National Centre
for the Replacement
Refinement & Reduction
of Animals in Research

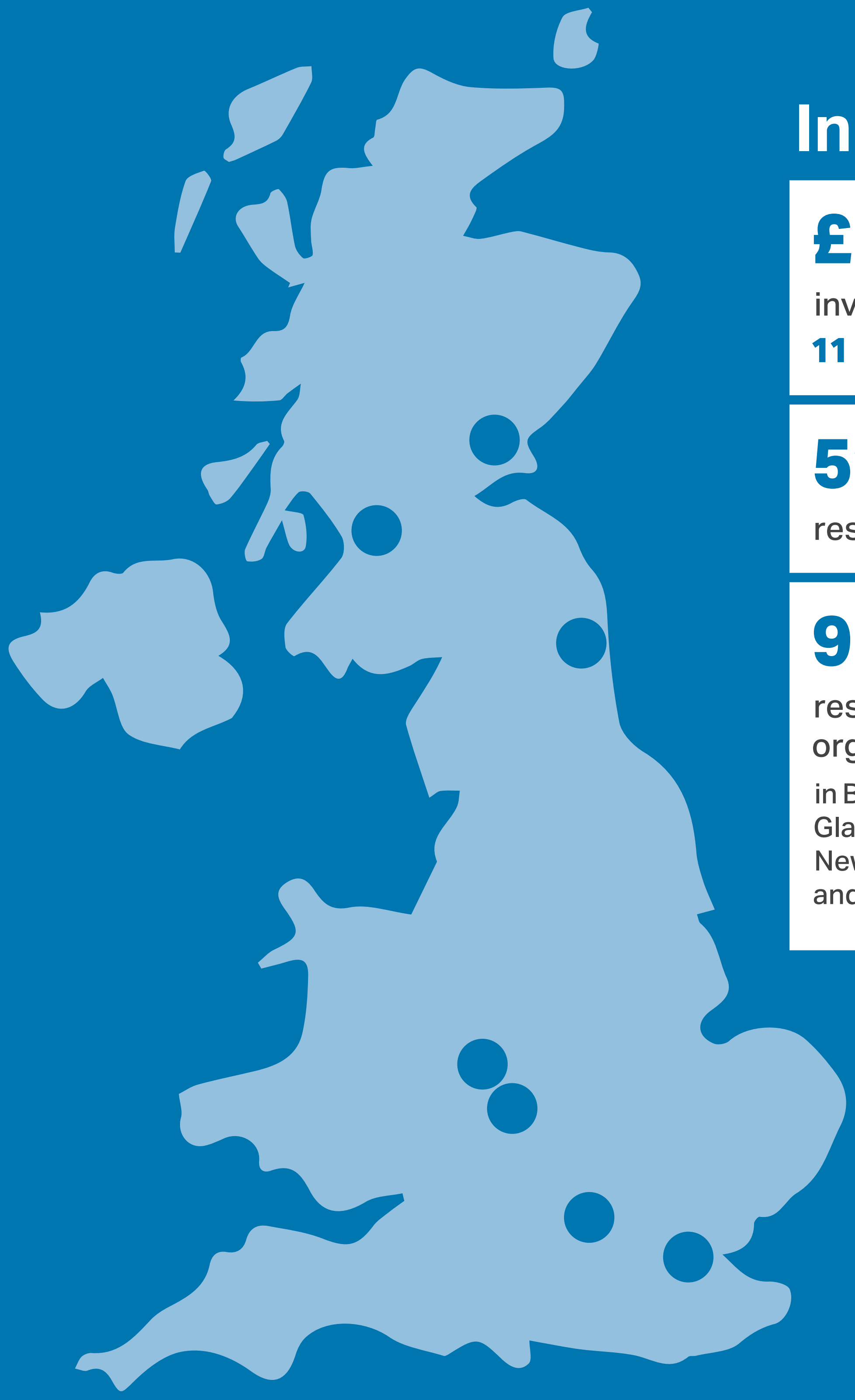
Impact report

Non-animal methods infrastructure grants

October 2025

Pioneering Better Science

Headline impacts from the NC3Rs non-animal methods infrastructure grants



Inputs

£3.95M
invested in
11 short-term awards

52
researchers supported

9
research organisations funded
in Birmingham, Dundee, Glasgow, London, Newcastle, Oxford, and Warwick

