



Engineering Biology Workshop Report

Findings, recommendations and next steps for
measurement science in engineering biology

Executive Summary

Engineering biology is one of the most transformative technologies of our time: revolutionising how we address society's most urgent challenges- from sustainable food systems and cutting-edge biomedicines to clean growth and environmental resilience. Predicted to add \$4 trillion each year to the global economy in the next decade, engineering biology provides new avenues for economic growth and increased productivity in the UK.

Realising the potential of engineering biology to transform healthcare, food systems, and sustainable manufacturing depends on strong measurement foundations that enable reliable data, safe scaling, and regulatory confidence.

In February 2026, the National Measurement Laboratory (NML) at LGC convened around 40 stakeholders from academia, industry, regulators, funding bodies and government to identify priority metrology and standards needs across the engineering biology lifecycle.

The workshop sought views from the sector on the measurement foundations needed for early-stage research, proof of concept and scaling up, and the frameworks required to support compliance and biosecurity.

Key insights

- Robust measurement is foundational to reproducibility, biosafety, and regulatory and public confidence.
- Access to national infrastructure and expertise, data quality and interoperability, and skills gaps limit reliable measurement across the sector.
- Measurement frameworks need to adapt and evolve across the different stages of the innovation life cycle to balance risks and innovation.
- Scaling from lab to real-world systems introduces significant measurement challenges, particularly in process control and environmental monitoring.
- Regulatory expectations are risk-based, but innovators face challenges navigating the many regulators and differing regulatory requirements between sectors, and in evidencing compliance.
- Greater coordination across data, standards, and training is needed to support innovation and biosecurity.

Recommendations

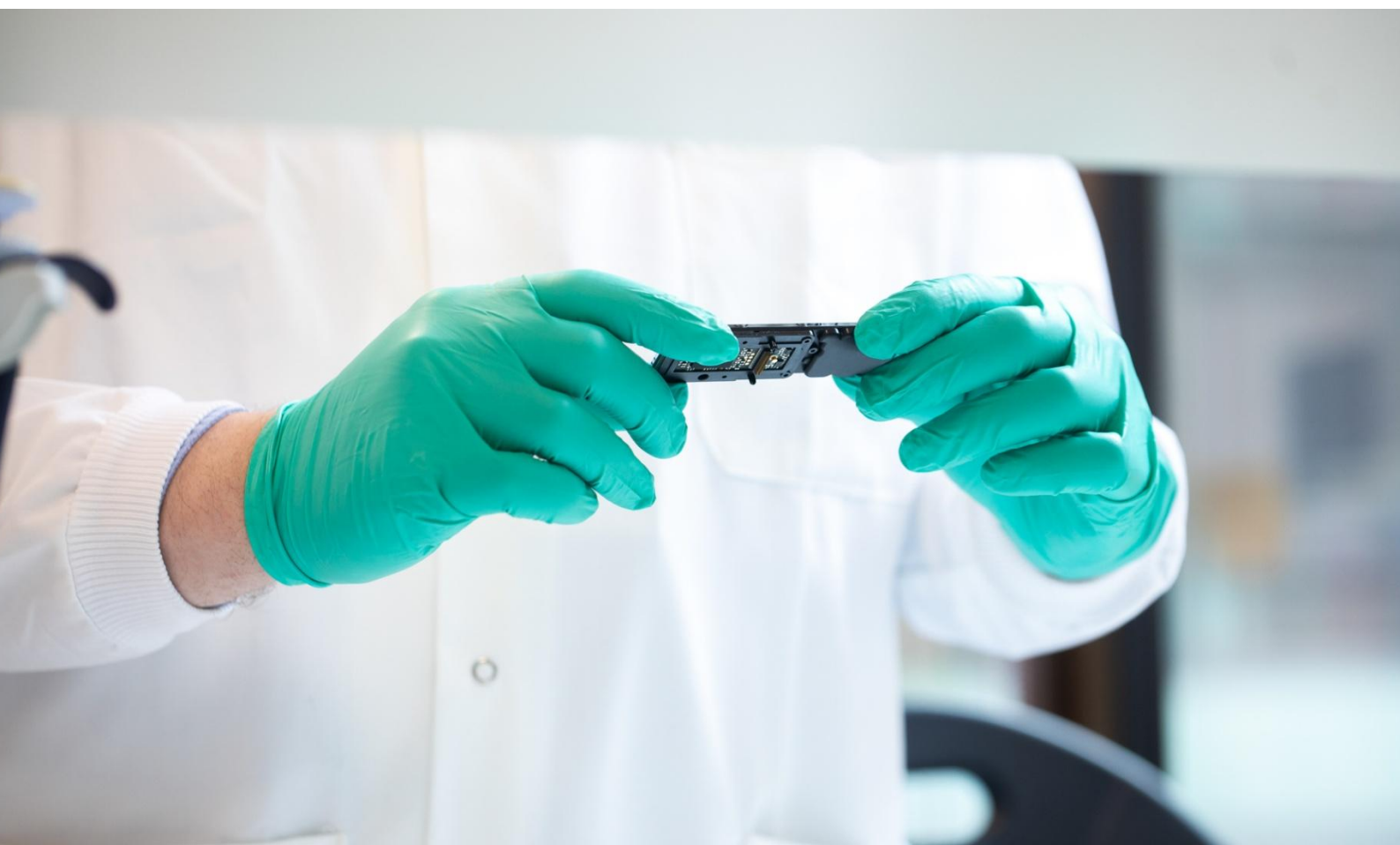
- 1. Strengthen measurement infrastructure and access, developing a national map of measurement capabilities and facilities and considering practical routes for improving access to instrumentation and technical expertise*
- 2. Develop fit-for-purpose documentary standards, including harmonised cross-sector terminology, creating risk-proportionate frameworks and/or pathways across technology readiness levels*
- 3. Promote earlier and ongoing dialogue between innovators and regulators, providing clearer signposting to existing relevant standards and guidance and helping clarify regulatory expectations*
- 4. Build data and digital foundations, identifying cross cutting needs around digital tools, data handling, data standards, and training*
- 5. Embed metrology and standards skills in academic and technical training, supporting cross-sector knowledge exchange and capability building*

