Innovation and Portfolio Management Annual Impact Report 2023–2024

SUPPORTING RESEARCH AND EDUCATION

for the Canadian Blood System

Canadian Blood Services
BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

Dr. Sandra Ramirez-Arcos,
Senior scientist,
Canadian Blood Services

Table of contents

Dear reader,

Each year, this report gives us a welcome chance to showcase some of the incredible contributions our innovation and portfolio management team has made to **Canada's Lifeline**. It's with great pride that we share these collective achievements and the meaningful ways they've supported our purpose: to help every patient, match every need and serve every Canadian.

In this report, you'll find stories highlighting groundbreaking research that has led to tangible benefits for patients, donors and Canada's blood system. These initiatives have brought enhanced safety measures, innovations in blood products, possible new treatment options, and changes to eligibility criteria that have made blood donation possible for thousands more people in Canada. As you read on, we hope you'll be inspired by our progress and the potential for future advances.

As always, people remain at the centre of our present and future success. Through our training programs, we were pleased to continue to support medical trainees and early-career researchers in their learning and skill development. Our investment this year in the Canadian Transfusion Trials Group, a new national network of investigators and partners, will also help to promote collaboration and excellence in transfusion medicine research through the development of high-quality clinical trials. Together, we share a vision for a safe and sustainable blood system, and it's our honour to support the people who will get us there.

We extend our deep appreciation to our funders, Health Canada's Strategic Policy Branch and the provincial and territorial ministries of health, and our partners and collaborators in transfusion and transplantation science and medicine for their ongoing support. Our achievements are built on the strength of these essential partnerships, and we look forward to the next leg of our shared journey.

Sincerely,

Dr. Isra Levy
Vice-President
Medical Affairs and Innovation

Dr. Chantale Pambrun
Senior Medical Director
Innovation and Portfolio Management

Innovation and portfolio management

WHO WE ARE

Through an interdisciplinary and collaborative research and education network, our innovation and portfolio management team guides all aspects of Canadian Blood Services' operations. Our research and education network brings together Canadian Blood Services scientists and trainees; our adjunct scientists in academic institutions; researchers funded through our competitive funding programs; and our partners in academia, non-profit organizations, hospitals, industry and government.

Our research and education initiatives focus on:

- **Recipients:** We examine safe and effective blood products so we can match every need.
- **Donors:** We aim to protect donor health and build a more inclusive blood system by expanding the donor base.
- **Health-care professionals:** We support health-care professionals by developing educational resources promoting best practices in transfusion.
- **Canada's blood system:** We contribute to new processes and products that can help make the blood system more sustainable and resilient to any disruptions in the blood supply.

By integrating science into Canada's blood system, we continue to deliver on the principles set out by Justice Horace Krever in the Royal Commission report that led to the founding of Canadian Blood Services more than 25 years ago. In 2023–2024, our world-leading team of discovery, development and social scientists supported research and education around three key strategic priorities for Canadian Blood Services (Canadian Blood Services, 2024c):

- Match products and services to patient and health system needs.
- Grow and diversify a flexible, sustainable donor and registrant base.
- Invest in our people and culture.

ABOUT THIS REPORT

This report highlights successes from our research and education network using impact case studies and spotlights on work in progress. Of course, this report provides only a small window into our accomplishments. This year also saw the innovation and portfolio management team collaborating to make whole blood more widely available and preparing to produce and evaluate dried plasma as a potential new product offering. A multi-year surveillance program is underway, starting in Manitoba, to test whole blood donations during tick season to see whether the Babesia parasite, which could be transmitted to a patient through transfusion, is present. And now that our seroprevalence studies — which analyzed antibodies against SARS-CoV-2 in donated blood samples during the pandemic — are complete, we're looking at how we can continue to bring broader value to public health research and surveillance.

More about these initiatives is available in Canadian Blood Services' 2023–2024 annual report (Canadian Blood Services, 2024a). To see the full list of research publications from our network, visit the research publications page on **blood.ca**.

Year at a glance

Our people

WE HELP BUILD LEADERS IN THE BLOOD SYSTEM

13
Professionals supported in completing formal research or clinical training

158
Investigators supported in conducting research

2,657
Professionals attending our learning events

Knowledge generation

WE SUPPORT RESEARCH TO STRENGTHEN THE BLOOD SYSTEM

Almost
$460K
in funding provided to support excellence in transfusion clinical trials

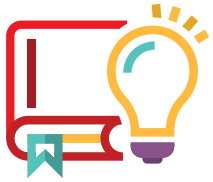
$1.3M
in funding awarded through our competitive programs

166
Projects receiving financial support

Evidence sharing

WE MOBILIZE KNOWLEDGE TO MAXIMIZE IMPACT

12
Blood safety measures informed



201
Knowledge products published

326
Learning opportunities delivered

Match products and services to patient and health system needs

CASE STUDY

Mitigating risks of bacterial contamination in transfusion

WHAT WAS ACHIEVED?

Over the last two decades, our research team has studied the growth of bacteria in blood components during storage. Although rare, bacterial contamination of blood components creates a significant risk of infection to transfusion recipients. The team's groundbreaking research has led to changes at Canadian Blood Services and internationally that have resulted in enhanced safety measures and innovations in blood products.

HOW WAS THIS ACHIEVED?

The most common bacteria that contaminate blood products come from people's skin and are likely introduced at the time of blood donation. Historically, bacteria that live on the skin, like *Staphylococcus epidermidis*, were considered harmless. But in 2007, our research team was the first to discover that these bacteria attach to surfaces when platelets — the component of blood that helps it clot — are stored, creating what are known as biofilms (Greco et al., 2007). Related studies identified other bacteria that can form biofilms during platelet storage, including the bacteria most likely to cause complications for people who need blood transfusions, like *Staphylococcus aureus* and *Serratia marcescens* (Greco-Stewart et al., 2012).

Dr. Sandra Ramirez-Arcos (left) pictured with Dilini Kumaran (right) in one of Canadian Blood Services' labs in Ottawa

Our work has changed the paradigm of what we used to call 'harmless' platelet contaminants. We are proud of our cumulative work revealing that platelet storage makes bacteria more virulent with potential safety implications for transfusion patients.

Dr. Sandra Ramirez-Arcos,
Senior scientist, Canadian Blood Services

The team recently uncovered new information about how bacteria change at the molecular level when they grow in platelet concentrates (Loza-Correa et al., 2021). Unlike red blood cells and plasma, which are stored at cold temperatures, platelets are stored at room temperature. The warmer storage temperature for platelets increases the risk that bacteria will spread and contaminate the blood product. The molecular changes that happen in bacteria during platelet storage increase the production of toxins, resistance to antibiotics, and secretion of molecules that trigger inflammation — findings with important implications for transfusion recipients (Chi et al., 2023).

WHAT WAS THE IMPACT AND OUTCOME?

The evidence generated by our research team has been documented in over 90 peer-reviewed research papers over the last two decades and has led to several improvements in Canadian Blood Services' processes. This research has changed the way donor skin is disinfected during donation (Ramirez-Arcos & Goldman, 2010) and revealed skin factors that affect efficient donor skin disinfection (Kumaran & Ramirez-Arcos, 2024). It has supported the implementation of sterility testing of blood components and cord blood and stem cell products (Ramirez-Arcos et al., 2015). It has underpinned a decision to extend the shelf life of platelet components from five to seven days (Ramirez-Arcos et al., 2020). And it has supported the development of new blood products, such as cold-stored whole blood (Ramirez-Arcos et al., 2022). Notably, in 2016 the team's work led to an important change in a CSA Group (formerly the Canadian Standards Association) standard, doubling the length of time that red blood cells can be exposed to uncontrolled temperatures from 30 to 60 minutes (Ramirez-Arcos et al., 2016).

