

saving the lives of people with blood cancer

Unlocking new ways to treat every patient



2023-2028

We are Anthony Nolan. We are pioneers in transforming the lives of those needing haematopoietic cell transplants across the globe. And we have always believed new ways to save and improve lives can – and must – be found.

Introduction

In April 2023, we launched our new organisational strategy which contains our ambitious new vision - to create a future where every patient who needs us can survive and thrive. Over the next five years we will focus our work on achieving three aims that will have the greatest impact, and make the biggest difference, for the most people.

- Survival: Giving every patient the best chance, and quality, of life.
- **Equity:** Ensuring all patients have the best access to, experience of, and outcomes from, treatment.
- **Progress:** Exploring and embracing new cell therapies and making them available to patients more quickly.

Research has been our strength from the very start when Shirley Nolan took the groundbreaking step of establishing the world's first register of volunteer bone marrow donors. But now is the time to push this pioneering spirit even further. Expanding our research will be the key to achieving the transformation we want, and need, for our patients.

To achieve these ambitious aims, we are investing in our three most powerful tools: Discovery, Data and Donors.

Discovery is the key to our research strategy. Through pioneering research we will further understand and address the issues that affect so many of our patients.

Data is vital to every decision we make. Making sure we collect, process, and analyse data that is complete, accurate, and accessible, is critical to helping us make the right decisions about every step we take.

Donors have always been at the core of our organisation. It is their selfless generosity that helps us give a second chance of life to three people every day. But we know we need to grow and diversify our register for those desperately seeking a donor. And we also know those donors' cells can be used in so many more ways, to help us discover new treatments and ultimately save more lives.

A word from our Chief Medical and Scientific Officer, Dr Robert Danby

Welcome to our new research strategy, which I am delighted to share with you. For 50 years, we've been pushing the boundaries of what haematopoietic cell transplantation can achieve, and we're proud of our strong track record in world-class research, enabling transplants for more patients and with greater success.

Now, as our organisational aims and scope expand, so too must our research. We must deliver and facilitate pioneering research to advance haematopoietic cell transplantation and embrace new cell therapies that offer even more possibilities for patients.

It's our aim to improve access, equity and outcomes for every patient who needs a transplant. And by outcomes, we don't just mean survival - we mean quality of life too. Despite all our progress, too few patients survive and too many suffer complications. We must do better, and we must do more.

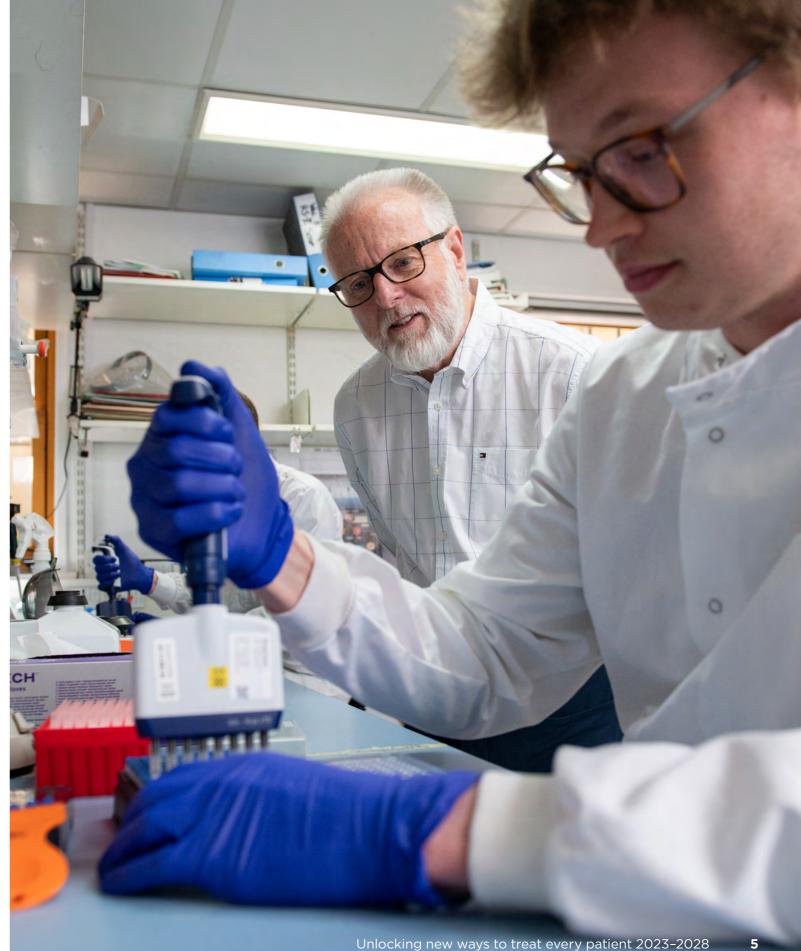
By working together and uniting our research scientists and clinicians, our patients and donors, and our partners across the international clinical and scientific community, we will promote collaboration, drive progress and innovation, and bring new hope to more patients.

