Medical Research Council

MRC Landscape Review

Transitioning to environmentally sustainable life science – challenges and opportunities

Foreword

It is with great pleasure that I introduce this important MRC Landscape Review, which focuses on the crucial task of identifying how research supported by the Medical Research Council (MRC) can be delivered in a more environmentally sustainable way.

MRC has long been at the forefront of ground-breaking research that has contributed to advancements in human health. As we continue to push the boundaries of scientific knowledge, it is incumbent upon us to also consider the broader impact of our work on the health of our planet. As leaders in medical research, we are devoted to proactively addressing the environmental impact of our endeavours.

This review shows MRC's commitment to fostering a research community that is not only innovative and impactful, but also environmentally responsible. Through the examination of current practices, challenges and opportunities, a roadmap must be developed for our research community to navigate towards a more sustainable future together.

The output of this engagement will include actions for MRC and colleagues across UK Research and Innovation (UKRI) to support our community in this endeavour. I am reassured and pleased to note that some of these are already in progress. Collaboration is paramount if we are to realise this vision.

Could I extend my gratitude to the dedicated researchers, practitioners and stakeholders who have contributed their insights and expertise to this review. It is through these collective efforts that we can forge a path towards sustainable and responsible medical research.

I encourage every member of our research community to familiarise themselves with the findings of this MRC Landscape Review, and to actively engage in the implementation of its recommendations.

Thank you for your commitment to excellence, sustainability, and the continued success of MRC.

Professor Patrick Chinnery
Executive Chair, Medical Research Council

Acknowledgements

This report has been produced through engagement with the wider medical research community. We would like to thank colleagues across UKRI as well as senior staff from MRC Institutes and Units for their time in interviews, workshops and seminars, and to survey and questionnaire respondents for their candour.

Particular thanks go to colleagues from the Academy of Medical Sciences, Dr Anna Hands and Prof Perdita Barran from the Manchester University, for their support and enthusiasm, organising workshops and producing reports, which have found their way into this review. Further thanks go to the Centre for Genomic Regulation (Barcelona, Spain), Prinses Maxima Centrum (Utrecht, Netherlands), Max Plank Institute (Munich, Germany) and others, who have engaged in discussion, hosted in their organisation and provided access to their respective community.

Furthermore, we thank colleagues from Wellcome Trust and the Royal Society of Chemistry for sharing their reviews and reports, providing a comprehensive view of the sector's needs.

Last, but not least, we thank Steve Myers from Team Technology for building, administering and analysing the survey.

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1. Executive Summary

Environmental sustainability of the academic system is far from a new issue, according to a report from ALLEA (the European Federation of Academies of Sciences and Humanities). It points to the Talloires Declaration (Association of University leaders for a sustainable future 1990) where more than 500 university representatives pledged to proactively 'engage in urgent action to prevent the drastic consequences of climate change'[1]. In 2023, little progress seems to have been made in discussions about the value of environmental sustainability vs research activity.

In its report to Parliament[2], the Climate Change Committee (CCC) noted that it has reduced confidence in meeting the current carbon budget (2023/2027).

Impacts of climate change and declining environmental sustainability are now seen and felt across the globe. Increasingly frequent occurrences of extreme weather, rapid decline in biodiversity and detrimental impacts on human health bring concerns over food security, flooding, water shortages and more. Colleagues in the National Health Service (NHS) are already seeing evidence of the impact in increased incidence of asthma and heart disease due to air pollution, and deaths caused by heat waves.

As a funder of medical research, MRC has an obligation to support its community to reduce the burden of human disease in an environmentally sustainable way. In 2022, we funded a first round of pilots for projects addressing this aim. The open, unrestricted call received a very wide range of proposals. MRC Environmental Sustainability Programme Board (ESPB) discussed and agreed that activity should be more focused to ensure that impact is maximised.

This Landscape Review is the outcome of the work undertaken in 2023. We have engaged with the wider community to understand the needs to which MRC should respond.

In doing so, we have co-hosted and attended workshops and seminars, and reviewed reports and investigations from other organisations. We have conducted and considered feedback from a survey, as well as activities relating to the establishment of the concordat on driving environmentally sustainable research and innovation in the UK.

The findings are clear and chime with those identified in other reports: the medical and clinical research community is very committed to making its activities more sustainable. However, it is lacking the breadth of expertise required and, crucially, needs evidence for changing practices, such as reducing freezer storage temperatures or using alternative reagents. Most of all, it is calling for the establishment of standards for environmentally sustainable research.