Next steps

These findings will inform delivery of EngBioMet, a national network connecting innovators with metrology capabilities to accelerate safe, scalable, and responsible engineering biology in the UK.

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Why measurement matters for engineering biology

Measurement is a foundational enabler of engineering biology. Without strong measurement frameworks, engineering biology risks fragmentation, delayed translation, and reduced public trust.

Metrology and standards are required throughout the innovation journey—from early discovery through to scale-up, manufacturing, and deployment—ensuring biological systems can be designed, tested, and produced with confidence.

Reliable, traceable measurements enable reproducibility and comparison across laboratories, support robust biosafety and biosecurity assessment, and provide the evidence base required for regulatory approval. Crucially, they also build confidence among investors, policymakers, and the public by demonstrating that engineered biological systems are safe, effective, and dependable.

Beyond validation, measurement underpins process control and optimisation in industrial settings, driving consistency, quality, and efficiency in bio-based production. It also enables interoperability across platforms and supports the high-quality data needed for AI-driven innovation.

The importance of metrology and standards has become more clearly recognised across the UK engineering biology innovation landscape, for example in the National Vision for Engineering Biology¹ and by the House of Lords Science and Technology committee². This has led to the creation and launch of EngBioMet, a national network that brings together the UK engineering biology and measurement communities. EngBioMet will focus on developing the methods, materials, technologies, and standards needed to deliver reliable, reproducible, and comparable biological data. Working with the community to build measurement capability and bridging the gap between innovators and regulators, EngBioMet will help ensure safety, supply chain assurance and compliance.

Addressing key measurement challenges, EngBioMet will embed metrology across the ecosystem, supporting safer, faster translation of research into real-world applications, reducing risk and enabling scale-up and commercialisation.

¹ [National vision for engineering biology](#)

² [Don't fail to scale: seizing the opportunity of engineering biology](#)

Workshop overview

The workshop was held at Guildford on the 23 February 2026, with around 40 external stakeholders from across academia, government departments and bodies, industry and the wider measurement community. They covered the sectors of health, food and agritech, environment and sustainability, with many cross-cutting organisations represented. To complement this activity, a second workshop will be held as part of the Government Chemist conference to capture the needs of the food sector (see Figure 1).

