STEM CELL TRANSPLANTATION
AND CELLULAR THERAPIES

Advancing Care through
Expertise and Innovation
A TRUSTED LEADER IN STEM CELL TRANSPLANTATION AND CELLULAR THERAPIES

The Division of Stem Cell Transplantation and Cellular Therapies program at Dana-Farber/Brigham and Women’s Cancer Center has been a leader in cellular therapies since our program’s founding in 1972.

Our stem cell transplantation program is one of the largest and most experienced transplant centers in the world. This experience makes a difference for our patients. Our outcomes regularly exceed expected outcomes established by the Center for International Blood and Marrow Transplant Research (CIBMTR). In addition, our active research program leads to advances in the field and improves outcomes.

We have performed more than 9,700 transplants* for adult patients, including more than:

4,950 allogeneic transplants
4,760 autologous transplants

Our program is also at the forefront of emerging cellular therapies such as CAR T-cell therapy, and is the highest volume center in New England. We were one of the first centers to offer this innovative therapy, and now offer all FDA-approved therapies as well as many CAR T trials for other types of blood cancer.

ACCREDITIONS AND AFFILIATIONS

Program Accreditations, Registrations, Licenses

- Foundation for the Accreditation of Cellular Therapy (FACT) for stem cell transplant and immune effector cell therapies
- U.S. Food and Drug Administration
- American Association of Blood Banks (AABB)
- Centers for Medicare and Medicaid Services
- The Joint Commission

Clinical and Research Affiliations

- Member of the Center for International Blood and Marrow Transplant Research (CIBMTR)
- Fully accredited by the National Marrow Donor Program (NMDP)
- Charter member of the Blood and Marrow Transplant Clinical Trials Network of the National Institutes of Health (BMT-CTN)
- Member of the Alliance for Clinical Trials in Oncology (formerly CALGB)
- Founding members of Dana-Farber/Harvard Cancer Center, designated a comprehensive cancer center by the National Cancer Institute

*Includes transplants since 1982 through 2018. While our transplant center has been operational since 1972, data capture using current standards began in November 1982.
LEADERSHIP

Robert J. Soiffer, MD
Vice Chair, Department of Medical Oncology;
Chief, Hematologic Malignancies;
Co-chief, Division of Stem Cell Transplantation
and Cellular Therapies; Chair, Executive
Committee for Clinical Programs

Catherine J. Wu, MD
Chief, Division of Stem Cell Transplantation
and Cellular Therapies

Edwin Alyea, III, MD
Director of Clinical Strategy,
Hematologic Malignancies

Joseph Antin, MD
Chief, Stem Cell Transplantation, Emeritus

Corey Cutler, MD, MPH
Director of Clinical Research, Stem Cell
Transplantation; Director, Stem Cell
Transplantation Survivorship Program

Vincent Ho, MD
Director of Clinical Operations,
Stem Cell Transplantation

Caron Jacobson, MD
Medical Director,
Immune Effector Cell Therapy

John Koreth, MBBS, DPhil
Director of Translational Research,
Stem Cell Transplantation

Sarah Nikiforow, MD, PhD
Technical Director, Immune Effector Cell
Therapy; Associate Medical Director, Connell
and O’Reilly Families Cell Manipulation
Core Facility

Jerome Ritz, MD
Executive Director, Connell and O’Reilly
Families Cell Manipulation Core Facility

Rizwan Romee, MD
Director, Haploidentical
Transplantation Program
ON-SITE CELLULAR THERAPY LAB FACILITATES
INNOVATIVE TREATMENT APPROACHES

The Connell and O’Reilly Families Cell Manipulation
Core Facility (CMCF) is a critical component of our stem
cell transplantation and cellular therapies program.
This cutting-edge lab is among the largest cellular
therapies labs at an academic medical center and
New England’s only Class 10,000 Good Manufacturing
Practices (GMP) cellular manufacturing facility. The
CMCF recently tripled in size to address the growing
cellular therapy field.