Outputs

£1.78M+
in-kind contributions provided by host institutions and industry partners

101 academic collaborations

24 industry partners

18
project partners providing expertise and training, access to facilities and equipment

National facilities established
including for stem cells, bioprinting, organoids and organ-on-a-chip systems, providing shared access and benchmarking capacity

1,800+
researchers directly trained or engaged through workshops, training programmes and network outreach

Thousands of animals
will be replaced annually as a result of this infrastructure funding

All projects were designed for rapid delivery, running from October 2024 – March 2025.

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Introduction

In 2024 the NC3Rs received an additional £4.85M from the Department for Science, Innovation and Technology, providing a significant opportunity to accelerate the uptake of non-animal methods to replace the use of animals. As the national leader in embedding these approaches into routine use across the life sciences, we used this funding to address a key barrier to their uptake – limited access to infrastructure and resources.

Through a competitive call, 11 short-term infrastructure awards totalling £3.95M[1] were made to establish facilities, equipment and develop training programmes. These initiatives are enhancing accessibility to non-animal technologies and fostering their integration into routine research practice.

The investment represents the first infrastructure funding dedicated specifically to non-animal methods, where traditionally this type of funding has been reserved for animal-based research. The awards are already strengthening national capability, encouraging innovation and delivering measurable 3Rs impacts by replacing the use of thousands of animals annually. They are also creating sustainable platforms to support future adoption across the UK. The case studies highlighted in this document illustrate the breadth of projects supported and their scientific and animal replacement impacts.

1. The non-animal methods infrastructure funding call was designed for rapid spend, with projects limited to six months in duration. A budget of £4M was made available.

Expanding human stem cell platforms and automation infrastructure to enable scalable and high-quality cell supply

A reliable supply of human stem cells is a major barrier to the wider adoption of stem cell-based models, with technical challenges in differentiation, scale-up and reproducibility limiting their use. We invested £1.38M across four awards to establish or expand core stem cell facilities, introducing robotic automation, high-throughput systems and standardised protocols with quality-control pipelines. As a result, these centres have been able to increase capacity to produce consistent and clinically-relevant stem cell-derived models, supporting the replacement of animal models in areas such as diabetes and Alzheimer's disease and laying the foundations for sustainable supply chains of high-quality stem cells for academia and industry.

Scaling the production of human stem cell-derived beta cells to replace mouse islets in diabetes research

Dr Ildem Akerman at the University of Birmingham used her award to expand the BetaCell facility, increasing its capacity to produce human stem cell-derived pancreatic beta cells as a replacement for mouse islets, which are used in their tens of thousands each year for diabetes research. Funding supported the installation of a custom perfusion-based suspension bioreactor and the introduction of automation, enabling scalable production and streamlining workflows to meet high demand from researchers locally and nationally. The new bioreactor enables the simultaneous production of up to 10 billion stem cell-derived islets, positioning the facility as a UK leader in the cell-replacement therapy field. The facility is prioritising the supply of human-derived beta cells to replace the use of animals, with 14 labs from across seven universities already accessing the cells, many of which are being used to develop cell replacement therapies for type 1 diabetes. Collaborations with the Cell and Gene Therapy Catapult[2] are underway to optimise protocols for industry-scale production of human-derived beta cells and to establish GMP-compliant quality control processes, supporting a reproducible and sustainable supply of cells and wider uptake including contributing to future NHS-delivered cell replacement therapies for diabetes. Building on this momentum, Ildem and colleagues have secured £300k in follow-on funding from the Cystic Fibrosis Trust to explore the use of human-derived beta cell transplants for cystic fibrosis-related diabetes, alongside extending the applications of human-derived beta cells for studying early-onset obesity and Alström syndrome, which collectively will replace the use of hundreds of animals per year.