Discussions focussed on the current metrology limitations, needs and potential solutions (both broad and technically specific) to improve reliability from early-stage research through to scaling up, and the measurements frameworks and regulatory evidence required to support ongoing compliance, with a particular emphasis on biosecurity. In addition, stakeholders were asked to identify preferred ways of working for the EngBioMet network to best support the community.

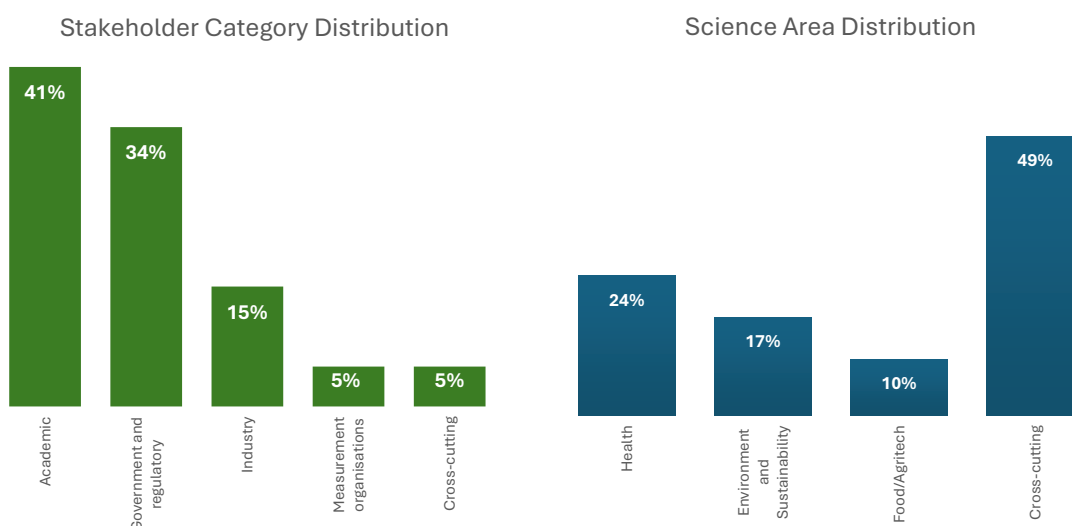


Figure 1: Stakeholder attendee distribution by organisation type and sector.

Details of the workshop questions can be found in Appendix A: Workshop questions.

Key findings

Measurement foundations for innovation

The workshop reinforced that measurement is not an add-on, but a core enabler of engineering biology—underpinning the entire innovation lifecycle from discovery through to deployment.

Participants highlighted that trust and confidence in engineering biology relies on the ability to:

- generate reproducible and comparable data across laboratories
- establish “ground truths” through the provision of reference materials and standards
- translate biological complexity into quantifiable, decision-ready evidence.

Without these capabilities, scientific results cannot be reliably validated, scaled, or accepted by regulators and investors. Importantly, strong measurement foundations also support biosafety and biosecurity, by enabling detection, monitoring, and risk assessment of engineered biological systems.

In practice, this means:

- Traceability is critical: measurements must be linked to recognised standards so that results are trustworthy across and between organisations and sectors.
- Consistency in terminology and methods is needed to ensure that data generated in different settings can be meaningfully compared.
- Standard operating procedures (SOPs) and agreed protocols help reduce variability inherent in biological systems.

Overall, the workshop highlighted that strengthening these foundations is essential to reduce uncertainty, build confidence across the ecosystem and accelerate translation from research to real-world application.

Barriers to reliable measurement

Despite recognition of its importance, participants identified several systemic barriers that prevent the consistent application of high-quality measurement practices. These fall into four broad categories.

Access to infrastructure and expertise

A major constraint that was repeatedly voiced is the limited access to specialist expertise, instrumentation and facilities, with the added challenge of a general lack of awareness of what national capabilities are, or may be, available.

Many organisations—particularly SMEs and academic labs—either do not have access to required technologies and expertise or lack the mechanisms to share or coordinate access across institutions. This contributes to what participants described as a ‘fragmented national capability’, where infrastructure exists but is underutilised or unevenly distributed. Even where equipment is available, organisations often do not have the trained personnel to operate instruments or the expertise to interpret complex datasets.