The sector wants funders to include clear and rigorous evaluation criteria in grant application systems that encourage researchers and their respective institutions to change their ways of working and achieve greater environmental sustainability.

Established as part of the work for the concordat, a 'funders round table' will continue to work on finding approaches to support and promote the sector with the implementation of more environmentally sustainable research.

1 ALLEA (May 2022) Towards Climate Sustainability of the Academic System in Europe and beyond, pp 12-13.
2 Climate Change committee (2023) Progress in reducing UK emissions: 2023 Report to Parliament.

2. Introduction

> “Healthier environments could prevent almost one quarter of the global burden of disease. The COVID-19 pandemic is a further reminder of the delicate relationship between people and our planet.
>
> Clean air, stable climate, adequate water, sanitation and hygiene, safe use of chemicals, protection from radiation, healthy and safe workplaces, sound agricultural practices, health-supportive cities and built environments, and a preserved nature are all prerequisites for good health.”

With 24% of all estimated global deaths linked to the environment, the medical research community is called upon to ensure that its actions to reduce human health burdens are not directly contributing to its increase. No longer can we consider whether the environmental impact of research is outweighed by its benefit to human health.

Assessments of greenhouse gas emissions produced by typical research groups in life sciences have shown annual emissions of up to 4tCO2e per researcher. Of this, approximately 50% arises from flights, 20% from electricity (with refrigeration driving a significant proportion) and 16-17% relating to purchasing (IT, lab consumables, chemicals). In addition, the increasing demand on computing – data processing and storage – must be taken into consideration in assessing the impact of research activities on the environment.

As a major funder of medical research in the UK and beyond, MRC is acutely aware of the requirement to show leadership by proactively driving change in both research practice and culture.

The work undertaken in our own facilities (Laboratory of Molecular Biology, Laboratory of Medical Sciences, Mary Lyon Centre) to transform infrastructure and the laboratory operations by participating in LEAF (Laboratory Efficiency Assessment Framework) has highlighted many of the individual challenges that are commonly encountered. Much of the latter required the provision of evidence that any change of practice would not alter or disrupt the science.

A typical example is the drive to store samples at -70°C instead of -80°C, which significantly reduces energy requirements. Significant time and resource was required to allay concerns by researchers that this change would have a detrimental impact on samples and, consequently, their research outcomes.

This need for evidence was recognised by MRC and a £1m fund was made available for a call to investigate ideas that could help make changes to research methods or medical practice. Applications sought to address a wide range of concerns, including regulatory, behavioural, technical and engineering aspects. While these projects were underway and plans were made to present the findings of this work to the community, the discussion moved on to consider potential further funding, including focus and best approach to delivery (academic research, moon shot, commission, etc).

This report aims to highlight where further investments will be most impactful.

3. Scope of the Review

In December 2022, MRC Environmental Sustainability Programme Board agreed the scope for the Landscape Review. It was shaped by the key outcomes considered necessary to inform future funding for finding practical applications for environmental sustainability in medical research.

The report aims to provide answers to the following questions:

- How can the MRC best support our research community in making medical research environmentally sustainable? Where is the greatest need?
- Is there a need for innovation or is a greater impact achieved by evidencing the impact of new ways of working?
- Is a research call the right method or would other approaches be more effective?

To allow these questions to be answered, extensive work was undertaken to understand the main blockers to environmental sustainability for our community. In doing so, providing direction on the best methods for removing these obstacles and the funding required to do so.

The investigations excluded aspects of estates and facilities (as measures to transform to net zero are well understood), Information and Communications Technology (as this forms part of wider activity within UKRI), and Travel (as this forms part of most organisations' policies, tailored to their respective organisational needs and specialism).

There is significant overlap in issues relating to environmental sustainability within the NHS and pharmaceutical industry, but patient care and clinical application, surgery, therapy, manufacturing processes and research not directed to improvement of human health were defined as outside of MRC remit and, therefore, excluded. However, some of the feedback – particularly from workshops and interviews – was relevant to any life sciences and will therefore form part of the findings of this report.

Landscape in UK and beyond

As the Research & Innovation (R&I) sector recognises the urgency of the situation and acknowledges its own contribution to the problem, an increasing number of reports have been produced by funding organisations, publishers and organisations representing significant elements of the research community. Where applicable and consistent with the scope, findings from these reports have been incorporated or taken into consideration in the Landscape Review.