And we'll move closer to the day when cell therapies mean more people will not only survive but thrive.

We're very excited for the future and we hope you are too.



Dr Robert Danby Anthony Nolan's Chief Medical and Scientific Officer



A note on terms

The phrase 'stem cell transplant' is sometimes used to refer to haematopoietic cell transplantation. For clarity, we use this to mean the transplantation of either bone marrow, umbilical cord blood or peripheral blood stem cells.

Building on our history

60 years ago, haematopoietic cell transplantation was a new experimental therapy. In its early years, it carried many risks and complications. Over time, through groundbreaking research and continual improvements in clinical practice, it has become a lifesaving treatment for thousands of patients with blood cancer and blood disorders in many countries across the world.

Anthony Nolan has played a huge part in this progress, not only by undertaking our own innovative research, but also by facilitating and investing in research that has contributed to these advances. We are proud of the role we have played alongside other research organisations, clinicians, scientists, patients, and donors.

Key

Milestones in the transplant community Achievements at Anthony Nolan

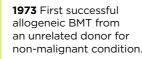
1957 First patients with acute leukaemia being treated with radiation followed by infusion of bone marrow (Dr E Donnall Thomas).

1958 First human leukocyte antigen (HLA) detected.

1968 First successful allogeneic BMT from a sibling donor for non-malignant condition.

1950 and 1960s

The first tentative steps in BMT were performed to recover bone marrow function in patients treated with radiation therapy. At the time, little was known about the need to match donors and recipients and tissue typing began to be established with the first HLA antigens being defined.



1974 European Society for Blood and Marrow Transplantation (EBMT) patient and donor

registry formed.

1978 Ciclosporin (CyA) is used to prevent graft-versus-host disease (GvHD) after BMT.

1979 First successful allogeneic BMT from unrelated donor for malignant condition performed.

1974 Shirley Nolan sets up the first bone marrow donor register in the world.

1978 Anthony Nolan's first tissue typing laboratory opens.

1970s

Allogeneic bone marrow transplants start to see more success. Tissue typing developed with more HLA antigens defined, enabling transplants to be performed using HLA-matched unrelated volunteer donors.

1988 First successful transplant using umbilical cord blood performed.

1988 First patients treated with donor leukocyte infusion (DLI) for relapsed leukaemia after BMT.

1988 Bone Marrow Donors Worldwide (BMDW) is established.

1988 Anthony Nolan becomes an internationally recognised donor register and research centre.

1980s

Bone marrow transplants are now established treatments for malignant blood diseases and other blood disorders. T cell depletion protocols start to be used to reduce incidence of GvHD.

1990 Dr E Donnall Thomas wins Nobel Prize in Medicine for his pioneering development of bone marrow transplantation.

1993 First reports using peripheral blood stem cells for transplantation.

1995 British Society of Blood and Marrow Transplantation (BSBMT) established.

1990 Anthony Nolan's state-of-the-art tissue typing laboratory opens at The Royal Free Hospital.

1996 Anthony Nolan Research Institute (ANRI) is established to study the science of haematopoietic cell transplants.

1998 A worldwide database of variations in HLA compatibility genes is released.

1990s

Peripheral stem cells start to replace bone marrow for transplants and less-toxic reduced intensity conditioning (RIC) regimens are introduced, allowing transplants in older patients. More advanced molecular methods start to replace serology for HLA typing.