Our research team's expertise also equips Canadian Blood Services to address challenges related to emerging pathogens. Future work includes exploring the risk of transfusing blood components contaminated with tick-borne bacteria like *Anaplasma phagocytophilum*. This work will complement our current surveillance activities as tick populations expand northward with climate change.

SPOTLIGHT

A possible new treatment for people with sickle cell disease

TREATMENT CHALLENGES

Sickle cell disease is a genetic blood disorder that affects the body's ability to produce hemoglobin, the red blood cell protein that carries oxygen from the lungs to the body. People with sickle cell disease have sticky, sickle-shaped red blood cells that can slow or block the flow of blood. A lack of oxygen-rich blood can lead to severe pain or other complications and reduce a person's life expectancy (Kavanagh et al., 2022).

Management of sickle cell disease focuses on preventing or treating pain and complications in various ways, including through regular blood transfusions or pain medications. Until recently, the only cure for sickle cell disease was a stem cell transplant (U.S. Food and Drug Administration, 2023). But transplants are not always effective, and finding a suitable stem cell donor can be a big challenge.

GENE EDITING TO CREATE HEALTHY BLOOD CELLS

Our research team is working on a one-time therapy using gene-edited blood stem cells. This potential new treatment removes the need for a compatible donor and brings hope of a possible cure for sickle cell disease.

> **If successful, this work could mean that patients will not have to go through repeated therapies or worry about donors being available to them; they would never have to go back to the clinic again.**
>
> **Dr. Hari Maganti,**
> *Scientist, Canadian Blood Services*

The treatment involves extracting blood stem cells from a person with sickle cell disease and growing them in a lab using a patent-pending protocol developed at Canadian Blood Services (Manesia et al., 2023). The genes in the stem cells are changed to correct the single mutation responsible for causing sickle cell disease and then returned to the person receiving treatment.

Because blood stem cells can develop into all types of blood cells, including red blood cells, the gene-edited blood stem cells go on to develop into healthy red blood cells instead of the sickle-shaped blood cells characteristic of sickle cell disease (Maganti et al., 2021). Although still in its early stages, this work may provide a new treatment option for people with sickle cell disease and other genetic blood disorders caused by a single mutation in a gene.

A NEW DELIVERY SYSTEM

A key part of this research is developing a new way to deliver the edited genes into the blood stem cells. In other gene therapies, viral vectors have been used for this job, but this method has known safety risks for recipients, including a risk of developing secondary cancers (Goyal et al., 2022). Instead, our research team, in collaboration with the National Research Council, is testing a new, potentially safer type of delivery technology: lipid nanoparticles.

Through animal studies, our research team has already shown that lipid nanoparticles effectively deliver gene-edited stem cells. And over the next few years, the team is planning more studies to better understand just how promising this therapy might be.

Bryenah Bennett (left) and Dr. Tanvir Hasan (right) work in one of Canadian Blood Services' labs in Ottawa.

CASE STUDY

Intravenous immunoglobulin therapies: Understanding how and why they work

WHAT WAS ACHIEVED?

Scientists at Canadian Blood Services have been studying the underlying biological mechanisms of intravenous immunoglobulin (IVIg) therapies to better understand who IVIg works best for and why. Although IVIg was first used in 1952 to treat patients with immune deficiencies, we still know little about how it works. Results from this research can be used to support the development of effective alternatives to IVIg (Tong et al., 2020).

HOW WAS THIS ACHIEVED?

Immunoglobulin therapies use antibodies to boost the immune system in patients with immune deficiencies, fight infections in people with weakened immune responses, and treat patients with autoimmune diseases by regulating the immune system. Immunoglobulin that are administered intravenously are called intravenous immunoglobulin therapies. IVIg is made from plasma collected from thousands of human donors. In Canada, IVIg is provided to hospitals by Canadian Blood Services. Demand for immunoglobulin therapies continues to grow in Canada and around the world.

Varied responses to IVIg among patients suggest something within the patients' immune systems may explain why it works well in some people but not others. To better understand how IVIg works, our research network examined how IVIg interacts with patient immune systems to reduce inflammation in the body.

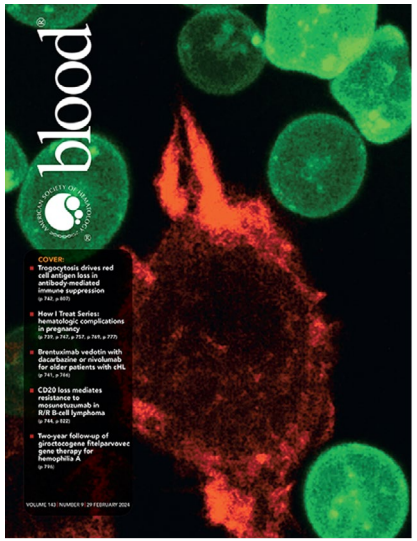
Researchers from our network discovered that immunoglobulin therapies cause human macrophages (a type of activated white blood cell) to produce large amounts of an anti-inflammatory molecule called interleukin-10 (IL-10). This IL-10 molecule may help explain how immunoglobulin therapies reduce inflammation (Hubbard et al., 2020; Kozicky et al., 2015, 2018; Kozicky & Sly, 2017) and why they can be used to treat a wide range of inflammatory disorders. Researchers also discovered that interleukin-11 (IL-11) may also contribute to the anti-inflammatory effect of immunoglobulin therapies. This suggests that regulating IL-11 may improve the efficacy of IVIg therapies (Figueiredo et al., 2014; Lewis et al., 2018).

One of our recent discoveries is that IVIg may work by regulating a process called trogocytosis. This process boosts the immune system when immune cells exchange molecules or membrane fragments (Cruz-Leal et al., 2024).

Knowing how IVIg acts could lead to the development of more targeted therapies for autoimmune diseases.

Importantly, a study from our research network also uncovered a gene that may explain why people respond differently to immunoglobulin therapies. The gene they found has two forms. In people with one form of the gene, immunoglobulin therapies work well and reduce inflammation. However, in people with a second form of the gene, these therapies do not work well. This is because people with the second form of the gene produce less IL-10. Sequencing this specific gene in people can determine who will respond best to IVIg therapies. Researchers confirmed the predictive model of this gene using mouse testing in 2019 (Kozicky et al., 2019).

In another first, our researchers discovered a way to deliver IVIg to specific areas of the brain. IVIg usually has a difficult time crossing the blood–brain barrier, but this new technique increased the delivery of IVIg into the hippocampus 39-fold. This discovery may inform the development of IVIg as a potential treatment for neurological conditions and diseases such as Alzheimer's disease (Dubey et al., 2020).



Our research on trogocytosis was featured on the cover of the February 2024 issue of Blood*, a high-impact, peer-reviewed medical journal.*

WHAT WAS THE IMPACT AND OUTCOME?

These insights into how IVIg works have made it possible to develop several potential IVIg replacement drugs (see our other case study, IVIg Use in Immune Thrombocytopenia: Preventing Platelet Destruction and Exploring IVIg Alternatives). The hope is that these alternatives may reduce the burden on the IVIg supply and improve patient outcomes.

These findings bring significant benefits to patients and health-care systems. A personalized approach to treatment can optimize outcomes for people with various immune-related disorders. Knowing that genetic variation in specific genes has an impact on how patients respond to IVIg therapies helps identify which patients will respond best to these therapies and which patients may benefit more from another treatment option.

There are are also potential economic benefits to IVIg alternatives. IVIg is costly to manufacture and distribute. The development of alternative IVIg replacement drugs could lead to cost savings in health-care systems and make therapies more accessible to more patients.

Albert,
Plasma donor

CASE STUDY

IVIg use in immune thrombocytopenia: Preventing platelet destruction and exploring IVIg alternatives

WHAT WAS ACHIEVED?

Our research has helped us better understand the biological mechanisms driving platelet destruction in patients with immune thrombocytopenia (ITP) so that IVIg — or an IVIg alternative — can be used most effectively.