The key reports include:

- Sustainability in the research and innovation endeavour (Royal Society of Chemistry, 16-17 May 2023)
- Enabling greener biomedical research (report from forum workshop, 15 March 2023 at the Academy of Medical Sciences, jointly hosted with MRC and the National Institute for Health and Care Research)
- Advancing Environmentally Sustainable Health Research (The Wellcome Trust, 3 August 2023)
- Towards Climate Sustainability of the Academic System in Europe and beyond (All European Academies, May 2022).

Findings from these reports were similar to the output of MRC's survey and are, therefore, incorporated into the recommendations. It should be noted that the response to the Landscape Review survey was limited but, due to similarity with the findings of other organisations, we consider the output representative.

MRC Survey

The survey was built and administered by an external organisation (Team Technology), which engaged closely with MRC Environmental Sustainability Programme in its design.

Key design considerations

The survey aimed to reach a wide range of professions and roles in medical research, not just the research community itself. To consider wider perspectives, it not only focused on MRC Institutes and Units, but also universities, pharma-industry, funders and the NHS. Promotion of the survey via social media channels meant that there was no restriction as to who could access the survey, but respondents were asked to define their roles and focus. Consequently, the survey did not require a response to all questions, some of which may have been outside the expertise or awareness of some respondents.

A balance was struck between detailed questions and ensuring that time which had to be given over to complete the survey was not excessive.

The survey consisted of a mix of question styles allowing respondents to demonstrate strength of view (rating scales), single options (drop down) and narrative fields for individuals to provide further details.

Responses were anonymous but people were encouraged to provide their details if they were interested in being interviewed or taking part in further investigations.

A brief section focused on understanding the respondent's background, experience and level of influence.

4. Findings

The output of the reports (see section 3) and discussions that took place in several workshops and panel discussions (see Appendices) showed similar key focus areas to be considered as next steps to achieve impact.

With different communities and areas of focus being involved, there were a variety of conclusions from the reports and engagements. However, the following were consistently highlighted:

Need for standardisation

Many of the reports noted that there are currently a number of frameworks available for the calculation of laboratory carbon emissions and evaluation of wider environmental impact (waste, use of chemicals, etc). However, there is no consistent standard for the application of these frameworks to enable environmentally sustainable research, notably in laboratory environments.

Reponses in workshops and reports alike noted the absence of a single repository, source or standard for environmentally sustainable research activities. Discussions with funding organisations have seen agreement that such a central repository requires significant resource to seek out, update and disseminate the knowledge and evidence for sustainable practice. It was noted that a more effective approach would be to use a framework, not dissimilar to the way in which the Athena Swann Charter (a framework used to support and transform gender equality) has gained momentum and become widely adopted in the academic world.

Within the MRC survey, the requirement for standardisation was not specifically mentioned. However, limited availability of guidance, information and evidence were consistently noted in all sections, bar procurement, as one of the major barriers to changing practice. This is despite a high percentage of respondents being aware of or already using frameworks, such as LEAF, Green Labs, S-Lab, etc.

Recommendation:

The UKRI has established a "round table" for research funders to support and develop the Concordat for Environmental Sustainability of Research and Innovation Practice[3]. A working group should be established to start developing minimum standards and a framework for environmentally sustainable research practice. MRC should take an active role in working with its community and funders (NIHR, charities, etc) to ensure that this will be applicable to developing a set of health research specific sub-set of standards.

Environmental sustainability criteria in research grants

What is clear from all reports considered in this review, and further validated by feedback from workshops and the survey, is that the community is lacking policies around environmental sustainability. Lack of 'enforcement' was noted in the survey. ALLEA[4] highlighted the vital role that funders must play in applying leverage to implement change and incentivise good practice in this area.

This is not only through evidence for the sincerity of funders in their declared ambitions in relation to environmental sustainability but also through active support of the 'bottom up' movement of scientists, technicians, estates professionals, etc, to make active change.

National Institute for Health and Care Research (NIHR) has established carbon reduction guidelines[5], and is currently the only UK funder to have established criteria on environmental sustainability for its grant applications[6], albeit by just requiring an assessment of the environmental impact of proposed research.