2003 First report of human CD19 directed CAR T cells killing leukaemia (animal models).

2008 The Anthony Nolan Cell Therapy Centre opens to process, store and use umbilical cord blood.

2000s

Increased use of umbilical cord blood transplants and development of double cord blood transplants. Development of genetically engineered cell therapies (CAR T cells) with first human clinical trials.

2010 First case report of CD19 CAR T-cell therapy for lymphoma.

2012 One million stem cell transplants celebrated worldwide.

2013 The UK's Aligned Registry is formed.

2017 IMPACT. the UK clinical trials network in HCT. is launched.



2012 Anthony Nolan becomes the first register to lower its minimum donation age to 16.

2013 Anthony Nolan Patient Services launched.

2015 Anthony Nolan brings Third Generation Sequencing to our Clinical Laboratories.

2018 Anthony Nolan Cell and Gene Therapy Services launched.

2010s

Use of haploidentical related donors for HCT increases due to post-transplant cyclophosphamide (PTCy). First effective CD19-directed CAR T-cells complete clinical trials and approved for the treatment of acute lymphoblastic leukaemia and lymphoma.

2023 Anthony Nolan launches a new organisational research strategy.

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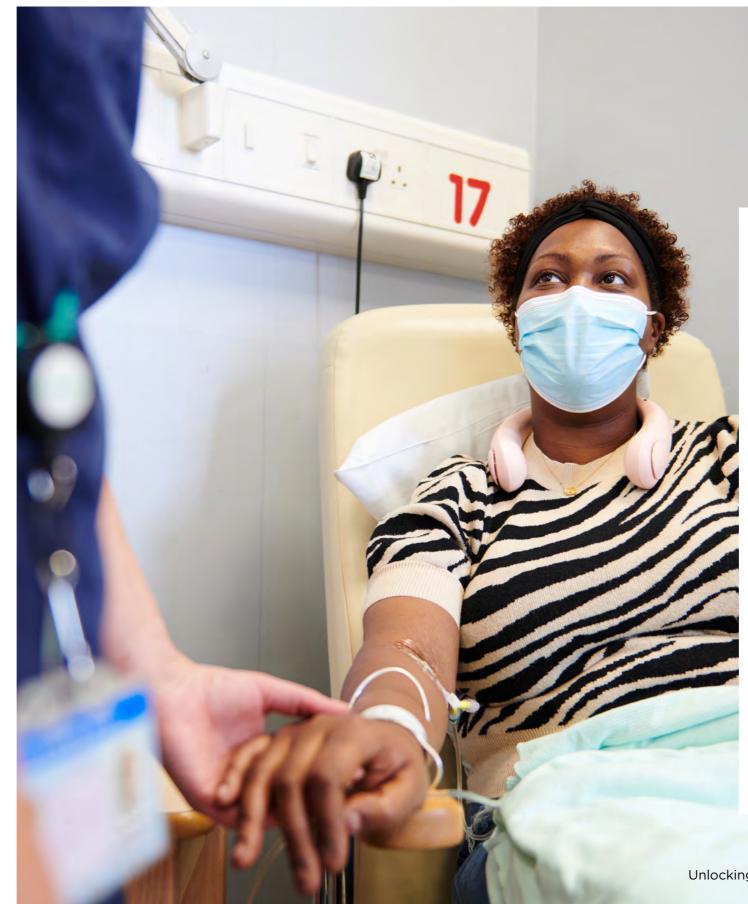
Increased use of post-transplant cyclophosphamide for HLA-matched and mismatched unrelated donors. Rapid expansion and development of cell therapies, including CAR T cells and CAR NK cells, for treatment of haematological and non-haematological conditions.

Creating a better future

Incredible progress has been made and countless lives have been transformed thanks to Anthony Nolan. However, approximately half of patients tragically don't survive longer than five years post-transplant. For those who do survive, their quality of life can be adversely affected by their treatment and complications after transplant. While so much has been achieved, we can and must do more.

To have the greatest impact, our research will continue to be centred around our patients and donors. We know we must take a wider, more holistic view of the whole patient journey, to identify new opportunities to improve outcomes and experience for every patient.