ITP is a condition in which the immune system mistakenly attacks and destroys platelets. This condition can lead to a low platelet count, which increases risk of bleeding and easy bruising and, in severe cases, can cause life-threatening internal bleeding. About five out of 10,000 people in Canada have ITP. A specific type of ITP that occurs in newborns is a condition called fetal and neonatal alloimmune thrombocytopenia (FNAIT). In this condition, maternal antibodies cross the placenta and destroy the baby's platelets. FNAIT can result in severe bleeding in the newborn and requires careful monitoring and medical intervention to manage the condition and prevent complications.

Immunoglobulin therapies are an important treatment option for patients with ITP or FNAIT because they reduce the risk of bleeding by increasing the number of platelets. Little is known about exactly how IVIg increases platelet counts in patients with ITP or FNAIT. IVIg therapies are also more effective for some patients than others, even among those with the same disorder, and their effectiveness can vary from treatment to treatment even in the same patient. Demand for IVIg keeps growing because its immune-boosting properties make it an effective treatment for a number of medical conditions. However, IVIg is a costly and limited resource so understanding how and why it works is crucial to using it wisely.

HOW WAS THIS ACHIEVED?

Our research has revealed previously unknown factors contributing to platelet destruction in ITP and miscarriage in FNAIT (Yougbaré et al., 2015), offering insights into how these bleeding disorders may be diagnosed and treated. Our collaboration with international researchers has also helped us understand what happens when the immune response mistakenly attacks healthy platelets in patients with ITP and FNAIT, and what factors may influence how they respond to IVIg treatment (Zeng et al., 2012).

WHAT WAS THE IMPACT AND OUTCOME?

Understanding how IVIg works in the body paves the way to the development of IVIg alternatives. These findings bring us closer to reducing our dependence on IVIg and pave the way to more effective, personalized and cost-efficient treatments.

Canadian Blood Services researchers are exploring a range of IVIg alternatives, including:

- Small-molecule drugs that can inhibit phagocytosis, a process some cells use to engulf and remove platelets in the body (Loriamini et al., 2023; Purohit et al., 2014).
- A monoclonal antibody that binds to a critical adhesion molecule on a type of white blood cell (Norris et al., 2021).
- Engineered monoclonal antibody fusion proteins, which are designed to block Fc receptors (proteins found on the surface of immune cells) and improve the immune response (Yu et al., 2016; Crow et al., 2019).
- A synthetic protein (the recombinant protein Fc hexamer) that shows much greater efficacy in treating ITP than IVIg therapies (Lewis et al., 2019).
- Sialidase inhibitors, originally designed as anti-influenza drugs, which may help block platelet destruction in the liver (Li et al., 2015).
- A novel approach that uses an engineered antibody to block platelet destruction by interfering with the receptor (Fc receptor III) and mediating platelet engulfment by macrophages (Gonzalez et al., 2024).

Our research network has also highlighted cost-effective alternatives to IVIg therapies. Alternatives include the oral medication eltrombopag, which stimulates platelet production and may be an effective option for ITP patients requiring surgery (Kaur et al., 2022). Fostamatinib, another medication with proven efficacy, may also be an option for some ITP patients (Podolanczuk et al., 2009).

Grow and diversify a flexible, sustainable donor and registrant base

CASE STUDY

Opening the door to donation for thousands affected by restrictions related to human variant of “mad cow” disease

WHAT WAS ACHIEVED?

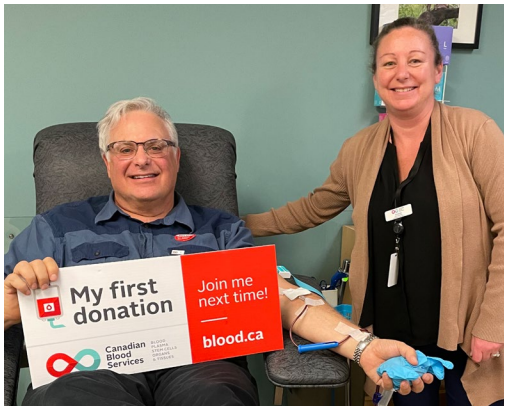
Thousands of people across Canada who have spent time in countries affected by variant Creutzfeldt-Jakob Disease (vCJD) — the human variant of bovine spongiform encephalopathy (BSE), commonly known as “mad cow” disease — are now eligible to donate blood and plasma for the first time in decades. In 2023, Canadian Blood Services received Health Canada approval to update eligibility criteria that prevented people from donating if they had lived or spent time in the United Kingdom, Republic of Ireland, or France during the 1980s and 1990s.

vCJD is a rare, fatal disease that can be transmitted through blood; it may be contracted by eating beef and beef products from animals with BSE. People with vCJD may be infected for many years before showing symptoms. In the 1990s, when a link between eating contaminated beef and vCJD was first established and cases of vCJD were peaking overseas, Canadian Blood Services and blood operators around the world put criteria in place that made people who had spent time in vCJD-affected countries ineligible to donate.

HOW WAS THIS ACHIEVED?

Three essential elements contributed to this landmark change in eligibility criteria:

- **Surveillance:** The decision to remove the eligibility criteria related to vCJD was informed by nearly 30 years of comprehensive surveillance conducted in Canada and around the world. Surveillance activities showed a significant decrease in cases of vCJD in recent years; cases of vCJD peaked in 2000 and have been in decline ever since. The last two reported cases of vCJD in the general population in the United Kingdom were in 2013 and 2016. There have been no cases of vCJD transmission by transfusion since 2006.
- **Risk modelling:** Our epidemiology and surveillance team, in collaboration with Héma-Québec, developed a risk simulation model to assess the risk of vCJD transmission through blood donations in Canada, assuming current eligibility criteria related to vCJD were removed (Pozzo di Borgo et al., 2023). Results showed minimal risk, with no contaminated blood donations predicted in the base case scenario over 85 years of follow-up. Even in the most pessimistic scenario, the estimated risk of vCJD transmission was extremely low (<1 in 16 million donations). These findings suggested that the eligibility criteria related to vCJD could be removed without compromising the safety of the blood supply.
- **Learning from other blood operators:** We also reviewed available research (including Seed et al., 2018; Stratton et al., 1997; Yang et al., 2017) that showed the risk of vCJD transmission through transfusion was minimal. Advances in manufacturing have also reduced the risk of vCJD transmission. For example, over 20 years ago Canadian Blood Services introduced leukoreduction, a step in the blood manufacturing process that removes white blood cells (leukocytes) from blood components. Studies suggest leukoreduction reduces the risk of vCJD transmission by transfusion, based on experiences in the United Kingdom, where there have been no cases of transfusion-transmitted vCJD since the introduction of universal leukoreduction, as well as evidence from experimental animal studies. Canadian Blood Services’ decision to remove eligibility criteria related to vCJD was aligned with similar changes made by blood operators globally, including the United States (2022), Australia (2022), and Israel (2023).



Dr. Isra Levy, vice-president, medical affairs and innovation, pictured with donor centre supervisor Amanda Marcantonio, makes his first blood donation. A former U.K. resident, he became eligible to donate after the change in eligibility criteria related to vCJD.

After Health Canada approved our research-informed submission to remove eligibility criteria related to vCJD, we officially implemented the change. Canadian Blood Services communicated the updated eligibility criteria and promoted donation in many ways. Thousands of potential donors were encouraged to schedule appointments to donate as of Dec. 4, 2023. A recruitment campaign began in January 2024 to raise awareness about the updated eligibility criteria among donors who had been previously deferred from donating.

WHAT WAS THE IMPACT AND OUTCOME?

Canadian Blood Services removed eligibility criteria related to vCJD on Nov. 27, 2023. Héma-Québec also removed eligibility criteria related to vCJD following our collaboration. At Canadian Blood Services, our strategic recruitment campaign was incredibly successful in boosting donor recruitment. In a little over four months, 11,158 blood donations were made possible because of the eligibility change.