3 UKRI (2023) Concordat for Environmental Sustainability of Research & Innovation Practice
4 ALLEA (May 2022) Towards Climate Sustainability of the Academic System in Europe and beyond.
5 NIHR (30 July 2019) NIHR Carbon Reduction Guidelines
6 Wellcome (3 August 2023) Advancing Environmentally Sustainable Health Research.

Discussions with other funders have also established that an absence of standards is contributing to a lack of inclusion of such criteria in grant applications, as it makes it difficult to judge 'what good looks like'. This is particularly the case for funders that support a wide range of research disciplines.

Recommendation:

The development of minimum standards and frameworks for environmentally sustainable research practice. These must be created both with the view of enabling researchers to improve their practice and for funders to recognise good practice for environmentally sustainable research in submitted proposals. This could be simplified with potential panel guidance and achievement levels in acknowledged frameworks.

Discussions within workshops and with fellow funding organisations have also raised concerns that these practices may increase the cost of research and, therefore, result in fewer awards being made. This is a particular concern for smaller charities, which note that their supporters are focused on the activities undertaken to resolve the respective problem or disease but are not necessarily focused on, or supportive of, environmental sustainability if it impacts how much research can be undertaken.

Although a fair concern, it sits outside the scope of our Environmental Sustainability Programme but could, over time, be addressed through wider engagement and education.

Culture change

All reports acknowledged the need for culture change in the wider research community and respective organisations. Funders were seen as a key driver of change but it was acknowledged that organisations and individuals also require changes to their conduct and activities. Culture change must work on all levels: funders, research organisations, grant holders, researchers and support systems.

It is concerning that 56% of respondents to the MRC Landscape Review survey did not know the carbon footprint of their research. Those who did provide information did not give the carbon footprint of their respective research, but instead organisation, site and, in some cases, personal estimates. Without understanding the impact of one's activity, making good decisions or changing research methods to become more environmentally sustainable will remain uninformed.

The Concordat for Environmental Sustainability of Research & Innovation Practice proposes not only that signatories declare publicly their ambitions and targets but also report on their emissions and progress. Furthermore, UKRI is embarking on a thorough assessment of its Scope 3 emissions through supply chain, and organisations and activities it invests in (excluding individual research grants). This is expected to provide a more detailed view of UKRI emissions, and therefore those of MRC, and also the extent to which the organisations we fund understand their respective environmental impact.

While this will provide a better understanding from an organisational level, it is important that researchers (as groups and individuals) understand their own emissions and impact on the environment, so they can undertake activities to reduce both.

Discussions about reducing the storage temperature of freezer samples and how to make data centres more environmentally sustainable are very good but fail to recognise a bigger picture of good sample and data management. A requirement for appropriate disposal of data or samples after minimum retention is achieved would reduce demand on storage. This requires a change in approach to policy making and should be a co-ordinated effort between funders.

Recommendations:

Review of the policy landscape in relation to the retention of data and samples with the aim to revise MRC or UKRI policies (if required) to drive regular and responsible disposal, therefore reducing demand on data and sample storage. This work could be undertaken as a commission to an independent provider.

Improve wider Environmental Sustainability literacy by offering basic training or induction for all staff and for managers. UKRI is rolling out a short 'all staff' training module, which should be extended into MRC Institutes and Units and be shared with colleagues in the wider sector.

Management of waste and hazardous materials

There was one aspect of notable difference between the feedback in the Landscape Review survey and the reports that were reviewed in the context of this document. When looking at specific issues the community tries to resolve in becoming more environmentally sustainable, the greatest concern raised in the MRC survey related to waste.

There is acute awareness of the types and volumes of waste produced by undertaking research in laboratories, specifically relating to single-use plastic, hazardous reagents and chemicals, packaging, and waste from biological services, such as clinical waste and bedding.

More effort must be made to establish the types of waste and their respective volumes to understand where the focus should be placed. Undoubtedly, this will be different for different research disciplines and facilities. There is already a statutory requirement on waste disposal service providers to submit accurate records for different wastes (type and volume), but not all suppliers are yet compliant, and some provide these reports to a landlord without further breakdown for individual tenants, for example, some MRC units.

Within UKRI, this should be done by directly targeting the supply chain via a commercial team, and holding workshops with suppliers to collectively address these problems. UKRI is currently working with the NHS and the University Purchasing Clusters to build a powerful pressure group that will influence and change supplier behaviours, including the reduction or use of alternative packaging for products.