Supporting high-throughput human stem cell neuronal assays as a replacement for animal models used in central nervous system autoantibody detection

Associate Professor Lahiru Handunnetthi established a stem cell facility at the University of Oxford for high-throughput human induced pluripotent stem cell (iPSC)-derived neuronal assays for the detection of autoantibodies in central nervous system diseases. Funding supported the installation of specialised equipment, optimisation of protocols and the development of pooled expertise, creating a robust platform for reproducible, high-quality data generation from patient samples. The facility has fully replaced traditional rat-based assays that rely on fetal and adult brain tissue, eliminating the use of up to 300 rats annually while increasing the diagnostic accuracy for conditions such as autoimmune psychosis and NMDA-receptor encephalitis. Comparative studies involving more than 200 patient samples demonstrated that the human-based iPSC assays are capable of detecting pathogenic antibodies with higher sensitivity than traditional rat-based assays, which frequently yield false negatives. Qualification studies further confirmed the suitability of the assays for clinically-relevant cohorts, with repeated testing of patient samples producing consistent binding patterns and strong intra-assay reliability. Standardised protocols, training programmes and quality control measures have already enabled adoption by three local research groups, with protocol sharing and training activities ongoing to support wider adoption by other national neuroimmunology groups. The team are also collaborating with industry partner, Johnson & Johnson Innovative Medicine, to evaluate the high-throughput platform for use in clinical trials.

2. An independent innovation and technology organisation accelerating the growth of the UK cell and gene therapy industry.

Building specialist infrastructure for complex 3D human tissue modelling

Advances in 3D bioprinting, bioreactors and organoid culturing technologies are rapidly expanding the capabilities of researchers to develop and qualify complex and physiologically-relevant 3D human tissue models as replacements for animal models. However, limited or inequitable access to specialist equipment and standardised benchmarking methods has slowed wider adoption. Three awards totalling £754k are addressing this gap by funding cutting-edge equipment and shared hubs across multiple institutions. By making these technologies accessible as collaborative resources, they are accelerating the uptake of complex 3D human models and reducing reliance on animal use in drug development, immunology and reproductive disease research.

Establishing national 3D bioprinting platforms to advance human *in vitro* models of disease for drug development

Professor Kenneth Dalgarno at Newcastle University used his award to install three advanced multi-modal bioprinters at the Universities of Newcastle, Cambridge and Bristol, enabling high-throughput, reproducible fabrication of complex 3D *in vitro* disease models for drug development. The bioprinters support diverse biomaterials, cell types and structural designs, producing high-resolution constructs that closely mimic human tissue architecture and function. Seven key users across three institutions working in cardiac drug safety, liver cancer, blood, bone and marrow biology, osteoarthritis and embryology have been trained to use the bioprinters, and over 200 researchers have participated in workshops to accelerate wider adoption across the UK. Qualification studies at Newcastle University have demonstrated that the bioprinted models accurately replicate human tissue responses. In cardiac models, cardiomyocyte and fibroblast co-cultures printed on high-density multi-electrode array chips were used to measure contractility and electrophysiological responses to Comprehensive *in vitro* Proarrhythmia Assay (CiPA) reference compounds, confirming their relevance for drug safety testing. For liver cancer, 3D luciferase-expressing hepatocellular carcinoma cells were co-printed with fibroblasts to model stromal variation in the tumour microenvironment, with drug responses to standard-of-care therapies, sorafenib and lenvatenib, evaluated through growth, viability and apoptosis assays. This technology has the potential to replace up to 1,000 mice per year at Newcastle University and the ongoing studies in leukaemia, embryonic development and osteoarthritis could increase the replacement potential of these bioprinters to 5,000 animals annually across the Universities of Cambridge and Bristol.

Establishing a human lymphoid organoid and explant hub to replace animal models in immunology research