Our proactive approach to donor recruitment and outreach contributed to filling thousands of appointment slots across Canada, ensuring a steady supply of lifesaving blood products for patients in need. This change also promoted inclusion and a sense of solidarity among potential donors. The removal of eligibility criteria related to vCJD marked a major shift driven by scientific research, community engagement, and a commitment to advancing public health.

Simone,
Blood recipient

SPOTLIGHT

Community-based research aims to build greater diversity in Canada's Lifeline

SOCIAL SCIENTISTS APPLY COMMUNITY-BASED APPROACHES IN RESEARCH WITH UNDER-REPRESENTED RACIALIZED COMMUNITIES

Recruiting and maintaining a donor base that reflects Canada's ethnic diversity ensures that Canadian Blood Services can best meet the needs of patients from all communities (Canadian Blood Services, n.d.). This is especially important for people in Canada who have rare blood types, need stem cell transplants, have complex treatment needs, or rely on regular blood transfusions to live with conditions like sickle cell disease. A diverse donor base helps to ensure that they can receive the blood products that best match their needs.

To effectively recruit and engage donors from all communities, a research-informed approach is key. Only by better understanding the unique perspectives of diverse communities and the factors that contribute to their ability to donate can we build a more diverse donor base.

Our social scientists are using community-based research approaches to identify and help address systemic barriers to donation within African and South Asian communities in Canada. Community-based research builds on strengths and resources within communities to understand the health and quality of life of community members and to identify changes needed to make improvements. This approach supports co-learning and collaborative partnerships in all research phases.

UNDERSTANDING BARRIERS

Two of our recent studies have engaged a range of community leaders and organizations, including the Sickle Cell Disease Association of Canada, Sikh Nation, and Sant Nirankari Mission. Interviews were conducted to explore systemic barriers to blood donation for people of African, Caribbean, Black, and South Asian descent; the research focusing on donation in South Asian communities marks a first in Canada.

Our initial findings bring to light systemic barriers to donation and recommend ways to make the donor experience more inclusive. Importantly, the findings highlight that there is no single "community" for people of African ancestry and that people may identify as belonging to multiple communities. They show that personal and systemic experiences of racism deeply inform community priorities, and that barriers may exist at multiple levels (Haw et al., 2023), from personal to systemic.

The need for a diverse donor base extends beyond the need for red blood cells. We have undertaken a research project that identifies and evaluates strategies to encourage people in Canada of diverse ethnic ancestry between the ages of 17 and 35 to join the stem cell registry. Engaging young adults and community advocates (Canadian Blood Services, 2023) has been a key focus of this project. The project has helped to raise awareness of stem cell donation and provided important insights about ways to meet the needs of different communities.

BUILDING A BLOOD SERVICE FOCUSED ON EQUITY AND DIVERSITY

Our researchers champion a powerful role for social sciences and donation studies in transfusion medicine more broadly. At national and international transfusion conferences (Haw, 2024; Haw & Holloway, 2023) they have demonstrated the important application of social sciences in transfusion medicine. One of our publications from 2021 explored donor discomfort with sexual risk behaviour questions (Haw et al., 2021) and was identified as one of the most cited articles in the peer-reviewed medical journal *Transfusion* for 2022–2023.

Dr. Jennie Haw (left), Dr. Kelly Holloway (centre), and research assistant Poojan Joshi (right) attend Canadian Blood Services' Research Day in Saskatoon, May 2024.

As blood services internationally strive to bring in new generations of donors, social scientists tackle challenging questions such as how to communicate sexual risk-based behaviour screening, and how to work with racialized communities to build a blood service focused on equity and diversity.

Dr. Jennie Haw,
Scientist, Canadian Blood Services

Invest in our people and culture

SPOTLIGHT

Our commitment to research training

DEVELOPING RESEARCH CAPACITY

Through our research and education network, our research trainees — students and postdoctoral fellows — gain knowledge of research methodologies and the blood system, equipping them to build successful careers in transfusion science.

We also provide trainees with opportunities to hone other valuable skills. Last year, trainees chaired our monthly science seminar series and helped plan our 2024 Research Day to gain experience in public communication and event organization. They also joined our funding peer-review panels to develop insights on how to write a successful grant application. With financial support from our travel bursaries, they attended national and international conferences where they expanded their professional networks and received feedback on their research. To showcase their research and build on their strengths in knowledge translation, trainees wrote posts for our *Research. Education. Discovery* (RED) blog and produced videos.

BUILDING CAREERS IN THE BLOOD SYSTEM

Since the inception of Canadian Blood Services' competitive training programs in 2000, 104 graduate students and 52 postdoctoral fellows from across Canada received stipends to complete their research training in transfusion or hematopoietic stem cell transplantation. Hundreds more trainees, from undergraduates to postdoctoral fellows, have also contributed to research in projects supported by our competitive research programs or led by members of our research team.

Here are just some of the contributions made by former trainees who have gone on to find successful careers supporting the blood system.

Industrial engineers support Canada's Lifeline

After completing all or part of their training with Canadian Blood Services research engineer Dr. John Blake in Dalhousie University's industrial engineering program, Matthew Nelson, Mazen El Ashkar and Andrea Friars have all joined **Canada's Lifeline**. As industrial engineers, they contribute directly to operational excellence in the implementation of new technologies and continuous improvement initiatives.

Scientist advances the field of red blood cell quality assessment

Dr. Syed Qadri, a past recipient of our Postdoctoral Fellowship Award in the lab of Canadian Blood Services senior scientist Dr. William Sheffield at McMaster University, is now an adjunct scientist with Canadian Blood Services and associate professor at Ontario Tech University. His research focuses on the molecular mechanisms that regulate red blood cell quality (Himbert et al., 2022) during storage and factors affecting their lifespan.

Dr. Melika Loriamini, past recipient of Canadian Blood Services' Graduate Fellowship award, the 2024 recipient of Canadian Blood Services' Dana Devine Award and the international AABB Outstanding Abstract Award for Trainees.

Laboratory medicine researcher improves clinical practices in hospital

Dr. Melika Loriamini, a past recipient of our Graduate Fellowship Award in the lab of Canadian Blood Services senior scientist Dr. Donald Branch at the University of Toronto, is now a clinical practice leader at Humber River Health. In her new role, she applies her research training and medical laboratory skills to improve clinical practices at the hospital.

The next generation of scientists

Dr. Yoelys Cruz-Leal, a current recipient of our Postdoctoral Fellowship Award, is advancing her training in the lab of Canadian Blood Services senior scientist Dr. Alan Lazarus at the University of Toronto. Her impactful research in antibody-mediated immune suppression (AMIS) was featured on the front cover of the peer-reviewed journal *Blood* in February 2024. Her research has the potential to improve prevention strategies for conditions like hemolytic disease of the fetus and newborn (HDFN), where maternal antibodies attack fetal blood cells due to differences in blood groups.

Mahsa Yazdanbakhsh, a current recipient of our Graduate Fellowship Award, is completing her PhD in the lab of Canadian Blood Services senior scientist Dr. Jason Acker at the University of Alberta. Her research on assessing the quality of red cell concentrates was recognized with the top abstract award by the Canadian Society for Transfusion Medicine (CSTM) (Canadian Blood Services, 2024). Her research could positively impact the care of preterm infants and advance transfusion medicine.

By participating in these events [Canadian Blood Services' Research Day], you not only contribute to the advancement of knowledge in transfusion medicine but also refine skills and establish connections that can be beneficial for your future endeavours.