To allow researchers to design experiments that are environmentally sustainable, evidence must be produced for using alternative reagents and chemicals, for example water-based products, or providing alternative research methods that avoid or minimise use of such materials. The Royal Society of Chemistry is actively pushing for a UK chemicals framework[7] and is planning to fund research to provide evidence for researchers to reduce the harm to the environment through the heavy use of chemicals. Considering the significance to the medical and clinical research community, this could be more impactful if the call is joined and co-funded by MRC.

Recommendations:

MRC Environmental Sustainability Programme to organise a workshop with relevant individuals from MRC Institutes and members of a supply chain that are directly involved with the disposal of waste in our owned facilities. Furthermore, suppliers should be identified where reduction of packaging is promising the most impact.

MRC Environmental Sustainability Programme to identify the most used hazardous reagents and chemicals used by medical research activities and discuss with the Royal Society the launch of a moon shot or fund to find effective alternatives.

7 Royal Society of Chemistry, (2020) Drivers and scope for a UK Chemicals framework – to be considered alongside our vision for a sustainable chemicals strategy.

5. Other outputs from MRC Survey

Analysis of the respondents

The survey was live between 19 June 2023 and 18 August 2023. MRC encouraged contributions to the survey via the Directors of MRC Institutes and HEI Units, as well as through social media, specifically LinkedIn. Organisations such as the Academy of Medical Sciences and the Royal Society of Chemistry also raised the profile of the survey within their communities.

In total, the survey registered 406 respondents, however, after removing empty or otherwise invalid responses, a total of 177 records were logged.

There was almost equal response from MRC (n=61) and Higher Education (n=66), followed by research institutes (n=26) with fewer than 10 responses each from commercial entities, funders, NHS, and government departments, respectively. However, most of the respondents were scientists (31%) and technical support staff (24%), and the vast majority (73%) had experience of more than five years in research organisations.

Over 70% declared working with samples, 50% working with live subjects, just under 40% referred to patients, indicating clinical research background (multiple options question).

Notably, 67% of respondents described themselves as being in a position of influencing or making decisions in the day-to-day activities in relation to environmental sustainability.

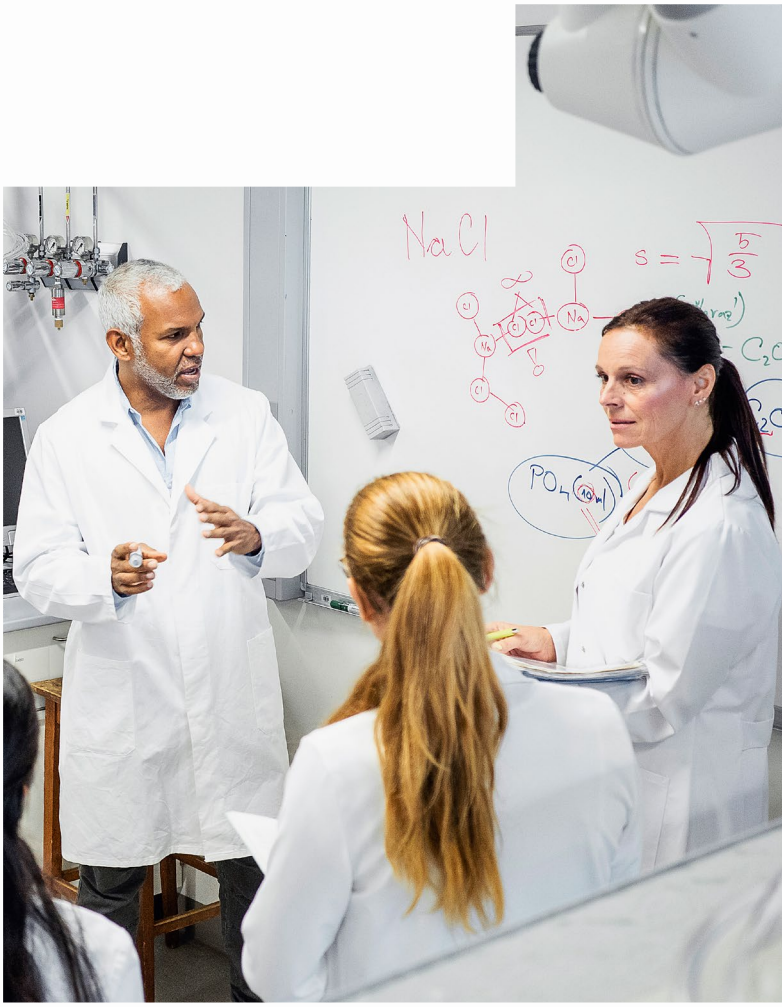
The feedback overall highlighted concerns relating to resource constraints that restrict ambitions in environmental sustainability and, in some cases, a significant tension between staff pushing the environmental sustainability agenda and senior leadership who may have concerns over the wider operational impacts.