We also need to understand more about each patient's background and circumstances, their specific disease or condition, and what makes the best donor for each individual. We need to acknowledge how this affects the care and support for each and every patient. Taking a more patient-centric view and applying it to our research, will allow us to better respond to, and address, the major challenges that remain.



Scientific research into new cell therapies is developing with unprecedented speed, bringing scope to pursue personalised therapies. Technologies to select and manipulate blood cells offer new treatment options and may even replace haematopoietic cell transplant for some patients. While many current cell therapies use the patient's own cells, future therapies are likely to use cells from healthy donors, increasing speed and access to treatment. At Anthony Nolan, our research will investigate the optimal donor, cell source and cell type for the development and production of these future therapies.

At every stage of Anthony Nolan's journey, the main driver of progress has been research. Research delivered through our expert scientific, clinical, and social research teams. Research undertaken collaboratively with partners in the UK and internationally. And research empowered by relationships with patients and donors, health care providers, donor registries and charities, and partners in academia, pharma, and biotech.

It is only by constantly striving to discover new ways to improve patient outcomes that we will take the crucial next steps in transforming the future for more patients.

That is why our research strategy exists.

If we are to unlock new ways to treat every patient... then research is the key.

Our research aims

Our vision is to deliver pioneering research that transforms patient survival, quality of life and equity.

We hope to realise this vision by focusing on achieving three aims:

Survival, Equity, and Progress.



Unlocking new ways to treat every patient 2023-2028

Our aim:

Survival

To transform outcomes for every transplant patient

Our research will:

- Increase our understanding of patient, donor and disease characteristics, and how together they influence clinical outcomes and quality of life.
- Improve, increase and integrate data to better understand patients, their journeys and their outcomes, and to enable more precise treatment and personalised care.
- Accelerate the translation of new discoveries into clinical practice.

Aim 01: Survival

Our research will better understand the patient, the donor, the disease, and the treatment. We want to understand how they influence each other and how together they determine outcomes.

We need to further understand what the optimal donor, cell source and cell product is for each patient and disease indication. For those patients without an HLA-matched donor, our research will investigate the preferred alternative and how best to overcome patient/donor disparity. High quality data is crucial to

increasing our understanding and improving patient outcomes. Making sure we collect accurate, complete and integrated data is critical. Having better data will allow us to accurately monitor transplant numbers, analyse changes in patient and donor practice, review clinical outcomes, and test research hypotheses.

Our research teams will work closely with health care providers, data registries, and key stakeholders to develop, support and facilitate integrated transplant and cell therapy data in the UK.

A major part of transforming outcomes will be ensuring that the research being done by us and others is translated into practice. New discoveries offer exciting and life-changing opportunities for our patients but often take many years from initial discovery to routine clinical use. At Anthony Nolan, we will promote important and practice-changing discoveries to the wider transplant community and act as advocates for our patients so that effective new treatments are funded and implemented into clinical practice.



Aim 01: Survival

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in the UK and worldwide.'

Dr Neema Mayor, Head of Immunogenetics Research at Anthony Nolan

Research in action: The genetics of patient-donor matching

One of our ongoing studies, which is providing a wealth of new data, is the Patient/Donor study. This research project is looking at biological samples from over 2,500 paired patients and unrelated donors to see how their genetic differences affect transplant outcomes. It has helped us to make huge leaps in our understanding of what specific genetic matches are most desirable for transplant success. You can find out more about our Patient/Donor project here.

'Anthony Nolan's Patient/Donor project has changed practice in the field of unrelated donor transplantation, both in the UK and worldwide. We have shown the importance and impact of HLA-DPB1 when matching patients and donors; we

'Anthony Nolan's Patient/Donor project has changed practice in the field of unrelated donor transplantation, both

have confirmed that the use of younger donors results in better outcomes for patients: and we have discovered that ultra-high resolution HLA typing, made possible by next generation sequencing technologies, improves survival and lowers the risk of GvHD.

This research has had real world impact for patients. But we don't plan to stop there - our future work will continue to identify factors that lead to better matches and improved outcomes for all patients.'