The CMCF is an experienced manufacturer of cellular
products for clinical use, including:

- Routine hematopoietic stem cells or
  purified stem cells
- Genetically-modified hematopoietic stem cells
- CAR T cells and other genetically-modified
  immune cells
- Dendritic, natural killer (NK), and cytotoxic T
  lymphocyte (CTL) cells
- Selected T-cell subsets (Tregs) for immunotherapy
- Cancer vaccines
- Mesenchymal stromal cells
- Induced pluripotent stem cells
- Limbal stem cells
The Kraft Family Blood Donor Center at Dana-Farber Cancer Institute and Brigham and Women’s Hospital is another vital part of our cellular therapies program. This on-site facility manages the apheresis collection process for stem cell transplant patients and donors, as well as patients treated with other autologous cellular therapies such as CAR T-cell. The Kraft Center also manages on-site therapeutic apheresis, photopheresis, and blood transfusions.

Since 2014, the Kraft Center has collected more than:

- 2,500 autologous stem cell transplant patients
- 580 allogeneic donors (related and unrelated)
- 100 CAR T-cell patients

In 2018, the CMCF processed more than 1,200 products for adult and pediatric stem cell transplants.

The CMCF supports more than 40 clinical research protocols for more than 15 FDA investigational new drugs (INDs), with a focus on translational research in stem cell transplant and cellular immunotherapy for cancer.

It is accredited by FACT for cellular therapy product processing with more than minimal manipulation.

**Lab Facts:**

- 15 separate ISO-7 clean rooms
- 32 individual workstations
- Operates at biosafety level 2-plus

Quality is a cornerstone of our program, with dedicated and highly-trained specialists in QA, QC, QI and regulatory management. We adhere to extensive safety systems and documentation resources.
A SPECIALIZED TEAM PROVIDES EXCEPTIONAL CARE TO PATIENTS

Our multidisciplinary team of experts has a deep understanding of the complex needs and complications of patients receiving stem cell transplant and cellular therapies. Our program has more than 45 credentialed transplant physicians and dedicated teams experienced in CAR T-cell therapy.

Our physicians are:
- Faculty members of Harvard Medical School
- Leaders in national organizations, working to influence policy and improve standards of care
- Authors of peer-reviewed published articles in leading journals

Patient care teams include:
- Attending physician
- Nurse practitioner/physician assistant
- Nurse coordinator
- Oncology nurse navigator
- Inpatient nurses
- Inpatient house staff/residents
- Non-RN coordinator
- Social worker
- Donor search and collection coordinators
- Donor collection NP/PA
- Financial counselor
- Clinical data specialist
- Housing resource specialist
- Research nurse and clinical research coordinator for patients on clinical trials

Patients are followed by the same attending physician and nurse practitioner throughout their treatment, enabling:
- Continuity of care
- Strong patient-care team relationship
- Clear and easy access for patients and their local providers

Dana-Farber's partnership with Brigham and Women's Hospital, one of the nation's leading hospitals, expands our care team to include experts in infectious disease, gynecology, oral medicine, dermatology, neurology, nephrology, cardiology, pulmonology and other areas to address any side effects or complications a patient may experience.
EXPERT, COMPASSIONATE NURSING CARE

Nurses play a key role in managing a patient’s clinical care in both the inpatient and outpatient settings.