Cost and implementation burden

The cost and complexity of implementing robust measurement systems (e.g. SOPs, accreditation, ISO standards, quality systems) can be prohibitive, particularly for smaller organisations.

Participants emphasised the need for proportionate approaches, where measurement requirements are aligned with the technology readiness level, the potential risk of the application and its intended use.

Data, standards, and interoperability

Data was identified as both a major opportunity and a significant challenge.

Data volume vs usability

While the sector generates large volumes of data, its value is often limited by inconsistent formats, lack of metadata standards and limited interoperability between systems and organisations.

For example, variability between sequencing platforms (e.g. short-read vs long-read technologies) introduces uncertainty in genomic characterisation, reducing confidence in results.

This lack of consistency limits reproducibility, makes it difficult to integrate datasets, compare results across studies and ultimately reduces the value of datasets for secondary use (including AI), complicating regulatory assessment.

Need for standardisation and infrastructure

Participants highlighted the need for:

- standardised data formats and ontologies
- interoperable platforms, data and digital tools

- trusted data environments for sharing sensitive information

The genomics sector was noted as an example of emerging good practice in both data standardisation and secure data sharing.

Supporting AI and digital tools

There is growing interest in applying AI to quality control, process optimisation and bio-surveillance. However, this depends on the availability of high-quality, curated datasets and robust measurement underpinning training data to provide confidence in AI. Without this, AI risks amplifying existing inconsistencies rather than improving decision-making.

Skills and capability gaps

A critical cross-cutting finding was the need to strengthen measurement skills and capability across the engineering biology workforce.

Participants noted that many scientists are not trained in measurement science and metrology principles, lacking understanding of key concepts such as uncertainty, validation, and traceability. This limits their ability to design robust experiments, implement effective quality systems and generate regulatory-ready data.

This challenge is amplified by the inherently interdisciplinary nature of engineering biology, where multiple different measurements (e.g. linking biological, chemical, and engineering data) may be required to provide a complete picture.

Individual capabilities

Key areas for development that were identified include:

- measurement science and metrology principles
- quality systems and SOP implementation
- data management and analysis
- biosafety and risk assessment

There is also a need to embed these skills across the career profile, from Masters and PhD programmes to the provision of accessible training for early-career technician and industry professionals. Common training approaches would also support cross-disciplinary understanding.

System-level capability

Beyond individual skills, participants highlighted the need for coordinated national training programmes and access to expertise through networks and centres of excellence. There is also a need for stronger links between academia, industry, and regulators.

Building this capability is essential to ensure that measurement infrastructure is effectively used, standards are consistently applied and innovation can scale safely and efficiently.

Scaling and real-world deployment

Moving from controlled laboratory environments to real-world applications introduces significant additional measurement challenges.

Measurement across the innovation lifecycle

A key insight was that measurement frameworks need to evolve across the different stages of the innovation life cycle.

Where early research requires “good enough” measurements to enable rapid iteration, later stages require higher rigour and standardisation for regulatory approval. The timeframes required for implementation and adoption of these frameworks was also highlighted, with interim approaches worth being considered.

Balancing these requirements is critical to avoid slowing innovation unnecessarily or introducing risk at later stages.

Laboratory to industrial scale

Biological systems often behave differently when scaled. Process conditions may change (e.g. temperature, mixing, nutrient supply), yields and performance may vary and previously controlled variables can become harder to monitor.

Participants noted that:

- measurements that work at lab-scale are often not directly transferable to industrial systems
- there is a lack of standardised approaches for monitoring and control at scale.

This creates uncertainty in process optimisation, product consistency and regulatory compliance. There may be opportunities to transfer learnings from other sectors to support effective and rapid scaling in the engineering biology sector.

Environmental deployment and monitoring

For applications involving environmental release (e.g. bioremediation, agriculture), additional challenges arise. These include detecting and tracking engineered organisms in complex environments, understanding persistence, spread, and ecological impact, and developing reliable environmental sampling methods.

Participants identified a need for:

- standardised monitoring protocols

- improved traceability mechanisms (e.g. molecular barcoding, sequencing).

These challenges are closely linked to public trust and perception, particularly where environmental risk is concerned.