Dr Neema Mayor, Head of Immunogenetics Research at Anthony Nolan

Our aim:

Equity

To achieve greater equity of access, experience, and outcomes

Our research will:

- Provide greater evidence and understanding of the disparities in patient access, experience and outcomes.
- Evidence new models of care and delivery for patients and donors.
- Engage and include patients, families and donors in the prioritisation, design and delivery of research.

Aim 02: Equity

Haematopoietic cell transplantation can be a lifesaving treatment for our patients. But not everyone has the same experience of, access to, or outcomes from, this treatment. We need to know more about the drivers of these differences and the extent to which age, socioeconomic status, education, ethnicity, language, sex, gender, and geographical location can affect patients' outcomes and experience.

Finding HLA-matched donors for patients is a cornerstone of what Anthony Nolan does. However, due to the complexity and diversity of HLA genetics, some patients will have unique genetic types for whom an ideal donor is highly unlikely to be found.

We will continue to collaborate with international donor registers to find matches globally for unique HLA types; improve the use of alternative donor sources such as umbilical cord blood: and support research into genetically modified cellular therapies that could bypass the need for genetic matching.

We also know that we must properly tackle the issues surrounding access to transplants and novel cell therapies.

We need to have a better understanding of how and when patients are referred to a specialist centre, how they receive their treatment and follow-up care and how these factors impact their outcomes, experience, and quality of life.

To understand and improve patient experience, it is vital that patients, families and donors play a central role in our research. We will seek their insight, views, and opinions at every stage of the process, so our research can be designed and delivered with their needs front of mind.



Aim 02: Equity

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'Patients receive fantastic support from their hospitals, Anthony Nolan, and other charities. But I would also like to see how factors like where you come from, how you receive your transplant, and what your income and personal circumstances are, can and do affect your outcome.'

Peter, Patient Advisory Group

Research in action: Socioeconomic status and quality of life

Our researchers are leading on pr to establish and understand links between patients' backgrounds a their quality of life after transplan Gathering information like this wil help inform practice throughout the transplant community and wil ultimately help us offer the best support possible for every patient out more about our patient report outcome research **here**.

'There is emerging evidence that socioeconomic status may influence haematopoietic cell transplant outcomes including survival, morbidity

orojects s and	and quality of life. However, at the moment in the UK there is no widely accepted method of routinely collecting
nt.	information about socioeconomic status
ill	or quality of life post-transplant. The patient services team has identified
ill	this as an area of opportunity and is developing a portfolio of social and
nt. Find rted	behavioural science research to gather patient-reported outcome data.'
nce	Dr Gemma Pugh, Head of Patient Reported Outcomes Research
rhidity	

Our aim:

Progress

To contribute to the development of new cell and gene therapies and ensure they are made available to more patients

Our research will:

- Discover, develop, and optimise novel cell and gene therapies.
- Support clinical studies of new cell and gene therapies to treat more patients and for a wider range of diseases.
- Discover barriers to the development of, access to, and delivery of new cell and gene therapies, and work to overcome these barriers.

Aim 03: Progress

Anthony Nolan has, and always will, explore and embrace new treatment opportunities to give patients more options and, ultimately, better outcomes. We are extremely excited by the rapid advancement of novel cell therapies, like CAR T-cell therapy, and our research strategy will support the discovery and development of pioneering cell and gene technologies.

We will not only perform our own research, but also provide donor cells to ethically-approved partners in academia and biotech to help advance the availability of breakthrough treatments for patients.

We will work towards a goal of novel cell and gene therapies being used to treat a wider range of diseases and conditions, offering more precise and personalised treatments with greater specificity and less toxicity.

Our research will contribute to the development of new cell products which will either act as a bridge - or even an alternative - to traditional transplant strategies. These new therapies have the potential to transform existing patient options.

But it is not something that we can do alone. We will work with fellow researchers, academic institutions, pharmaceutical companies and industrial partners to ensure these opportunities are realised for more patients, and more quickly.

In the process of exploring and embracing these developing therapies, we will work to understand and overcome the barriers to access, availability, and delivery of these new therapies. Our research will investigate how an individual's personal circumstances. location and access to healthcare systems influence their opportunity to benefit from these emerging treatments and the clinical trials that offer early access to them.