**Before Treatment**
- Assesses needs and coordinates resources to support patients and caregivers
- Provides tailored education to ensure patients and caregivers understand what to expect during and post treatment
- Serves as a consistent contact to answer clinical questions across their journey

**During Admission**
- Administers conditioning chemotherapy, stem cell/CAR-T infusion, and supportive treatments throughout nadir and engraftment
- Provides ongoing monitoring of physiologic status and support for coping with complex treatment
- Conducts discharge education and coordinates post-discharge services to facilitate patients’ transition home

**Follow-Up Care**
- Manages post-transplant/treatment care with transplant physician and local oncologist
- Monitors blood counts and medication level
- Addresses side effect concerns
- Monitors for graft-vs-host

Both Dana-Farber Cancer Institute and Brigham and Women’s Hospital have earned Magnet designation for excellence in nursing service and practice by the American Nurses Credentialing Center — the nation’s preeminent accreditation organization.
SUPPORTING PATIENTS THROUGHOUT THE TREATMENT JOURNEY

Our program provides comprehensive care for stem cell transplant and cellular therapies patients — from treatment planning, donor search, and inpatient care through post-treatment care.

Services and support include:

- A shared care initiative that fosters pre- and post-treatment collaboration with local providers, enabling more care close to home
- Comprehensive patient and caregiver education program
  - Multiformat patient education materials including printed guides, website, videos, and interactive learning modules to meet different learning styles and diverse audiences
  - Dedicated caregiver guide and support
- Stem cell transplantation survivorship program to address the long-term needs to stem cell transplant survivors
  - Survivors can also access support and services through Dana-Farber’s Adult Survivorship Program
- Graft-versus-host disease prevention and management
- Dedicated program for older patients that helps guide therapy decisions, minimize side effects, and enhance the patient’s overall quality of life
- Specialized programs for transplant and cellular therapies patients, including imaging, infectious disease, pathology, radiation oncology, neurology, photopheresis
- Hematopathologic evaluation and diagnosis
- Toxicity management
- Nutrition services
- Pharmacy services
- Integrative therapies
- DNA sequencing for leukemia and related disorders
- Dedicated social work resources
- Patient and family resource center
- Emotional and psychosocial support
- Financial counseling
- Housing assistance
A STEM CELL TRANSPLANTATION CLINICAL PROGRAM WITH DEEP EXPERIENCE AND STRONG OUTCOMES

Our stem cell transplantation program is one of the largest in the nation, caring for adult patients with a variety of hematologic malignancies, bone marrow failure syndromes, and rare and congenital blood disorders. We are experienced in both autologous and allogeneic transplantation.

For allogeneic transplant patients, we offer:

- Related donor transplant
- Haploidentical (“half-match”) transplant with a biological parent, child, or sibling
- Unrelated donor transplant
- Umbilical cord blood transplant
- Reduced-intensity (“mini” or “RIC”) transplant
- Outpatient transplant for some patients

Having experience with a range of donor sources enables us to make stem cell transplant available to more patients.
STEM CELL TRANSPLANTATION PROGRAM BY THE NUMBERS*

<table>
<thead>
<tr>
<th></th>
<th>1982-99</th>
<th>2000-18</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total transplants</td>
<td>1,807</td>
<td>7,920</td>
<td>9,727</td>
</tr>
<tr>
<td>Autologous transplants</td>
<td>1,068</td>
<td>3,700</td>
<td>4,768</td>
</tr>
<tr>
<td>Allogeneic transplants</td>
<td>739</td>
<td>4,220</td>
<td>4,959</td>
</tr>
<tr>
<td>Related donor (includes haploidentical)</td>
<td>545</td>
<td>1,341</td>
<td>1,886</td>
</tr>
<tr>
<td>Matched, unrelated donor</td>
<td>135</td>
<td>2,153</td>
<td>2,288</td>
</tr>
<tr>
<td>Cord blood and Mismatched</td>
<td>59</td>
<td>726</td>
<td>785</td>
</tr>
<tr>
<td>Myeloablative conditioning regimen</td>
<td>739</td>
<td>1,747</td>
<td>2,486</td>
</tr>
<tr>
<td>Non-myeloablative conditioning regimen</td>
<td>2,421</td>
<td>2,421</td>
<td>2,421</td>
</tr>
</tbody>
</table>

*Includes transplants since 1982 through 2018. While our transplant center has been operational since 1972, data capture using current standards began in November 1982. Does not include rescue transplants.