Dr Pablo Céspedes at the University of Oxford established a human lymphoid organoid and explant hub, providing researchers with access to advanced *in vitro* models for studying adaptive immune responses without using animals. The hub combines state-of-the-art infrastructure, optimised protocols and hands-on training, giving researchers access to primary human tonsil and spleen tissue, high-throughput imaging and precision-cut tissue handling instruments. It currently supports six Oxford research groups and the organoid and explant models have already replaced 1,512 mice in a six-month period across seven CRISPR/Cas9 screening studies, identifying enzymes and surface proteins critical for B-cell differentiation and adaptive immunity. Dissemination through workshops and seminars has reached over 50 academic and industry researchers, fostering four new collaborations including with vaccine manufacturers ReNewVax and Neovac, and academic groups at the University of Dundee, enabling the use of lymphoid organoids in preclinical testing of vaccines and therapeutics. Pablo's team has since secured £175k via an NC3Rs Partnerships and Impact award to further characterise the models using single-cell RNA sequencing, high-dimensional flow cytometry and high content microscopy, generating open access multimodal datasets for use by other researchers. Collaborations with new end-user labs at the Universities of Dundee and Oxford are currently testing the transferability of the organoid and explant models, applying them to study B-cell germinal centre reactions, antibacterial immune response and T-cell immunity, further reducing the reliance on mouse models.

Expanding the capacity of organ-on-a-chip centres and training infrastructure for microphysiological systems

Investments in organ-on-a-chip centres of expertise have increased access to microphysiological systems and structured hands-on training, supporting a national ecosystem for non-animal model development and qualification. Wider adoption has previously been limited by unequal access, uncertainty about which system is most appropriate for particular research questions, challenges in comparing results across platforms and the need for specialist training. Two awards totalling £1.06M supported the expansion of an existing facility and the establishment of a new dedicated Centre, providing access to commercial platforms, hands-on training, experimental set-up support and guidance on selecting appropriate systems. This combination of equipment and expertise is enabling researchers to study disease mechanisms and drug responses *in vitro*, replacing the use of animals in musculoskeletal, cardiovascular and gastrointestinal research.

Driving the adoption of organ-on-a-chip platforms through training and cross-sector collaborations

Professor Hazel Screen used her award to increase the capacity of the Queen Mary University of London Centre for Predictive *In Vitro* Models, equipping the facility with multiple commercially available organ-on-a-chip platforms, microfluidics and microfabrication technologies, alongside the infrastructure required to support their use. The Centre provides access, tailored training and a dedicated website, enabling researchers at all levels to adopt organ-on-a-chip approaches. Six research groups are developing and characterising organ-on-a-chip models for musculoskeletal and cardiovascular applications, including tendon-bone and vascularised tendon interfaces, with the aim of replacing mouse studies. 24 postdoctoral researchers and PhD students have received hands-on training through these projects, embedding expertise in these *in vitro* methods. The facility has also integrated organ-on-a-chip technologies into 15 industry-linked PhD projects funded through an EPSRC Centre for Doctoral Training programme, extending applications to rheumatoid arthritis, acute myeloid leukaemia, polycystic kidney disease, drug metabolism studies and inflammatory skin disease, replacing the use of animals in these studies. The Centre is now developing a scalable training programme to advance understanding of organ-on-a-chip models, supporting national adoption across academia and industry, with plans to support 100 projects over the next five years that will replace an estimated 28,000 rodents used in research and testing.

Establishing the UK's first gut-on-a-chip research centre for gastrointestinal and microbiome research

Dr Tamas Korcsmaros used his award to establish the UK's first dedicated gut-on-a-chip research centre at Imperial College London, creating a national hub for non-animal approaches in gastrointestinal research. Building on the Imperial organoid facility and biobank, the Centre for Intestinal Systems hosts a suite of leading gut-on-a-chip technologies, including a fully automated computer-controlled simulation of the entire gastrointestinal tract and its microbiome, significantly expanding its technological capabilities. This infrastructure enables side-by-side comparison of multiple gut-on-a-chip platforms, helping researchers select the most appropriate systems, alongside benchmarking studies focused on assessing the suitability, reproducibility and predictive capacity of the gut-on-a-chip systems as replacements for animal models. Standardised protocols have been developed for key readouts, such as barrier integrity and cytokine responses, across eight platforms, supporting the wider adoption of gut-on-a-chip models. Four Imperial College research groups and five external collaborators, including pharmaceutical companies and the Bezos-Imperial Centre for Sustainable Proteins, are already using the Centre to replace animal models in studies ranging from host-microbiome interactions to comparative studies of new dietary products previously tested in mice. More than 1,500 researchers have engaged with the Centre through targeted dissemination, including the newly established network – the London gastroIntestinal Organoid Network (LION). Now embedded as a core facility at Imperial College London, the Centre is expanding training and online resources to broaden access and extending applications to inflammatory bowel disease, cancer, infection and cystic fibrosis, further advancing human-relevant models of gastrointestinal biology with the potential to replace up to 12,000 mice annually.