Regulation, compliance, and biosecurity

The workshop highlighted both strengths and challenges in the relationship between measurement and regulation.

Risk-based regulatory frameworks

Regulators typically apply risk-based approaches, with requirements varying depending on the product type, its intended use and the sector (e.g. health, food, environment).

A consistent principle is that regulation focuses on product characteristics (identity, purity, performance) rather than the specific processes used to produce them.

Measurement evidence is used to demonstrate safety, efficacy or function, quality and consistency and can provide value where potential 'weight of evidence' approaches may be considered.

Challenges for innovators

Participants highlighted several regulatory and compliance barriers:

- difficulty identifying which standards apply
- lack of clarity on acceptable measurement approaches
- variation in expectations across regulators.

While regulators accept a mix of accredited methods, in-house validated methods and internationally aligned standards, developers often lack guidance on which are most appropriate or how they should be combined.

Need for earlier engagement

A strong and consistent theme was the need for earlier and more iterative dialogue between innovators and regulators.

Early engagement would help clarify expectations, reduce uncertainty as to what is needed, and enable proportionate evidence generation. Without this, there is a risk of misaligned data generation, avoidable delays in approval and increased costs and inefficiencies being added into the system.

Biosecurity considerations

Participants emphasised that measurement frameworks must also support biosecurity, including:

- identifying sequences of concern
- screening biological materials and their suppliers
- ensuring traceability of engineered organisms.

These considerations are becoming increasingly important as technologies become more widely accessible and scale more rapidly. The growing intersection with digital and AI systems was also raised as a concern.

Workshop outcomes and recommendations

The workshop delivered a shared understanding across sectors and stakeholder groups of the critical measurement challenges across engineering biology. There was clear consensus on the importance of risk-based, proportionate measurement frameworks and the need for early and close engagement throughout the innovation life cycle.

The discussions helped identify priority areas for action, including infrastructure accessibility, standards, data, and skills.

Recommendations

- 1. Strengthen measurement infrastructure and access, developing a national map of measurement capabilities and facilities and considering practical routes for improving access to instrumentation and technical expertise*
- 2. Develop fit-for-purpose standards, including harmonised cross-sector terminology, creating risk-proportionate frameworks and/or pathways across technology readiness levels*
- 3. Promote earlier and ongoing dialogue between innovators and regulators, providing clearer signposting to existing relevant standards and guidance and helping clarify regulatory expectations*
- 4. Build data and digital foundations, identifying cross cutting needs around digital tools, data handling, data standards, and training*
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Next steps

The formation of priority working groups to drive delivery through EngBioMet will provide a foundation for coordinated national action, with immediate priorities to:

- Establish and launch working groups:
 - Reproducibility, scale up and process control

- Regulation, compliance and biosecurity
 - Skills development and public engagement
 - Data and digital foundations
- Deliver targeted sector-specific workshop (food sector)
- Define pilot projects and early deliverables to address recommendations within working groups, building on the technical challenges raised
- Continue to engage regulators, industry, and academia in co-development
- Continue to align with UKRI, DSIT, and international initiatives

Appendix A: Workshop questions

Early-stage research, proof of concept and scaling up

- How can strong measurement foundations improve the reliability and biosecurity of Engineering Biology Innovation
 - What measurement challenges currently limit the reliability, reproducibility, and safe practice of engineering biology research – early stage, proof of concept and scaling up?
 - What foundational standards, tools, and training (e.g., terminology, data formats, SOPs, control materials) are needed to strengthen early research, proof of concept and scaling up

Quality control, compliance, and biosecurity

- How can standards and measurement frameworks support compliance, and biosecurity?
 - What measurement evidence will regulators expect for safety, efficacy, quality, and biosecurity safeguards?
 - Which (international) standards (e.g. ISO, IGSC, OECD, ASTM, biosafety/biosecurity IBBIS, IGSC, SBRC, others) are you aware of or should EngBio technologies align with?

Ways of working for EngBioMet

- Which Working Group(s) should we prioritise moving forward? What key challenge(s) should they focus on?
What specific goals and deliverables/outputs should Metrology and Standards aim to achieve within each Working Group?



 measurement@LGCGroup.com

 www.uknml.com