Donor Services for Allogeneic Patients

Our experienced Donor Services team supports related and unrelated donors for allogeneic patients in numerous ways:

- Specialized unrelated donor search team that routinely reviews strategies for finding the best donor for each patient in the shortest timeframe and at the lowest cost. Our unrelated donor program is the largest NMDP-designated allogeneic donor program in the U.S.
- Organizes community engagement events to grow Be the Match Registry®
- Donor education and advocacy
- Stem cell and bone marrow collection coordination
- Follow-up care and support for donors

Our program is a fully accredited member of the National Marrow Donor Program as a transplant center, an apheresis and marrow collection center, donor center, and Be the Match Registry® community engagement center.
Disease and Conditions Treated with Transplant

We utilize stem cell transplant to treat patients diagnosed with the following conditions, including older adults and those with advanced disease:

**BLOOD CANCERS AND MALIGNANT DISORDERS**
- Acute lymphoblastic leukemia (ALL)
- Acute myeloid leukemia (AML)
- Chronic lymphocytic leukemia (CLL/SLL)
- Chronic myelogenous leukemia (CML)
- Hodgkin lymphoma
- Non-Hodgkin lymphoma
- T-cell lymphoma
- Mantle cell lymphoma
- Follicular lymphoma
- Multiple myeloma
- Waldenström’s macroglobulinemia
- Blastic plasmacytoid dendritic cell neoplasm (BPDCN)
- Testicular or germ cell cancer
- And others

**MYELOPROLIFERATIVE DISORDERS AND MYELODYSPLASTIC SYNDROMES**
- Myelofibrosis
- Myeloproliferative disorders (MPD)
- Myelodysplastic syndromes (MDS)
- Chronic myelomonocytic leukemia (CMML)
- And others

**NON-MALIGNANT AND CONGENITAL BLOOD DISORDERS**
- Aplastic anemia
- Diamond-Blackfan anemia
- Dyskeratosis congenita
- MonoMAC Syndrome
- Paroxysmal nocturnal hemoglobinuria (PNH)
- Shwachman-Diamond syndrome
- Sickle cell anemia
- Thalassemia
- Hemaphagocytic lymphohistiocytosis (HLH)
- Immunodeficiency syndromes
- And others

**Early Referral for Transplant Evaluation**

We encourage you and your patients to consult with us early in the treatment cycle to evaluate if a stem cell transplant may be appropriate. For our guide on Recommended Referral Timing for Transplant Evaluation, call 617-632-3069 or visit www.dana-farber.org/sctmd.
### Number of Transplants by Disease Type*

<table>
<thead>
<tr>
<th>Primary Disease</th>
<th>1982-99</th>
<th>2000-18</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>767</td>
<td>1,848</td>
<td>2,615</td>
</tr>
<tr>
<td>Multiple myeloma/Plasma cell disorder</td>
<td>229</td>
<td>1,969</td>
<td>2,198</td>
</tr>
<tr>
<td>Acute myeloid leukemia</td>
<td>203</td>
<td>1,598</td>
<td>1,801</td>
</tr>
<tr>
<td>Myelodysplastic syndromes</td>
<td>66</td>
<td>588</td>
<td>654</td>
</tr>
<tr>
<td>Hodgkin lymphoma</td>
<td>51</td>
<td>544</td>
<td>595</td>
</tr>
<tr>
<td>Acute lymphoblastic leukemia</td>
<td>115</td>
<td>391</td>
<td>506</td>
</tr>
<tr>
<td>Chronic lymphocytic leukemia, SLL</td>
<td>141</td>
<td>319</td>
<td>460</td>
</tr>
<tr>
<td>Chronic myelogenous leukemia</td>
<td>225</td>
<td>209</td>
<td>434</td>
</tr>
<tr>
<td>Aplastic anemia, sickle cell, and other disorders of hematopoiesis</td>
<td>7</td>
<td>142</td>
<td>149</td>
</tr>
<tr>
<td>MPD and Mixed MDS/MPD</td>
<td></td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>Myelofibrosis</td>
<td>3</td>
<td>95</td>
<td>98</td>
</tr>
<tr>
<td>Testicular/Germ cell tumor</td>
<td></td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>Immunodeficiency syndromes</td>
<td>23</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Other disease</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Blastic plasmacytoid dendritic cell neoplasm (BPDCN)</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Other solid tumor</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,807</strong></td>
<td><strong>7,920</strong></td>
<td><strong>9,727</strong></td>
</tr>
</tbody>
</table>