Only by understanding these barriers and variations in practice, can we work to overcome them and achieve our organisational aim of increasing equity.



Aim 03: Progress

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Dr Diana Hernandez, Head of Translational Immunotherapy

Research in action: A world first for genetically modified CAR T-cells

Alyssa, 13, is the first patient in the world reported to have received an allogeneic base-edited cell therapy to treat her aggressive leukaemia. Alyssa was diagnosed with T-cell acute lymphoblastic leukaemia in 2021 and went through all the conventional therapies available, including chemotherapy and a bone marrow transplant. Unfortunately, her cancer resisted all treatment and came back.

Alyssa was enrolled on to a trial involving genetically modified allogeneic CAR T-cells at Great Ormond Street Hospital (GOSH), in collaboration with the UCL Great Ormond Street Institute of Child Health (UCL GOS ICH) to treat her 'incurable' cancer. Just 28 days after receiving the modified T-cells, Alyssa was in remission. The cells used to develop this treatment were sourced from a volunteer donor on the Anthony Nolan register.

'The trial has shown initial evidence that precise genetic engineering of cells is safe, paving the way for future development of cell therapies for a huge variety of cancers.'

Alyssa is doing well at home recovering with her family and continues follow-ups at GOSH. Without this experimental treatment, her only option would have been palliative care.

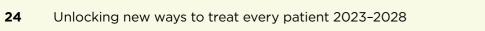
'The trial has shown initial evidence that precise genetic engineering of cells is safe, paving the way for future development of cell therapies for a huge variety of cancers. The team at GOSH used genetic engineering to be able to use cells from a healthy donor rather than the patient's own cells. 'tricked' the cells into not attacking themselves and then armed them with a receptor that can recognise and attack cancerous cells - all of which will make this treatment safer and cheaper going forward. We feel excited for patients who may now benefit from precisely engineered cell therapies in the future.'

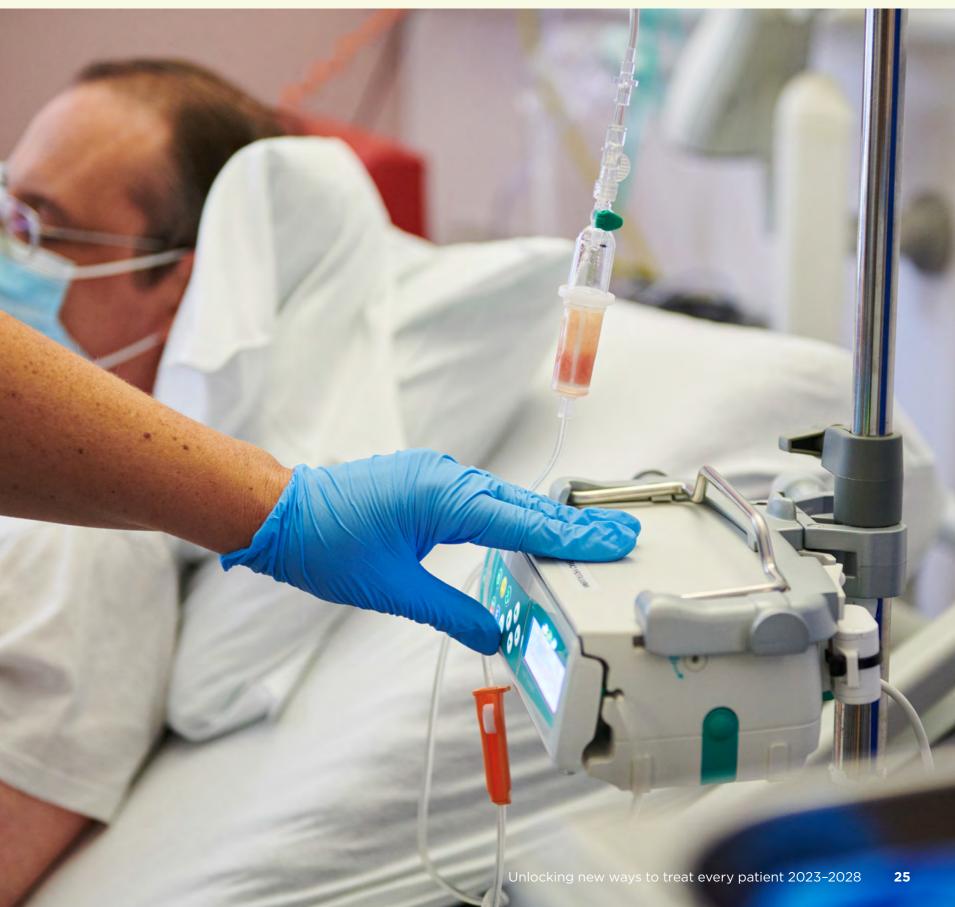
Dr Diana Hernandez, Head of Translational Immunotherapy at the Anthony Nolan Research Institute