Mahsa Yazdanbakhsh,
Current recipient of our Graduate Fellowship Award

SPOTLIGHT

New national network aims to promote excellence in transfusion clinical trials

IMPROVING TRANSFUSION PRACTICE

Clinical trials can play a key role in bringing new health interventions to patients by providing evidence about the effects of these interventions on human health. In transfusion medicine, clinical trials may focus on the uses of new blood products or new uses of existing products. In 2023, we leveraged our network to facilitate the creation of the Canadian Transfusion Trials Group (CTTG), a national network of researchers dedicated to promoting collaboration and excellence in the design and execution of clinical trials. We provided a $2.3 million investment over five years to establish the CTTG, with the aim of accelerating high-quality clinical trials to improve transfusion practice for patients in Canada and worldwide (Queen's University, 2023).

COLLABORATION AND EFFICIENCY IN RESEARCH

The CTTG is bolstered by leadership from co-directors Dr. Donald Arnold and Dr. Jeannie Callum, representing the transfusion medicine clinical research communities at McMaster University, Queen's University and the University of Toronto. The CTTG unifies the expertise of physician-investigators, transfusion scientists, students, medical trainees and research staff from across Canada toward one goal: accelerating high-quality clinical trials to improve transfusion practice.

The CTTG will foster collaboration and efficiency in the development of clinical trial protocols, centralized data management and biostatistics. The CTTG is establishing working groups that will support ongoing activities around clinical trials, community engagement, translational research, knowledge translation, data, education and mentorship.

The Canadian Transfusion Trials Group will significantly advance our understanding of the science of blood transfusion through rigorous, evidence-based research supported by a powerful transfusion data engine and a broad research team across Canada.

Dr. Jeannie Callum,
Co-director, Canadian Transfusion Trials Group

This funding [for CTTG] acknowledges the innovative nature of the trials group and its potential to inform best practice in transfusion medicine worldwide through a national network and multidisciplinary partnerships.

Dr. Donald Arnold,
Co-director, Canadian Transfusion Trials Group

IMPLICATIONS AND FUTURE DIRECTIONS

Securing funding for transfusion trials in Canada

In its first year, the CTTG created a process for physician-investigators to be able to use CTTG expertise to strengthen their protocols and secure funding for their clinical trials. Now, twice a year, the CTTG provides feedback on clinical studies before physician-investigators submit their grant applications to external funding agencies. In just one year, the CTTG provided letters detailing its support for four applications. One of these applications, which focuses on the use of albumin as an intervention to improve recovery after acute kidney injury in critically ill patients (Clark, 2023), received $416,667 in funding from the Canadian Institutes for Health Research.

Facilitating access to data for transfusion research and practice change

The CTTG has developed a process to determine the data requirements of clinical studies and has partnered with GEMINI Medicine to use transfusion data from over 35 hospitals in Ontario to understand how blood is used and how blood use is changing over time. In partnership with Canadian Blood Services, the CTTG hosted a meeting to explore the creation of a Canadian Donations and Transfusion Database (CANDAT). This comprehensive multi-centre research database of blood donors, blood products and blood transfusion recipients would be the first of its kind in Canada.

Engaging patients and blood donors in clinical research

The CTTG's newly established community engagement working group contributed to the development of a patient partnership plan for a clinical trial (McQuilten et al., 2021). This trial is investigating the effectiveness of immunoglobulin replacement therapy compared to oral antibiotics for the treatment of infections in people with hematological malignancies. The CTTG plans to expand patient and donor engagement networks and develop community engagement resources for researchers.

Wai Yin,
Blood recipient

SPOTLIGHT

Improving transfusion practice with Transfusion Camp

A NEED FOR TRANSFUSION MEDICINE EDUCATION

Blood transfusion is the most common procedure in hospitals. In almost every medical specialty, physicians and nurse practitioners prescribe, manage, or monitor transfusions and transfusion reactions. However, studies show there's room to improve their knowledge of transfusion medicine. Transfusion education is an important part of ensuring the blood components used in transfusion — vital and limited resources — are used appropriately and properly administered.

GROWTH OF A SUCCESSFUL PROGRAM

In 2012, transfusion experts at the University of Toronto established Transfusion Camp for medical residents in a range of specialties, including blood disease, cancer, critical care, anesthesia, and childbirth. The Transfusion Camp curriculum was designed to share up-to-date transfusion practices using a mix of high-quality lectures and team-based learning seminars in which learners work through sample patient cases with transfusion experts.

In 2013, our knowledge mobilization team first partnered with Transfusion Camp with the aim of extending the program's reach across Canada. Today, we continue to support the coordination, curriculum development, delivery and evaluation of Transfusion Camp in collaboration with transfusion educators, residency training program administrators and partner organizations.

In 2020, the curriculum was adapted as a program for nurse practitioners in British Columbia and is now a requirement for credentialing nurse practitioners in B.C. to prescribe blood and blood products.

Since its beginning 12 years ago, Transfusion Camp has significantly expanded and is now offered in most Canadian medical schools. It also reaches international audiences, with two medical schools and four teaching hospitals in the United Kingdom offering Transfusion Camp to their residents. In 2023, Transfusion Camp educators worked with local faculty in Rwanda (Skelton et al., 2023; Hagumimana et al., 2023; Skelton, 2023) to adapt the camp curriculum to their local environment and provided a two-day train-the-trainer workshop. The pilot was highly successful and Transfusion Camp offerings in Rwanda continue to expand.

COMMON PURPOSE

The benefits of Transfusion Camp extend to all its participants, from learners to those developing and delivering the material. In 2023–2024, 64 faculty members from across Canada were involved in developing and delivering Transfusion Camp. In recognition of their outstanding contributions, the junior faculty member with the best evaluations from learners is now recognized with the Transfusion Camp Impactful Educator Award.

Through their involvement in Transfusion Camp, health-care professionals are establishing a strong community of practice and a collaborative network for sharing best transfusion practices nationally and internationally. For example, nurse practitioners and transfusion medicine physicians worked together on a steering committee to tailor team-based learning seminars for the nurse practitioner Transfusion Camp, which was delivered by 21 faculty members. In Rwanda, the physicians and laboratory technicians who participated in the Transfusion Camp train-the-trainer workshop will be able to expand the program within their own jurisdictions and in neighbouring countries, including Uganda.

- University of British Columbia
- University of Alberta
- University of Calgary
- University of Saskatchewan
- University of Manitoba
- Western University
- University of Toronto
- McMaster University
- Queen's University
- University of Ottawa
- Université Laval
- Université de Sherbrooke
- McGill University
- Université de Montréal
- Dalhousie University

In the 2023–2024 academic year, Transfusion Camp was offered in 16 medical schools in Canada.

Drs. Nadia Gabarin, Sebastian Vuong, Lianne Rotin, and Sheharyar Raza (left to right) are transfusion medicine fellows. As medical residents, they completed Transfusion Camp and are now involved as Transfusion Camp educators.

DEMONSTRATED IMPACT

In 2023–2024, close to 450 medical residents, representing 13 specialties from 16 Canadian medical schools, and 52 nurse practitioners participated in Transfusion Camp. Internationally, about 40 medical residents in the United Kingdom and 51 physicians and laboratory technicians in Rwanda participated in the program.

Validated assessments tell us that Transfusion Camp has a positive impact on medical residents and nurse practitioners (Yeung et al., 2023). The essential learning opportunities provided through this program equip participants to provide the best care for patients and serve as good stewards of the blood system.