### Transplants for Older Adults*

Stem cell transplant has become a viable option for older adults up into their 70s. A major factor has been the development of reduced-intensity transplants in which lower doses of chemotherapy are used. Our Older Adult Hematologic Malignancies Program provides dedicated support for older patients. Each patient receives collaborative care from both their DF/BWCC oncologist and a geriatrician from Brigham and Women’s Hospital to identify the best treatment approach as well as to manage other health and wellness issues they may face.

<table>
<thead>
<tr>
<th>Age/Year</th>
<th>1982-98</th>
<th>1999-03</th>
<th>2004-08</th>
<th>2009-13</th>
<th>2014-18</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-59 yrs.</td>
<td>154</td>
<td>193</td>
<td>330</td>
<td>433</td>
<td>430</td>
<td>1,540</td>
</tr>
<tr>
<td>60-64 yrs.</td>
<td>54</td>
<td>118</td>
<td>257</td>
<td>501</td>
<td>460</td>
<td>1,390</td>
</tr>
<tr>
<td>65-70 yrs.</td>
<td>19</td>
<td>40</td>
<td>127</td>
<td>396</td>
<td>492</td>
<td>1,074</td>
</tr>
<tr>
<td>70+ yrs.</td>
<td>0</td>
<td>3</td>
<td>29</td>
<td>129</td>
<td>265</td>
<td>426</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>227</strong></td>
<td><strong>354</strong></td>
<td><strong>743</strong></td>
<td><strong>1,459</strong></td>
<td><strong>1,647</strong></td>
<td><strong>4,430</strong></td>
</tr>
</tbody>
</table>

*Includes transplants since 1982 through 2018. While our transplant center has been operational since 1972, data capture using current standards began in November 1982.
Novel cellular therapies that help the immune system fight cancer such as CAR T-cell therapy, cancer vaccines, NK-cell therapy, and other genetically-modified T cells have emerged as potent therapeutic options for many patients with blood cancers. Our program remains at the forefront of emerging cellular therapies and is often among the first to offer clinical trials in this area. Several novel therapies are being manufactured and evaluated through our Cell Manipulation Core Facility.

In 2017, the FDA approved CAR T-cell therapy for some types of blood cancers. Our program was among a select group of centers to offer the clinical trial that led to the first CAR T-cell therapy approved for adult non-Hodgkin lymphoma. We now offer all FDA-approved CAR T-cell therapies as well as several clinical trials of CAR T-cell therapy for other forms of lymphoma, leukemia, multiple myeloma, as well as some solid tumors. We also offer trials exploring new areas in cellular therapies such as Tregs, NK-cell therapy, and cytotoxic T lymphocyte (CTL) cells.

We have also treated many patients through clinical trials of CAR T-cell therapy for acute myeloid leukemia, acute lymphoblastic leukemia, and multiple myeloma.
Cellular Therapies Program Leaders

**Caron Jacobson, MD**
Medical Director,
Immune Effector Cell Therapy Program

**Sarah Nikiforow, MD, PhD**
Technical Director, Immune Effector Cell Therapy Program
Assistant Medical Director,
Connell and O’Reilly Families
Cell Manipulation Core Facility

**Jerome Ritz, MD**
Executive Director,
Connell and O’Reilly Families
Cell Manipulation Core Facility
IMPROVING PATIENT CARE AND OUTCOMES THROUGH BASIC AND TRANSLATIONAL RESEARCH INITIATIVES

Our robust research enterprise in basic and translational research aims to advance and improve care and outcomes for transplant and cellular therapies patients.