How will we achieve these aims

We will achieve our research aims of Survival, Equity and Progress by:

- **1** Strengthening and expanding Anthony Nolan's research portfolio.
- 2 Enhancing infrastructure and collaborations to enable pioneering research.
- **3** Inspiring and investing in future talent.





Strengthening and expanding Anthony Nolan's research portfolio

Over the next five years, we will strengthen and expand our research portfolio to include new research priorities and opportunities across the patient and donor journey. We will:

- Ensure our core research to understand and identify the optimal donor, cell source, and cell product for every haematopoietic cell transplant remains a key priority.
- Use laboratory-based research and bioinformatics, to further improve our understanding of HLA-genetics and diversity, and investigate novel approaches to improve patient and donor matching and selection.
- Prioritise the major causes of patient morbidity and mortality post-transplant (graft failure (rejection), graft-versus-host disease (GvHD), infection and disease relapse), and investigate new ways to prevent and treat these complications.
- Broaden our research to include more consideration of quality of life (QoL), patient-reported outcomes (PRO), patient experience, and barriers to patient equity.
- Increase our research into new cell therapies and gene technologies, to enhance our understanding of the optimal donor, cell source, and cell type for these new treatments, and to improve methods of cell isolation, expansion and storage.



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'As a bioinformatician, our research is constantly moving forward with both scientific developments - like new sequencing strategies - and with the fast-paced development of new computing technologies. These dual advances allow us to ask questions of our data that were not possible even a few years ago, helping us to push the boundaries of our research to support all our patients and all those impacted.'

Dr James Robinson, Head of Bioinformatics

Our research is not all laboratory based

Our Bioinformatics team uses complex biological data and cutting-edge computing technology to understand how the vast levels of variation we see in HLA are reflected in different populations. We have developed new software and systems to further understand the different HLA profiles in patients, donors, and the general population. By understanding these differences, we can continually improve our donor register to provide better support to all patients.

But our analysis doesn't just focus on the UK. We are also working in partnership with DATRI, the donor register in India, to better understand how their donor recruitment strategy can support both their patients and patients from the British Asian population.

Enhancing infrastructure and collaborations to enable pioneering research

Over the last 50 years, we have made great progress and many advances through our strong collaborative networks. We will further expand these collaborations with partners across the world and across different sectors, aiming to become a leading voice in the international research community. We will:

- Develop and support prospective clinical trials and trial infrastructure that will change the way we treat and support patients requiring haematopoietic cell transplants and cell therapies.
- Collaborate with strategic partners to advance the way we gather and share data for the benefit of patients and donors.
- Provide cell materials and research expertise to biotech, pharma and academic institutions to facilitate pioneering advancements in cellular technologies and support innovation.
- Forge new partnerships, here and abroad, to combine our expertise, resources and influence to speed up new discoveries and translate results into clinical practice more quickly.



'The IMPACT clinical trial accelerator network has been an important innovation for patients. Research nurse funding has been critical to IMPACT's success in recruiting nearly 1,400 patients to clinical trials in less than five years and we hope to extend this funding to more centres across the UK.

Prof Ronjon Chakraverty, Chief Investigator and IMPACT Medical Director

Developing innovative clinical trials

To improve clinical outcomes for patients here and abroad, it is vital that we continue to advance the field of haematopoietic cell transplantation through the development and delivery of innovative clinical trials.