Annex: Summaries of other projects funded in the call

Enhancing human-relevant stem cell platforms to replace animal models

Professor Kate Storey's award enabled the Human Pluripotent Stem Cell Facility at the University of Dundee to upgrade liquid handling robotics and automated microscopy equipment, expanding the capacity to generate human iPSCs. Standard operating procedures were developed to enable the reproducible production and wider adoption of genetically engineered iPSCs. The facility has already supported the development of iPSC models of Alzheimer's disease, amyotrophic lateral sclerosis, myocardial infarction and diabetes, minimising the reliance on mouse-derived cells. Five local neuroscience groups have adopted the iPSC-based systems, replacing their use of primary mouse neurons, astrocytes and microglia and the use of hundreds of mice annually.

Establishing a core human stem cell facility to advance human-relevant models of neurological disease

Professor Selina Wray used her award to establish a new human iPSC core facility at University College London, providing researchers with access to advanced equipment and standardised protocols for fibroblast reprogramming, iPSC generation and organoid differentiation. The facility will support 21 research groups working on projects spanning epilepsy, dementia, cerebellar ataxia and Parkinson's disease research, with the potential to replace the use of mouse models by between 20 to 500 mice per group annually through the adoption of human iPSC-derived systems. Work is underway to automate differentiation protocols to further increase capacity at the facility. To address reproducibility challenges, Selina's group is contributing to an NIH-led international study benchmarking protocols across laboratories. The facility is also promoting wider adoption of iPSC technologies, with protocols openly available via the Protocols.io platform.

Expanding bioreactor capacity for complex 3D human reproductive tissue models

Professor Andrew Blanks' award funded a second bioreactor at the University of Warwick, doubling capacity for generating self-assembling 3D cell culture systems, termed assembloids, for human reproductive disease research. The scaffold-free, movement-based bioreactor system has reduced Matrigel use by 80-fold and eliminated animal use in Andrew's lab, while producing more physiologically relevant uterine assembloids that are capable of self-generating their extracellular matrix. The new bioreactor also enables the growth of larger assembloids, approximately three times the size of those produced previously, with tissue thickness more closely resembling that observed *in vivo*. This increased capacity has already supported two collaborations including the differentiation of human embryonic stem cells into germ cells and the development of a novel endometriosis explant model, potentially replacing animal use in further key areas of human reproductive disease modelling.

Advancing non-animal approaches for assessing oral drug development

Professor Hannah Batchelor at the University of Strathclyde used her award to establish a facility that aims to replace the use of animals in the evaluation of oral drug performance. Funding enabled the procurement and integration of an advanced analytical probe into a multi-compartmental *in vitro* model that simulates the upper gastrointestinal tract, allowing real-time, physiologically-relevant monitoring of oral drug disintegration and dissolution. The facility provides hands-on training for multiple users and supports internal formulation screening and collaborative projects with academic and industry partners, including with AstraZeneca. A new collaboration with the University of Nottingham is underway to correlate *in vitro* disintegration with human gastric conditions, further reducing the reliance on animal studies. This technology has the potential to halve the number of animal studies required locally over the next three years, replacing up to 50 studies that would currently be conducted in pigs or dogs.

Leveraging AI and machine learning to improve disease modelling and replace animal use

Professor Crispin Miller at the University of Glasgow used his award to install advanced computational hardware that enables the use of AI and machine learning to analyse datasets from organoids, genetically engineered mouse models and humans for large-scale disease modelling. His team have curated a FAIR-compliant dataset that combines large scale imaging and RNA sequencing data, enabling direct comparison with human tissues. By developing innovative workflows and self-supervised AI models, the project is improving how researchers select disease models and predict outcomes, while also reducing reliance on animal experiments. Four groups are using the platform to model human tissues and contextualise mouse and organoid data in relation to human biology, with datasets and tools to be made publicly available.

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