**Our transplant research program:**

- Is supported by funding from NIH program project and research project grants, Leukemia & Lymphoma Society, Patient-Centered Outcomes Research Institute, and other sources
- Offers several clinical trials, many of which are only available at DF/BWCC.

**Current transplant research efforts are focused on:**

- Relapse treatment and prevention – exploring strategies in immunotherapy and vaccine therapy to induce or restore anti-tumor activity
- Management/prevention of GVHD – evaluating novel treatments for acute and chronic graft-versus-host disease
- Shared care – assessing the impact of a post-transplant shared care model between DF/BWCC and local providers on outcomes and quality of life
- Quality improvement – optimizing resource utilization, testing efficiency, and transplant safety and care
- Novel applications – evaluating stem cell transplant for autoimmune diseases

**Cellular therapies cancer research explores:**

- CAR T-cell therapy in combination with other immunotherapies; earlier in the treatment cycle; and for other forms of blood cancer
- Allogeneic (“off the shelf”) CAR T-cell therapy
- Vaccine therapies for melanoma, glioblastoma, and stem cell transplant patients
- Engineered T-cell receptor (eTCR) T cells for synovial sarcoma
- NK-cell therapy for myeloid malignancies

**We have many transplant and cellular therapies trials open at any time, typically offering:**

- 20 clinical trials for stem cell transplant patients
- 15 immune effector cell trials (i.e. CAR T and other cellular therapies)
- A robust pipeline with new trials opening monthly
Focus on Quality — Committed to the Highest Standards in Patient Care

Quality is a cornerstone of our program. Our Stem Cell Transplantation and Cellular Therapies Quality Assurance Department teams with clinicians, investigators, and programs to achieve outstanding outcomes. Services provided include:

Quality Assurance and Regulatory Compliance

- Performing internal and external audits to ensure that Dana-Farber and its contracted services and suppliers operate in compliance with established policies, procedures, and standards
- Auditing departmental practices and instituting corrective action when needed
- Ensuring that Dana-Farber is always in a state of inspection readiness and compliance with all policies and regulations

Quality Improvement (QI)

- Improving patient care
- Ensuring patient safety
- Enhancing patient satisfaction
- Reducing unnecessary testing and readmissions
- Improving workflow
- Reducing costs

Regulatory Affairs

- Actively involved, both across Dana-Farber and nationwide, in shaping the regulatory field for cellular therapy
- Helping Dana-Farber investigators gain clearance for clinical trials using novel cellular therapy products
- Conversing with the U.S. Food and Drug Administration about the challenges of fitting cellular therapy manufacturing into the regulatory pharmaceutical environment
- Ensuring Dana-Farber’s status as one of the first centers registered as a Human Cell and Tissue Product Establishment when federal regulations changed

Data Capture and Analysis

- Capturing data from various cellular therapy programs and clinical trials engaged in services for patients
- Benchmarking certain data against internal standards and national standards
- Reporting other data to external agencies to ensure quality and establish ongoing quality improvement measures in the field of cellular therapy
We look forward to partnering with you to care for patients with hematologic malignancies and other blood disorders.

**Patient Referrals**

To refer a patient for evaluation for stem cell transplant, CAR T-cell therapy, or other cellular therapies, we recommend you consult with us early in the patient’s treatment for evaluation for these advanced therapies.

**Stem Cell Transplantation**
617-632-6028

**Cellular Therapies**
877-801-2278
cartinquries@dfci.harvard.edu

**International Patients**
+1-617-658-4835
brighamandwomensintl@bwh.harvard.edu

**Online Referrals**
www.dana-farber.org/patientreferrals