TRANSPLANTATION, TISSUE ENGINEERING AND REGENERATIVE MEDICINE INSTITUTE AT NORTHWESTERN MEDICINE
“Today at Northwestern, we continue to set expectations high, striving for ambitious but realistic goals. The question is not whether we can get there, but how and when. With the ultimate goal of using the patient’s own cells to regenerate and replace diseased organs, while eliminating the need for anti-rejection drugs, the team at Northwestern is poised to solve the organ shortage.”

Michael Abecassis, MD, MBA, Director, Comprehensive Transplant Center

TRANPLANTATION, TISSUE ENGINEERING AND REGENERATIVE MEDICINE INSTITUTE AT NORTHWESTERN MEDICINE

Over just a few decades, the field of organ transplantation has exploded from its experimental beginnings. It has evolved into arguably the most progressive, complex, and challenging area of modern-day healthcare. Today, not only survival but total rehabilitation among patients of all ages is now a realistic prospect. Transplantation represents the most effective form of treatment for the final degenerative stages of diabetes and heart, lung, liver, kidney, and intestinal failure.

In establishing the Comprehensive Transplant Center in 2009, Northwestern Medicine recognized the need to integrate interdisciplinary research and training to advance the field of transplantation to the next level. By fostering a shared purpose, the Center builds on exceptional existing clinical and research strengths to galvanize individual efforts into a nexus of creativity. We currently enjoy international visibility as a top 3% transplant program in volume and outcomes in North America. We are also an innovation leader, having achieved many “firsts.”

These scientific advances have grown out of a need to improve transplant outcomes, and they have become relevant in other areas. These areas are tissue and organ regeneration, stem cell biology, and developing immune tolerance programs to avoid lifetime anti-rejection medications. The Center has identified biomarkers predictive of transplant complications, which in turn inform therapeutic decisions for better outcomes. Finally, it has focused on bio-engineering tissue and organs instead of relying on transplanted donor organs. As metrics of progress, this Center is addressing issues that are particularly germane to outcomes including age-related complications, diabetes, and cardiac disease, as well as other health issues that can affect transplant recipients. To this end, health services investigators are studying survivability (outcomes research) complementing the biomedical research. The vision for the Transplantation, Tissue Engineering and Regenerative Medicine Institute at Northwestern Medicine is to leverage the strengths of the Center, integrating 50 years of clinical care, discovery, and education in transplantation by expanding the scope to include breakthrough research using novel tissue engineering and regenerative medicine approaches.

THE FOCUS, THE ENGINE, AND THE GOALS

Immune Tolerance

Northwestern Medicine is a national leader in immune tolerance. This consists of teaching an individual’s immune system not to attack a “foreign” transplanted organ, while making sure that other “foreign” invaders such as bacteria and viruses are appropriately destroyed. Achieving this fine balance ties in with related fields of immunity, such as cancer and infectious disease. Currently, Northwestern Medicine has promising Phase II and III clinical trials on the...
induction of chimerism—the coexistence of donor and recipient cells—in order to achieve durable transplantation tolerance in mismatched donor/recipient combinations.

**Tissue Engineering**

Recent advances in tissue engineering and in stem cell biology hold great promise for tissue and organ regeneration and the creation of bio-artificial organs. These regenerative medicine approaches form the basis for great solutions to the challenge of the critical shortage of transplantable organs. Strategies designed to accelerate bio-artificial organ development include the study and use of stem cells, which are immature precursor cells that can be programmed to turn into a mature cell of any type. Because of this programmability, stem cells can be used to seed bio-engineered scaffolds for organ regeneration and repair.

Stem cells can either be generated by reprogramming skin, fat, or even blood and brain cells from patients back into embryonic-state cells. These advances are very new. So much so that the discovery that mature skin cells—called induced pluripotent stem (iPS) cells—can be reprogrammed was just awarded a Nobel Prize in 2012. Another breakthrough is generating stem cells at the site of a diseased organ so as to repair the damaged tissue. Currently, Northwestern Medicine is engaged in groundbreaking research to build bio-engineered organs using animal models with the hope that this will soon result in the ability to provide patients requiring transplants with ‘just-in-time’ organs. The ultimate objective is to eventually be able to use the patients’ own cells to regenerate these organs, thereby totally avoiding rejection following transplantation.

**Regenerative Medicine**

Regenerative medicine at Northwestern Medicine includes new nanotechnology strategies. Nanomedicine is an area of great strength, leadership, and expertise internationally at Northwestern Medicine. Regenerative nanomedicine is an exciting new interdisciplinary field that uses nanoscale technology to repair, replace, or regenerate tissues or organs. The goal of these efforts is to develop clinical approaches to restore, replace, or enhance biological functions that have been lost due to disease, injury, aging, or congenital abnormalities. Specific examples include spinal cord injury, heart disease, degenerative joint conditions, neurological disorders, wound healing, bone damage, and organ failure. Nanomedicine efforts are already underway in many of these areas, as well as cardiovascular repair using novel bio-inspired delivery vehicles that are targeted to the site of vascular injury. These cardiovascular therapies could revolutionize how atherosclerotic arteries are treated representing paradigm-shifting technology.

Success in transplantation has already meant better outcomes for people whose own organs are failing. Under the broader umbrella of the Transplantation, Tissue Engineering and Regenerative Medicine Institute, we will maintain and push the regional, national, and international standing and leadership that we have already achieved well into the next 50 years. Today is where tomorrows begin.
THROUGH NORTHWESTERN MEDICINE, WE ARE CREATING A NATIONAL EPICENTER FOR HEALTHCARE, EDUCATION, RESEARCH, COMMUNITY SERVICE, AND ADVOCACY.

Northwestern Medicine

Northwestern Memorial HealthCare and Northwestern University Feinberg School of Medicine impact human health through Northwestern Medicine so as to be the destination of choice for people seeking quality healthcare. We are building support to advance that care through leading-edge treatment and breakthrough discoveries. Northwestern Medicine is composed of people who also share our passion for educating future physicians and scientists. Our commitment to transform healthcare and to be among the nation’s top academic medical centers can only be accomplished through innovation and excellence as displayed by the Transplantation, Tissue Engineering and Regenerative Medicine Institute.

Through transplantation, tissue engineering, and regenerative medicine, we have the opportunity to expand the number of collaborative scientific teams focused on innovative solutions to organ damage and disease.

We invite interested friends to invest in the Institute. Your philanthropic support will advance the vision and research of our exceptional clinician-scientists and basic science investigators as we continue to deliver exceptional care and train the next generation of leaders.