaluating measurement uncertainty, designing effective experiments, and statistical tools for analytical scientists. Our courses consistently receive excellent feedback from delegates and we have a high level of repeat customers.

DELEGATES TRAINED | **320 ACROSS 23 COURSES**

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

OVER 95% | OF RESPONDENTS FEEL OUR TRAINING COURSES MEET THEIR EXPECTATIONS

Details of all our training programmes are available at www.lgcgroup.com/training



Great quality, great value. Used [this training] as a main source for development of method validation procedure policy and document templates.

Training course delegate

SUPPORTING ANALYTICAL SCIENCE ACROSS EUROPE

Eurachem is a network of organisations in Europe that support international traceability of chemical measurements and the promotion of good quality practices. They provide a focus for analytical chemistry and quality related issues and publish a range of well-used guidance documentation in this field.

This year we have co-edited two revised Eurachem guides,

"Metrological traceability in chemical measurement" and "Measurement uncertainty arising from sampling", as well as inputted into a supplement on method validation. This will help Eurachem continue to communicate authoritative best practice and ensure practical and appropriate accreditation and regulation across Europe.

SKILLS FOR INDUSTRY

CAMS
Community for Analytical Measurement Science

CAMS (Community for Analytical Measurement Science), an industry-led network of world-class analytical measurement science training, research and innovation, which was officially launched at the Royal Society of Chemistry in June. The NML is a partner in CAMS, having helped establish the initiative and providing ongoing Secretariat support and co-funding.

The launch event was opened by Dr Julian Braybrook (Director of Measurement Science at

the NML and UK Government Chemist) and Stephen Metcalfe MP (then Chair of All-Party Science Group within Parliament) and was well attended by representatives from industry, academia, the NHS and interest groups.

CAMS promotes and develops a range of research initiatives in the field of analytical measurement science to help provide UK industry with the skilled scientists they need. To date, over £7.8M in funding has been committed to CAMS from the Analytical Chemistry Trust Fund, the Department for Business, Energy & Industrial Strategy and the Community's industry and academic members.

New interactive analytical measurement training resources for applying and practicing skills online, developed as part of a BEIS-funded pilot project for the training institute arm of CAMS (BEAM), will be launched in summer 2020.

11 | ACADEMIC POSTS
3 | LECTURESHIPS
3 | POST DOCS
5 | FELLOWSHIPS

SELECTED PUBLICATIONS

The quality and credibility of our science is demonstrated in part through our publications in peer reviewed journals. In 2019 our scientists published 34 peer review publications. Here is a short selection:

Dunn PJH et al. Systematic comparison of post-column isotope dilution using LC-CO-IRMS with qNMR for amino acid purity determination. *Anal Bioanal Chem* 411:7207-7220. DOI:10.1007/s00216-019-02116-2

Garson JA et al. Quantitative analysis of human endogenous retrovirus-K transcripts in postmortem premotor cortex fails to confirm elevated expression of HERV-K RNA in amyotrophic lateral sclerosis. *Acta Neuro Comms* 7:45. DOI:10.1186/s40478-019-0698-2

Larios R et al. Accurate quantification of carboplatin adducts with serum proteins by monolithic chromatography coupled to ICPMS with isotope dilution analysis. *J Anal Atom Spectrom* 34:729-740. DOI:10.1039/C8JA00409A

Morley GM et al. Particle tracking analysis of extracellular vesicles as a non-destructive surrogate tool for mesenchymal stromal cell health monitoring. *Front Nanosci Nanotech* 5:1-6. DOI:10.15761/FNN.1000179

Phelan JE et al. Integrating informatics tools and portable sequencing technology for rapid detection of resistance to anti-tuberculous drugs. *Genome Med* 11:41. DOI:10.1186/s13073-019-0650-x

Saraiva L et al. Comparison of Volumetric and Bead-Based Counting of CD34 Cells by Single-Platform Flow Cytometry. *Cytom Part B: Clin Cy* 96B:508-513. DOI:10.1002/cyto.b.21773

OUR PEOPLE

Isabel Abad-Alvaro was awarded a poster prize at the 2019 European Winter Conference on Plasma Mass Spectrometry

Malcolm Burns has been appointed as a specialist adviser to the Food Standards Agency for molecular biology analysis and food authenticity testing


Jonathan Campbell has been appointed Chair of the CCQM Cell Analysis Working Group, recognising our expertise in this area

Phil Dunn has been appointed Secretary of IUPAC Commission on Isotopic Abundances and Atomic Weights (CIAAW) sub-committee responsible for drafting the replacement IUPAC Technical Report on stable isotope reference materials

Sarah Hill has been invited to join the Hong Kong Accreditation Service as an external technical expert auditor for ISO accredited laboratories

Jim Huggett has been appointed Chair of the CCQM Nucleic Acid Analysis Working Group, recognising our expertise in this area

OUR PEOPLE
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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