Anthony Nolan, in collaboration with Leukaemia UK and NHS Blood and Transplant, funded the IMPACT partnership - a UK platform for the development, approval and delivery of clinical trials in the field of haematopoietic cell transplantation launched in 2017. Bringing together clinicians and scientists from transplant centres across the UK enables clinical trials to be developed more rapidly, delivering benefits to patients more quickly.

This has since transitioned into the ACT (Accelerating Clinical Trials) initiative, which we are funding and supporting.

Inspiring and investing in future talent

For many years, the Anthony Nolan **Research Institute and our expert scientists** have consistently produced world-class scientific and clinical research - and will continue to do so. We will:

- Embed the principles of research culture and methodology into all aspects of our work.
- Encourage innovative thinking to produce paradigm shifts in patient outcomes and donor care in haematopoietic cell transplantation and cell therapies.
- Inspire and invest in the next generation of future researchers through our education and training programmes, undergraduate and postgraduate degrees, fellowships, and funding opportunities.
- Establish a new Anthony Nolan Research Office to oversee all new research, provide guidance and support to our research teams, and to standardise our research governance and funding.



'As a haematology doctor working in a transplant centre, I saw first-hand the incredible work that Anthony Nolan does and the direct impact this has on patient care. So I was delighted when an opportunity arose for me to work for the organisation and carry out my research MD. Anthony Nolan has such motivation and enthusiasm to make a tangible difference with its translational research, and it is inspiring to work with colleagues and for an organisation who have already made such a sizeable impact in the scientific area.'

Dr Angharad Pryce, Senior Medical Officer

Opening doors for research careers

'Being able to carry out a PhD was a huge life goal of mine. I am particularly pleased to have been able to continue on a project I began as a research assistant and with a supervisor I have a great working relationship with. Having PhD positions within the organisation is a great way to contribute to the rapidly developing scientific field and drive Anthony Nolan to the forefront of the scientific community. Additionally, I have been able to present my research internationally, which not only is vital for my own development, but also spreads awareness of Anthony Nolan research and promotes collaboration across the globe.'

Kathryn Strange, PhD Student

Glossary of terms

- Allogeneic cells/tissue from another person (donor)
- **BMT -** bone marrow transplant
- BSBMTCT British Society of Blood and Marrow Transplantation and Cellular Therapy
- BSHI British Society for Histocompatibility and Immunogenetics
- CAR T-cell therapy a pioneering cellular therapy that modifies T-cells to better target cancers
- Cell and gene therapies a blanket term for therapies using cells or genetically modified cells
- CIBMTR Center for International Blood and Marrow Transplant Research
- **EBMT -** the European Society for Blood and Marrow Transplantation
- **EFI -** European Federation for Immunogenetics

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 GvHD - graft-versus-host-disease, a common complication of allogeneic haematopoietic cell transplantation when the donor cells harm the recipient

- HCT Haematopoietic Cell Transplantation; the transplantation of haematopoeitc cells (bone marrow, umbilical cord blood or peripheral blood stem cells) to recover normal bone marrow function
- HLA Human Leucocyte Antigen; the genes responsible for a persons tissue type
- IMPACT a partnership of organisations committed to improving the outcomes of stem cell transplantation through cutting-edge research. It is jointly funded by Anthony Nolan, Leukaemia UK and NHS Blood and Transplant
- NHSBT NHS Blood and Transplant
- NICE The National Institute for Health and Care Excellence
- UKSCSF UK Stem Cell Strategic Forum
- WMDA World Marrow Donor Association

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Our research strategy has three ambitious aims: Survival, Equity and Progress.

We will deliver these by expanding and strengthening our research portfolio, fostering partnerships, and investing in future talent.

This is our research strategy for the next five years. But as an organisation we never stand still. We are constantly evolving, reacting, and adapting – so our research strategy will too. If we need to make changes, we're not afraid to do so – not if it means a better outcome and a better future for our patients.

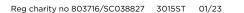
There are so many ways you can be part of realising our ambitions and we're keen to hear from you. Any researchers, clinicians, academics, potential partners, and future collaborators are encouraged to get in touch.

By working together, we can discover, create and implement the changes our patients need to see. Be part of something amazing.

Visit our **website** to find out more.



Find out more at anthonynolan.org





saving the lives of people with blood cancer