> **As an intensivist and anesthesiologist working and teaching in Northern Ontario, there is limited access to transfusion medicine specialists. The Transfusion Camp initiative stands out for its commitment to providing exceptional transfusion medicine education, regardless of geographic location. This is an inspiring example of how we as clinical educators can come together to ensure that all trainees have access to the tools and knowledge that they need to provide Canadians with the best possible health care.**
>
> **Dr. Sarah Mary McIsaac,**
> *Associate professor, Northern Ontario School of Medicine University, and first recipient of the Transfusion Camp Impactful Educator Award*

Bibliography

INNOVATION AND PORTFOLIO MANAGEMENT

Canadian Blood Services. (2024a). *Momentum*. [link]

Canadian Blood Services. (2024b). Our research publications. https://www.blood.ca/en/research/our-research-activities/our-research-publications

Canadian Blood Services. (2024c). *Strategic plan*. https://www.blood.ca/sites/default/files/StrategicPlan-2024-02-21_EN.pdf

MITIGATING RISKS OF BACTERIAL CONTAMINATION IN TRANSFUSION

Chi, S.I., Yousuf, B., Paredes, C., Bearne, J., McDonald, C., & Ramirez-Arcos, S. (2023). Proof of concept for detection of staphylococcal enterotoxins in platelet concentrates as a novel safety mitigation strategy. *Vox Sanguinis*, *118*(7), 543–550. https://doi.org/10.1111/vox.13440

Greco, C., Martincic, I., Gusinjac, A., Kalab, M., Yang, A.-F., & Ramirez-Arcos, S. (2007). Staphylococcus epidermidis forms biofilms under simulated platelet storage conditions. *Transfusion*, *47*(7), 143–1153. https://doi.org/10.1111/j.1537-2995.2007.01249.x

Greco-Stewart, V.S., Brown, E.E., Parr, C., Kalab, M., Jacobs, M.R., Yomtovian, R.A., & Ramirez-Arcos, S. (2012). Serratia marcescens strains implicated in adverse transfusion reactions form biofilms in platelet concentrates and demonstrate reduced detection by automated culture. *Vox Sanguinis*, *102*(3), 212–220. https://doi.org/10.1111/j.1423-0410.2011.01550.x

Kumaran, D. & Ramirez-Arcos, S. (2024). Sebum components dampen the efficacy of skin disinfectants against Cutibacterium acnes biofilms. *Microorganisms*, *12*(2), 271. https://doi.org/10.3390/microorganisms12020271

Loza-Correa, M., Yousuf, B., & Ramirez-Arcos, S. (2021). Staphylococcus epidermidis undergoes global changes in gene expression during biofilm maturation in platelet concentrates. *Transfusion*, *61*(7), 2146–2158. https://doi.org/10.1111/trf.16418

Ramirez-Arcos, S., Evans, S., McIntyre, T., Pang, C., Yi, Q., DiFranco, C., & Goldman, M. (2020). Extension of platelet shelf life with an improved bacterial testing algorithm. *Transfusion*, *60*(12), 2918–2928. https://doi.org/10.1111/trf.16112

Ramirez-Arcos, S., & Goldman, M. (2010). Skin disinfection methods: Prospective evaluation and postimplementation results. *Transfusion*, *50*(1), 59–64. https://doi.org/10.1111/j.1537-2995.2009.02434.x

Ramirez-Arcos, S., Kou, Y., Ducas, E., & Thibault, L. (2016). Changing the 30-min rule in Canada: The effect of room temperature on bacterial growth in red blood cells. *Transfusion Medicine and Hemotherapy*, *43*(6), 396–399. https://doi.org/10.1159/000445753

Ramirez-Arcos, S., Kou, Y., Kumaran, D., Culibrk, B., Stewart, T., Schubert, P., & McTaggart, K. (2022). Assessment of bacterial growth in leukoreduced cold-stored whole blood supports overnight hold at room temperature prior to filtration: A pilot study. *Vox Sanguinis*, *117*(5), 678–684. https://doi.org/10.1111/vox.13246

Ramirez-Arcos, S., Kou, Y., Yang, L., Perkins, H., Taha, M., Halpenny, M., & Elmoazzen, H. (2015). Validation of sterility testing of cord blood: Challenges and results. *Transfusion*, *55*(8), 1985–1992. https://doi.org/10.1111/trf.13050

A POSSIBLE NEW TREATMENT FOR PEOPLE WITH SICKLE CELL DISEASE

Goyal, S., Tisdale, J., Schmidt, M., Kanter, J., Jaroscak, J., Whitney, D., Bitter, H., Gregory, P., Parsons, G., Foos, M., Yeri, A., Gioia, M., Voytek, S., Miller, A., Lynch, J., Colvin, R., & Bonner, M. (2021). Acute myeloid leukemia case after gene therapy for sickle cell disease. *New England Journal of Medicine*, *386*(2), 138–147. https://doi.org/10.1056/NEJMoa2109167

Kavanagh, P. L., Fasipe, T. A., & Wun, T. (2022). Sickle cell disease: A review. *Journal of the American Medical Association*, *328*(1), 57–68. https://doi.org/10.1001/jama.2022.10233

Maganti, H. B., Bailey, A. J. M., Kirkham, A. M., Shorr, R., Pineault, N., & Allan, D. S. (2021). Persistence of CRISPR/Cas9 gene edited hematopoietic stem cells following transplantation: A systematic review and meta-analysis of preclinical studies. *Stem Cells Translational Medicine*, *10*(7), 996–1007. https://doi.org/10.1002/sctm.20-0520

Manesia, J. K., Maganti, H. B., Almoflehi, S., Jahan, S., Hasan, T., Pasha, R., McGregor, C., Dumont, N., Laganière, J., Audet, J., & Pineault, N. (2023). AA2P-mediated DNA demethylation synergizes with stem cell agonists to promote expansion of hematopoietic stem cells. *Cell Reports Methods*, *3*(12), 100663. https://doi.org/10.1016/j.crmeth.2023.100663

U.S. Food and Drug Administration. (2023, December 8). *FDA approves first gene therapies to treat patients with sickle cell disease* [Press release]. https://www.fda.gov/news-events/press-announcements/fda-approves-first-gene-therapies-treat-patients-sickle-cell-disease

INTRAVENOUS IMMUNOGLOBULIN THERAPIES: UNDERSTANDING HOW AND WHY THEY WORK

Cruz-Leal, Y., Norris, P. A. A., Gil Gonzalez, L., Marjoram, D., Wabnitz, H., Shan, Y., & Lazarus, A. H. (2024). Trogocytosis drives red blood cell antigen loss in association with antibody-mediated immune suppression. *Blood*, *143*(9), 807–821. https://doi.org/10.1182/blood.2023020860

Dubey, S., Heinen, S., Krantic, S., McLaurin, J., Branch, D. R., Hynynen, K., & Aubert, I. (2020). Clinically approved IVIg delivered to the hippocampus with focused ultrasound promotes neurogenesis in a model of Alzheimer's disease. *Proceedings of the National Academy of Sciences of the United States of America*, *117*(51), 32691–32700. https://doi.org/10.1073/pnas.1908658117

Figueiredo, C. A., Drohomyrecky, P. C., McCarthy, S. D., Leontyev, D., Ma, X. Z., Branch, D. R., & Dunn, S. E. (2014). Optimal attenuation of experimental autoimmune encephalomyelitis by intravenous immunoglobulin requires an intact interleukin-11 receptor. *PLOS ONE*, *9*(7), e101947. https://doi.org/10.1371/journal.pone.0101947

Hubbard, J. J., Pyzik, M., Rath, T., Kozicky, L. K., Sand, K. M. K., Gandhi, A. K., Grevys, A., Foss, S., Menzies, S. C., Glickman, J. N., Fiebiger, E., Roopenian, D. C., Sandlie, I., Andersen, J. T., Sly, L. M., Baker, K., & Blumberg, R. S. (2020). FcRn is a CD32a coreceptor that determines susceptibility to IgG immune complex-driven autoimmunity. *Journal of Experimental Medicine*, *217*(10), e20200359. https://doi.org/10.1084/jem.20200359

Kozicky, L. K., Menzies, S. C., Hotte, N., Madsen, K. L., & Sly, L. M. (2019). Intravenous immunoglobulin (IVIg) or IVIg-treated macrophages reduce DSS-induced colitis by inducing macrophage IL-10 production. *European Journal of Immunology*, *49*(8), 1251–1268. https://doi.org/10.1002/estusji.201848014