There is a need for multiple actions to address: training and education, regulation (grant conditions or standards) and proactively pushing for a cultural shift. The work by UKRI and the wider sector on the concordat is aiming to drive this on a macro level but organisations, such as funders (UKRI, Wellcome Trust, charities, etc) and research organisations alike will need to drive change in a more granular and organisation-specific way.

Recommendation:

MRC to actively contribute and support the UKRI Environmental Sustainability Programme in the development of environmental sustainability education for senior leaders with focus on biomedical research.

Procurement also triggered significant responses. There is a strong suggestion that the implementation of procurement requirements is not sufficient, and closer engagement with supply chains is required to achieve change. Examples, such as a workshop for the mass spectrometry community in Manchester, highlighted that, as clients, we do not ask the right questions about environmental performance of equipment and materials, or the use of specific features of equipment.



6. Conclusion

The scope of the Landscape Review aimed to find answers to the following key questions:

- How can MRC best support our research community in making medical research environmentally sustainable? Where is the greatest need?
- Is there a need for innovation or is greater impact achieved by evidencing the impact of new ways of working?
- Is a research call the right method or would other approaches be more effective?

Responses to the survey and findings from workshops, as well as findings from reports by other organisations, have provided a clear indication of what the next actions should be, although not necessarily to be actioned by MRC.

How can MRC support best our research community in making medical research environmentally sustainable? Where is the greatest need?

The strongest feedback indicated that MRC should support the medical and clinical research community by representing its specific requirements in the wider work with UKRI and other funders (Wellcome Trust, NIHR, etc) to establish standards for environmentally sustainable research. There is a need for a 'single source' of knowledge and evidence that provides information to our community. This activity should take place at UKRI level, but with support from MRC in relation to the specific needs of our community.

Furthermore, we need to continue activities to educate, enable and promote knowledge exchange. The MRC Environmental Sustainability Seminar series is already successful (three conferences in 2023) in organising discussion and thinking around different aspects of research including the estate, health and safety, research continuity, supply chain (November 2023 meeting in Newcastle), as well as areas, such as lab operations, human resources and finance.

The work for the Landscape Review has identified areas in which a review and potential revision of policy may be helpful, and desired, by the research community, such as better management and disposal of samples and data to reduce demand for freezers and data storage. Initial discussions will be held with the respective teams at MRC and UKRI, specifically with colleagues from the Digital Research Infrastructure team to consider the next steps for these issues, which are much wider ranging than medical research.

Is there a need for innovation or is a greater impact achieved by evidencing the impact of new ways of working?

The Landscape Review provided an emphatic response to this question. Calls from the community to provide evidence of the effectiveness of changes to practices are stronger than the consideration of new technology, materials or practices.

However, at the same time, we noted that there is a strong reluctance to change methods or practices irrespective of the existence of evidence. A good example is the discussion around the operation of freezers at -70°C as opposed to -80°C, where evidence of both validity and impact is often ignored or denied.

In other words, focus must be on both the validation of methods (best undertaken by use of commissions or grants) in parallel to more education across all aspects of research activities. This, of course, requires a way of ensuring dissemination to appropriate communities. MRC should work actively with other funders and organisations in the sector (such as Wellcome Trust, NIHR, NHS) to establish effective communication of knowledge.

Is a research call the right method or would other approaches be more effective?

Given the findings from this Landscape Review, the benefits of a research call, such as the MRC call in 2022, would be less beneficial to the community than funding work to validate specific methods and practices. Some of these may benefit from joint approaches with other organisations, such as NIHR to look at clinical work, and Royal Society of Chemistry to explore use of alternative, less harmful reagents, for example. Direct commissioning of work on such problems is deemed more cost and time effective.

That said, it should be noted that the Wellcome Trust report noted MRC's call on environmentally sustainable practices as the only one of its kind at the time, which has a reputational benefit and demonstrates the determination of MRC to help its communities in solving these problems.