Kozicky, L. K., Menzies, S. C., Zhao, Z. Y., Vira, T., Harnden, K., Safari, K., Del Bel, K. L., Turvey, S. E., & Sly, L. M. (2018). IVIg and LPS co-stimulation induces IL-10 production by human monocytes, which is compromised by an FcγRIIA disease-associated gene variant. *Frontiers in Immunology*, *9*, 2676. https://doi.org/10.3389/fimmu.2018.02676

Kozicky, L. K., Zhao, Z. Y., Menzies, S. C., Fidanza, M., Reid, G. S. D., Wilhelmsen, K., Hellman, J., Hotte, N., Madsen, K. L., & Sly, L. M. (2015). Intravenous immunoglobulin skews macrophages to an anti-inflammatory, IL-10-producing activation state. *Journal of Leukocyte Biology*, *98*(6), 983–994. https://doi.org/10.1189/jlb.3VMA0315-078R

Kozicky, L. K., & Sly, L. M. (2017). Assessment of antibody-based drugs effects on murine bone marrow and peritoneal macrophage activation. *Journal of Visualized Experiments*, *130*, e56689. https://doi.org/10.3791/56689

Lewis, B. J. B., Leontyev, D., Neschadim, A., Blacquiere, M., & Branch, D. R. (2018). GM-CSF and IL-4 are not involved in IVIG-mediated amelioration of ITP in mice: A role for IL-11 cannot be ruled out. *Clinical and Experimental Immunology*, *193*(3), 293–301. https://doi.org/10.1111/cei.13144

Tong, T. N., Blacquiere, M., Sakac, D., Burke-Murphy, E., Yi, Q., Callum, J., Cserti-Gazdewich, C., Parmar, N., Shehata, N., Pavenski, K., Lau, W., Lin, Y., Lieberman, L., Branch, D. R., & Pendergrast, J. (2020). The utility of a monocyte monolayer assay in the assessment of intravenous immunoglobulin-associated hemolysis. *Transfusion*, *60*(12), 3010–3018. https://doi.org/10.1111/trf.16131

IVIG USE IN IMMUNE THROMBOCYTOPENIA: PREVENTING PLATELET DESTRUCTION AND EXPLORING IVIG ALTERNATIVES

Crow, A. R., Kapur, R., Koernig, S., Campbell, I. K., Jen, C. C., Mott, P. J., Marjoram, D., Khan, R., Kim, M., Brasseit, J., Cruz-Leal, Y., Amash, A., Kahlon, S., Yougbare, I., Ni, H., Zuercher, A. W., Käsermann, F., Semple, J. W., & Lazarus, A. H. (2019). Treating murine inflammatory diseases with an anti-erythrocyte antibody. *Science Translational Medicine*, *11*(506), eaau8217. https://doi.org/10.1126/scitranslmed.aau8217

Gonzalez, L.G., Won, K.D., Tawhidi, Z., Cummins, E., Cruz-Leal, Y., Cabado, Y.T., Sachs, U.J., Norris, P.A.A., Shan, Y., Bhakta, V., Li, J., Samudio, I., Silva-Moreno, B., Cerna-Portillo, L., Oro, A.P., Bergqvist, P., Chan, P., Moorehead, A., Sholzberg, M., Sheffield, W.P., & Lazarus, A.H. (2024). Human Fc gamma receptor IIIA blockade inhibits platelet destruction in a humanized murine model of ITP. *Blood Advances*, *8*(8): 1869–1879. https://doi.org/10.1182/bloodadvances.2023012155

Kaur, M. N., Arnold, D. M., Heddle, N. M., Cook, R. J., Hsia, C., Blostein, M., Jamula, E., Sholzberg, M., Lin, Y., Kassis, J., Larratt, L., Tinmouth, A., Carruthers, J., Li, N., Liu, Y., & Xie, F. (2022). Cost-effectiveness of eltrombopag vs intravenous immunoglobulin for the perioperative management of immune thrombocytopenia. *Blood Advances*, *6*(3), 785–792. https://doi.org/10.1182/bloodadvances.2021005627

Lewis, B. J. B., Ville, J., Blacquiere, M., Cen, S., Spirig, R., Zuercher, A. W., Käsermann, F., & Branch, D. R. (2019). Using the K/BxN mouse model of endogenous, chronic, rheumatoid arthritis for the evaluation of potential immunoglobulin-based therapeutic agents, including IVIg and Fc-μTP-L309C, a recombinant IgG1 Fc hexamer. *BMC Immunology*, *20*, 44. https://doi.org/10.1186/s12865-019-0328-6

Li, J., van der Wal, D. E., Zhu, G., Xu, M., Yougbare, I., Ma, L., Vadasz, B., Carrim, N., Grozovsky, R., Ruan, M., Zhu, L., Zeng, Q., Tao, L., Zhai, Z. M., Peng, J., Hou, M., Leytin, V., Freedman, J., Hoffmeister, K. M., & Ni, H. (2015). Desialylation is a mechanism of Fc-independent platelet clearance and a therapeutic target in immune thrombocytopenia. *Nature Communications*, *6*, 7737. https://doi.org/10.1038/ncomms8737

Loriamini, M., Lewis-Bakker, M. M., Frias Boligan, K., Wang, S., Holton, M. B., Kotra, L. P., & Branch, D. R. (2023). Small molecule drugs that inhibit phagocytosis. *Molecules*, *28*(2), 757. https://doi.org/10.3390/molecules28020757

Norris, P. A. A., Kaur, G., Khan, R., Zhu, G., Ni, H., & Lazarus, A. H. (2021). Anti-inflammatory activity of CD44 antibodies in murine immune thrombocytopenia is mediated by Fcγ receptor inhibition. *Blood*, *137*(15), 2114–2124. https://doi.org/10.1182/blood.2020009497

Podolanczuk, A., Lazarus, A. H., Crow, A. R., Grossbard, E., & Bussel, J. B. (2009). Of mice and men: An open-label pilot study for treatment of immune thrombocytopenic purpura by an inhibitor of Syk. *Blood*, *113*(14), 3154–3160. https://doi.org/10.1182/blood-2008-07-166439

Purohit, M. K., Chakka, S. K., Scovell, I., Neschadim, A., Bello, A. M., Salum, N., Katsman, Y., Bareau, M. C., Branch, D. R., & Kotra, L. P. (2014). Structure-activity relationships of pyrazole derivatives as potential therapeutics for immune thrombocytopenias. *Bioorganic & Medicinal Chemistry*, *22*(9), 2739–2752. https://doi.org/10.1016/j.bmc.2014.03.016

Yougbaré, I., Lang, S., Yang, H., Chen, P., Zhao, X., Tai, W. S., Zdravic, D., Vadasz, B., Li, C., Piran, S., Marshall, A., Zhu, G., Tiller, H., Killie, M. K., Boyd, S., Leong-Poi, H., Wen, X. Y., Skogen, B., Adamson, S. L., … Ni, H. (2015). Maternal anti-platelet β3 integrins impair angiogenesis and cause intracranial hemorrhage. *Journal of Clinical Investigation*, *125*(4), 1545–1556. https://doi.org/10.1172/JCI77820

Yu, X., Menard, M., Prechl, J., Bhakta, V., Sheffield, W. P., & Lazarus, A. H. (2016). Monovalent Fc receptor blockade by an anti-Fcγ receptor/albumin fusion protein ameliorates murine ITP with abrogated toxicity. *Blood*, *127*(1), 132–138. https://doi.org/10.1182/blood-2015-08-664656

Zeng, Q., Zhu, L., Tao, L., Bao, J., Yang, M., Simpson, E. K., Li, C., van der Wal, D. E., Chen, P., Spring, C. M., Wang, M., Zhang, L., Ruan, C., Hou, M., Xia, R., & Ni, H. (2012). Relative efficacy of steroid therapy in immune thrombocytopenia mediated by anti-platelet GPIIbIIIa versus GPIbα antibodies. *American Journal of Hematology*, *87*(2), 206–208. https://doi.org/10.1002/ajh.22211