7. Appendices

Meetings & Workshops

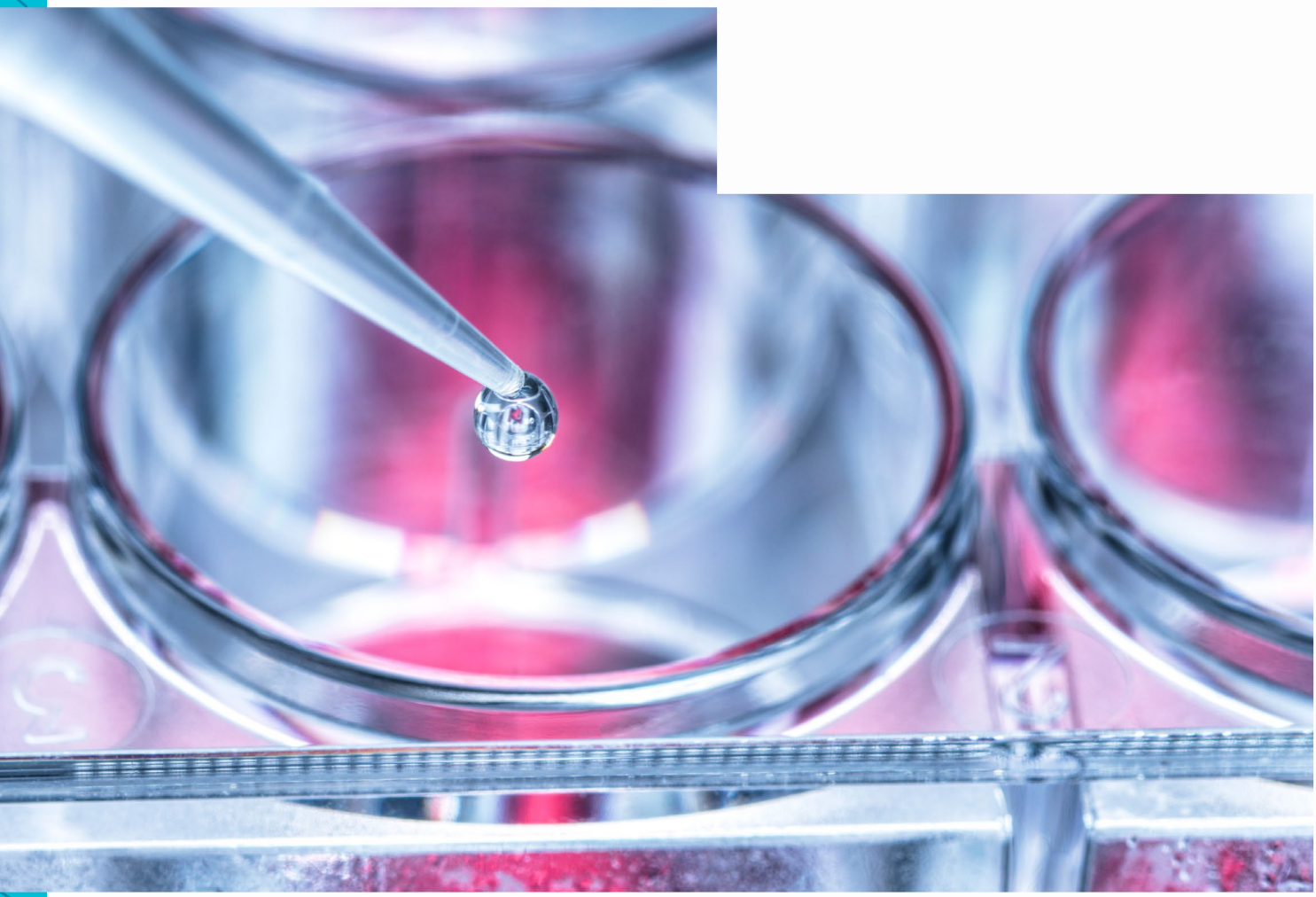
Academy of Medical Sciences (co-hosted by MRC and NIHR) FORUM Workshop,15 March 2023.

The Royal Society, Sustainability in the research and innovation endeavour, Part of the conference series "Transforming our Future", 16 and 17 May 2023.

Centre for Genomic Regulation, Workshop on environmentally sustainable laboratories, 5 May 2023. (The report of the workshop is available on request from SustainableResearch@mrc.ukri.org)

British Academy, Sustainability in Research & Innovation, 31 August 2023.

GreenLabs, Sparking green movement in the funding landscape, 21 September 2023.

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