OPENING THE DOOR TO DONATION FOR THOUSANDS AFFECTED BY RESTRICTIONS RELATED TO HUMAN VARIANT OF "MAD COW" DISEASE

Pozzo di Borgo, A., Germain, M., O'Brien, S. F., Delage, G., Renaud, C., & Lewin, A. (2023). Risk of variant Creutzfeldt–Jakob disease in a simulated cohort of Canadian blood donors. *Vox Sanguinis*, *118*(9), 738–745. https://doi.org/10.1111/vox.13493

Seed, C. R., Hewitt, P. E., Dodd, R. Y., Houston, F., & Cervenakova, L. (2018). Creutzfeldt-Jakob disease and blood transfusion safety. *Vox Sanguinis*, *113*(3), 220–231. https://doi.org/10.1111/vox.12631

Stratton, E., Ricketts, M. N., & Gully, P. R. (1997). The epidemiology of Creutzfeldt-Jakob disease in Canada: A review of mortality data. *Emerging Infectious Diseases*, *3*(1), 63–64. https://doi.org/10.3201/eid0301.970108

Yang, H., Huang, Y., Gregori, L., Asher, D. M., Bui, T., Forshee, R. A., & Anderson, S. A. (2017). Geographic exposure risk of variant Creutzfeldt-Jakob disease in US blood donors: A risk-ranking model to evaluate alternative donor-deferral policies. *Transfusion*, *57*(4), 924–932. https://doi.org/10.1111/trf.13971

COMMUNITY-BASED RESEARCH AIMS TO BUILD GREATER DIVERSITY IN CANADA'S LIFELINE

Canadian Blood Services. (n.d.). Building greater diversity in **Canada's Lifeline**. https://www.blood.ca/en/diversity

Canadian Blood Services. (2023). Summer internship focuses on strategies to increase diversity in the stem cell registry. https://www.blood.ca/en/research/our-research-stories/research-education-discovery/summer-internship-focuses-strategies

Haw, J. & Holloway, K. (2024, September 7). Canadian Blood Services social scientists attend ISBT 2023. *Research. Education. Discovery.* https://www.blood.ca/en/research/our-research-stories/research-education-discovery/canadian-blood-services-social

Haw, J. (2024, May 2). Countdown to CSTM 2024: Bringing research to life. *Research. Education. Discovery*. https://www.blood.ca/en/research/our-research-stories/research-education-discovery/countdown-cstm-2024-bringing-research

Haw, J., Walrond, J., Jayachandran, J., Dordunoo, D., Eche-Ameh, H., Muwhen, U., Phiri, P., Rastogi, J., & Tinga, B. (2023). Sickle cell disease and the need for blood: Barriers to donation for African, Caribbean, and Black young adults in Canada. *Transfusion*, *63*(7), 1324–1332. https://doi.org/10.1111/trf.17396

Haw, J., Woo, H., Kohut, T., & Fisher, W. (2021). Sexual risk behavior questions: Understanding and mitigating donor discomfort. *Journal of AABB*, *62*(2), 355–364. https://doi.org/10.1111/trf.16755

OUR COMMITMENT TO RESEARCH TRAINING

Canadian Blood Services. (2024, July 9). CSTM 2024: Reflections from Canadian Blood Services trainees, part 1. *Research. Education. Discovery.* https://www.blood.ca/en/research/our-research-stories/research-education-discovery/cstm-2024-reflections-canadian-blood

Himbert, S., D'Alessandro, A., Qadri, S.M., Majcher, M.J., Hoare, T., Sheffield, W.P., Nagao, M., Nagle, J.F., & Rheinstädter, M.C. (2022). The bending rigidity of the red blood cell cytoplasmic membrane. *PLOS ONE*, *17*(8), e026961. https://doi.org/10.1371/journal.pone.0269619

NEW NATIONAL NETWORK ACCELERATES IMPACT OF RESEARCH ON PATIENT CARE BY SUPPORTING HIGH-QUALITY CLINICAL TRIALS

Clark, E. (2023). *Albumin to enhance recovery after acute kidney injury (ALTER-AKI)*. https://clinicaltrials.gov/study/NCT04705896

McQuilten, Z.;Weinkove, R., Crispin, P., Degelia, A., Dendle, C., Gilbertson, M., Johnston, A., Keegan, A., Pepperell, D., Pullon, H., Reynolds, J., Van Tonder, T., Trotman, J., Waters, N., Wellard, C., Weston, H., Morrissey, C.O., & Wood, E. (2021, June 9–17). *Rational: A randomised controlled feasibility trial comparing prophylactic immunoglobulin with antibiotics in patients with acquired hypogammaglobulinemia secondary to haematological malignancies* [Conference presentation], 26th Congress of the European Hematology Association, virtual conference. **https://repository.monashhealth.org/monashhealthjspui/handle/1/46051**

Queen's University. (2023, July 11). Canadian Transfusion Trials Group receives $2.3M for innovative research network. **https://healthsci.queensu.ca/stories/news-announcements/canadian-transfusion-trials-group-receives-23m-innovative-research**

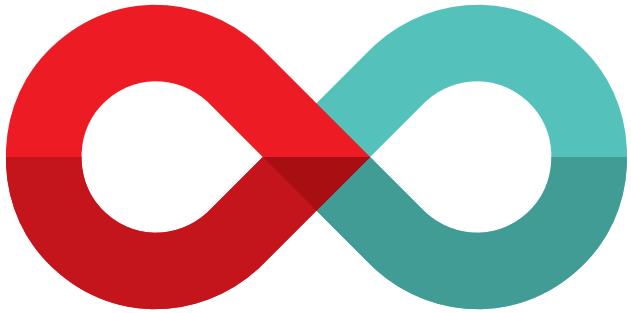
IMPROVING TRANSFUSION PRACTICE WITH TRANSFUSION CAMP

Hagumimana, J., Skelton, T., Pendergrast, J., Nizeyimana, F., Masaisa, F., Kanyamuhunga, A., Gashaija, C., Chargé, S., Kapitany, C., Morgan, M., Meirovich, H., & Lin, Y. (2023). Transfusion Camp Rwanda: A prospective feasibility study evaluating the delivery of Transfusion Camp to a multidisciplinary group of postgraduate medical trainees in Rwanda. Transfusion, 63(11), 2170–2178. **https://doi.org/10.1111/trf.17568**

Skelton, T. (2023, October 31). Canadian Blood Services supporting global efforts in transfusion medicine education. *Research. Education. Discovery.* **https://www.blood.ca/en/research/our-research-stories/research-education-discovery/canadian-blood-services-supporting**

Skelton, T., Nizeyimana, F., Pendergrast, J., Hagumimana, J., Masaisa, F., Kanyamuhunga, A., Gashaija, C., Callum, J., Pavenski, K., Khandelwal, A., Lieberman, L., Chargé, S., Kapitany, C., Morgan, M., Meirovich, H., & Lin, Y. (2023). Transfusion medicine education delivery in Rwanda: Adapting Transfusion Camp to a resource-limited setting. *Transfusion*, *63*(11), 2159–2169. **https://doi.org/10.1111/trf.17531**

Yeung, K. C. Y., Kapitany, C., Chargé, S., Callum, J., Cserti-Gazdewich, C., D'Empaire, P. P., Khandelwal, A., Lieberman, L., Lee, C., Pavenski, K., Pendergrast, J., Shehata, N., Hsia, C. C., Lavoie, M., Murphy, M. F., Prokopchuk-Gauk, O., Rahmani, M., Trudeau, J., Zeller, M. P., & Lin, Y. (2023). Transfusion camp: A retrospective study of self-reported impact on postgraduate trainee transfusion practice. *Transfusion*, *63*(4), 839–848. **https://doi.org/10.1111/trf.17278**



Canadian Blood Services

BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES