LIFE TRANSFORMED

Celebrating Over 55 Years of Restoring and Transforming *Life*

Penn Medicine Transplant Institute 1966 – 2021

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A MESSAGE FROM ABRAHAM SHAKED

Here at Penn Medicine, we've been building the region's largest and most dynamic home for transplantation for over five decades. It's a home established on a foundation of innovation that began with surgeon and transplant pioneer Clyde F. Barker, MD.

My goal, our shared goal, is for the Penn Transplant Institute to change the field of transplant medicine, and in so doing, change the lives of all the patients who trust us with their care.

Every day we work to deliver the most exceptional level of care and give each person the opportunity at a new life, a healthy and vibrant life, regardless of the severity of their illness. We unwaveringly pursue research that drives the field forward, and we do this work in the same space. Our physicians, nurses, therapists, pharmacists, social workers, researchers and psychiatrists are not separated by buildings or by blocks but instead share a system, a space, that fosters the most effective teamwork in pursuit of the ultimate goal — exceptional care for exceptional outcomes.

What does it take to get a very sick patient facing end-stage organ failure and coordinate care from the moment they walk through our doors and for the rest of their lives? It requires the ultimate team. At Penn, we have that team. Now, with over 55 years and more than 13,000 transplants behind us, our team looks forward. We look forward as one of the leading centers for transplantation because of our team, our care and our outcomes. Outcomes that mean the ultimate gift, the gift of a new and extended life for those we care for at Penn.

From the very beginning, this incredible work has been made possible because of the invaluable vision of Penn's leadership, the commitment of our staff, the selflessness of organ donors, the partnerships we foster with the Children's Hospital of Philadelphia and the generosity of our philanthropic partners. Philanthropy that allows us to invest in the latest technology, provide the highest standard of patient care and pursue the research that will advance both. **Thank you for all you do to help us continue to touch so many lives and create so many second chances.**

Abraham Shaked

Abraham Shaked, MD, PhD
Director, Penn Transplant Institute
Eldridge L. Eliason Professor of Surgery

OUR MISSION

LIFE-SAVING CARE

In the last 55 years, the team at the Penn Transplant Institute has performed more than 13,000 transplants. That's an impressive number. But at Penn, numbers are far less important to us than our patients — sick people with complex needs that require the combined efforts of experts across multiple disciplines.

At the Penn Transplant Institute, we understand that patients' psychological, pharmacological, financial, emotional and medical needs are equally important to their overall outcomes. To give each one of our patients the opportunity to enjoy the quality of life that a healthy organ can offer, we bring all of our disciplines together around the patient, making the experience as personal as possible. Excellent, compassionate health care happens when you create an outstanding team of nurse coordinators, advance practice providers, surgeons, physicians, psychiatrists and social workers. Rounding out the team are pharmacists and physical therapists working alongside financial coordinators, transplant nutritionists, respiratory therapists, administrators and many others. It happens when every member of the team has a voice. It happens when your clinical team partners with researchers who are working to answer the most pressing questions and overcome each modern challenge to organ transplantation. It happens when you continually work to expand the donor pool through innovation and determination. It happens when you use the latest technologies and treatment strategies not just to support patients but to increase their chances of getting transplanted.

Penn has the numbers — thousands of successful transplants, top-rated programs and excellent patient outcomes. But behind those numbers is what really matters to our team – patients who come to us bearing the burden of overwhelming sickness, hoping to find a medical team that not only understands their illness, but understands who they are as an individual, as a family member and as part of a community. Respect for the whole patient drives every member of the Penn Transplant Institute, and it's what creates real leaders in the field that never stop looking for innovative ways to offer life-saving and life-changing organ transplants.

OVER 55 YEARS, MORE THAN 13,000 LIVES SAVED

CELEBRATING OVER 55 YEARS OF TRANSPLANT EXCELLENCE

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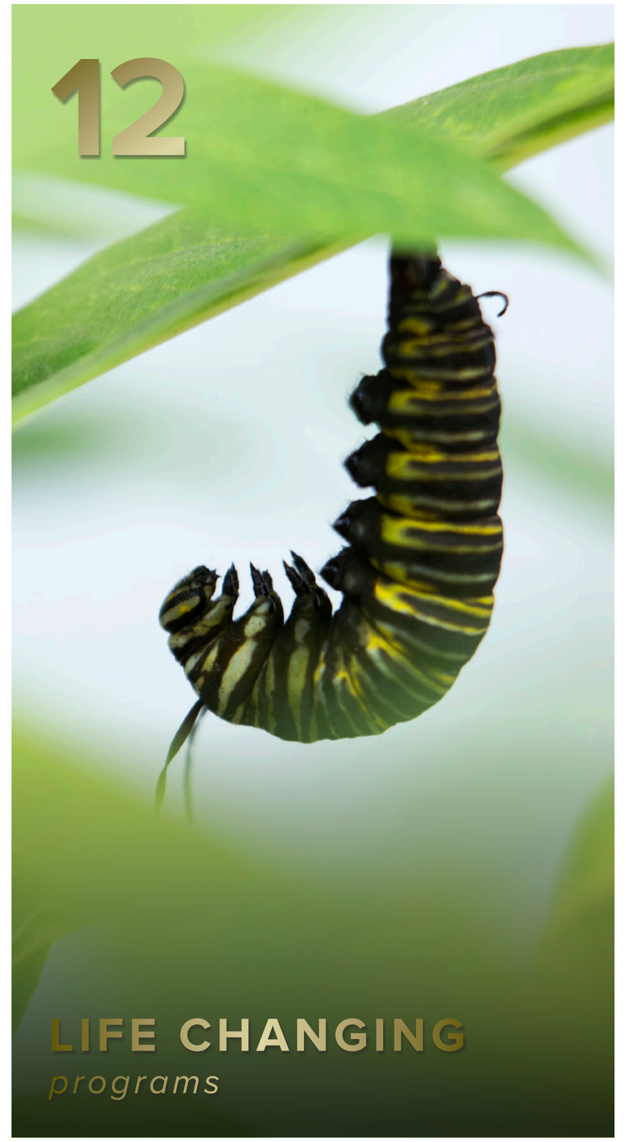

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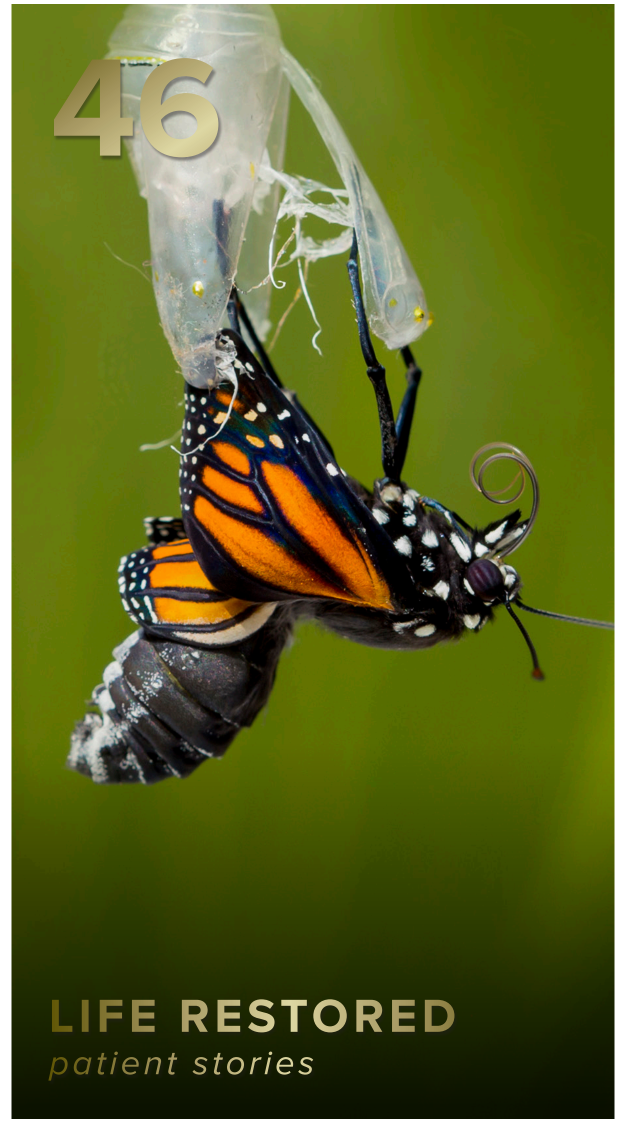

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LOOKING BACK

> *Progress in transplantation assumes there are needs not met by the available approaches and that the barriers to meeting those needs can be surmounted. At Penn, we continuously strive for this progress, to surmount the obstacles, to meet the needs and improve the care for all those facing transplantation.*
>
> **—Clyde F. Barker, MD**
> *Donald Guthrie Professor of Surgery, University of Pennsylvania*
> *Chair of the Department of Surgery (1983 – 2001)*

MAKING HISTORY

In 1964, the field of transplantation was in its infancy. **Clyde F. Barker, MD,** took on a fellowship at the University of Pennsylvania with **Rupert Billingham, PhD,** a pioneer in organ transplantation, who was then running the Department of Genetics. At that time, Penn had just one dialysis machine, available to only one patient at a time. Other patients with end-organ kidney disease were dying. These patients had no other medical options and therefore died from their kidney failure.

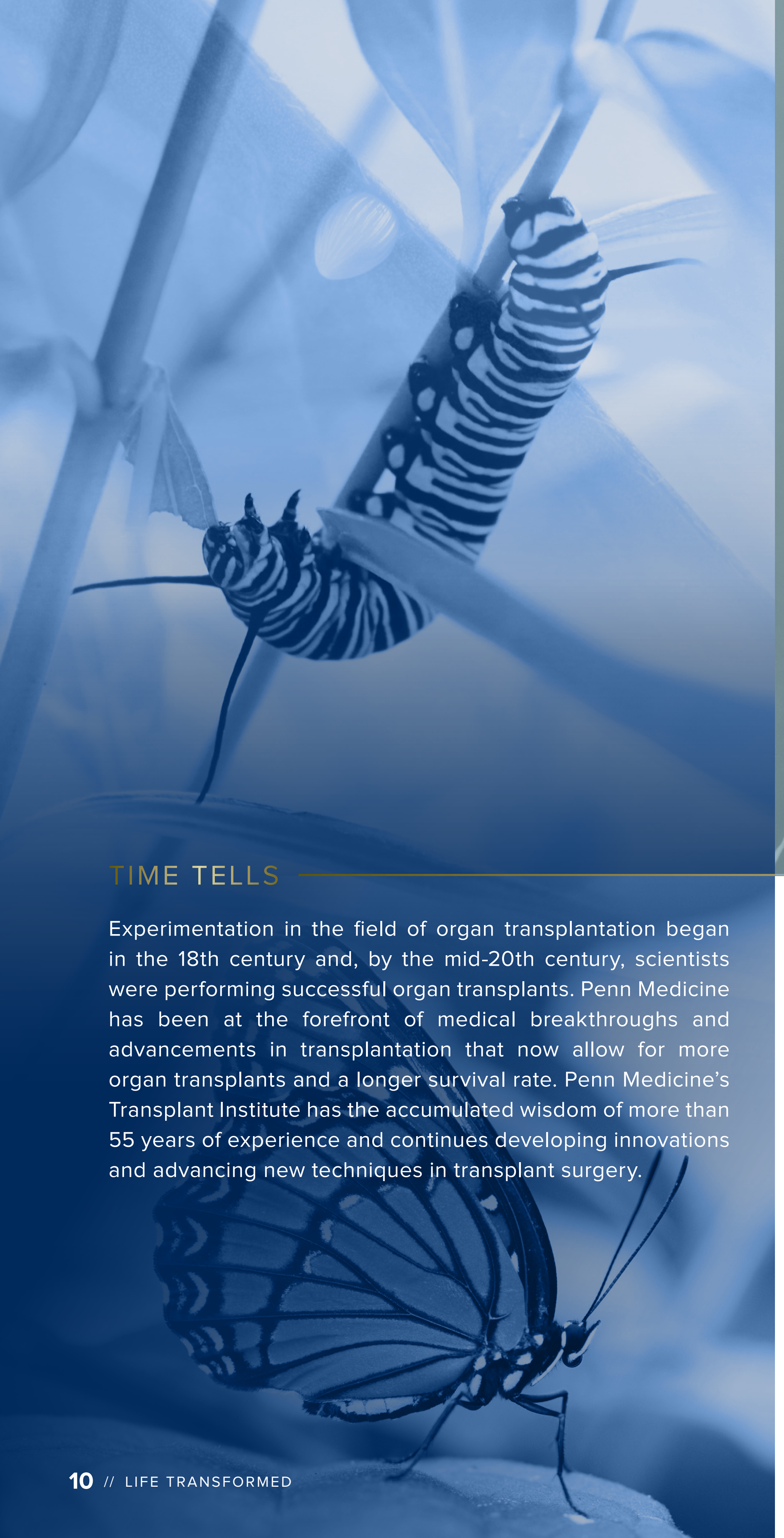
That wasn't good enough for Dr. Barker, who sought to learn as much as he could about transplantation by spending his vacations touring dozens of transplantation sites in the United States, including scrubbing in with **Thomas Starzl, MD, PhD,** widely known as the father of modern transplantation. As a trained vascular surgeon, Dr. Barker felt confident he could bring this life-saving technique to patients at Penn.

With the support of Dr. Billingham, Dr. Barker performed the very first kidney transplant in 1966 on Howard Mehl, who received a kidney from his brother. In a time when the survival rate was no better than 50 percent, Mehl lived until 2015. However, it wasn't always easy to prevent rejection of the organ until more advanced immunosuppressant medications became available in the early 1980s.

Even so, Barker's first transplant embodied the spirit of Penn Transplant medicine — to create as many opportunities for patients to receive transplants as possible, including investigating avenues thought to be closed.

As the Penn Transplant Institute grew, Penn sought the most scientific and forward-thinking minds in transplant medicine to help build one of the leading centers in transplant medicine today. Here is a look at Penn's history of innovation and excellence in the field of transplantation.

Clyde F. Barker, MD, *performing the first kidney transplant at Penn Medicine.*



TIME TELLS

Experimentation in the field of organ transplantation began in the 18th century and, by the mid-20th century, scientists were performing successful organ transplants. Penn Medicine has been at the forefront of medical breakthroughs and advancements in transplantation that now allow for more organ transplants and a longer survival rate. Penn Medicine's Transplant Institute has the accumulated wisdom of more than 55 years of experience and continues developing innovations and advancing new techniques in transplant surgery.

1966-1980

1966 **Clyde F. Barker, MD,** performed the first successful kidney transplant on Howard Mehl.

1972 **Dr. Barker** performed the first liver transplant at Penn. The patient lived only a few days after surgery.

1974 **Dr. Barker** helped form the **Delaware Valley Society of Transplant Surgeons** to share the responsibility of recovering and distributing kidneys for transplant among the region's transplant programs. This organization grew into the **Gift of Life Donor Program,** an Organ Procurement Organization (OPO) charged by the Organ Procurement and Transplant Network (OPTN) of the federal government to fairly distribute organs across the country.

1980 The immunosuppressant drug cyclosporine was made available, improving outcomes for transplant patients.

1984-1995

1984 The first dual organ transplant was performed at Penn.

1986 The first pancreas transplant was peformed at Penn.

The first successful liver transplant was peformed at Penn.

1987 The first heart transplant was performed at Penn by **L. Henry Edmunds, Jr., MD.**

1991 The first lung transplant was performed at Penn by **Larry R. Kaiser, MD.**

1994 The **Penn Transplant Center** was established. This was the first time all solid organ transplant programs came under one administrative structure.

1995 **Abraham Shaked, MD, PhD,** was recruited to lead Penn's Liver Transplant Program, along with **Kim Olthoff, MD.**

The first adult-to-child living donor liver transplant was performed at Penn.

1999-2011

1999 The first adult-to-adult living donor liver transplant was performed at Penn.

2000 The Islet Cell Isolation Lab was established by **Ali Naji, MD**.

2001 The first Islet Cell transplant was completed at Penn.

2003 **Penn Transplant Institute (PTI)** was established.

2009 **Penn's VCA (Vascularized Composite Allotransplantation)** program was established.

2011 **The Human Tissue Lab** was built to advance surgical training on human tissue.

The Clyde F. Barker Penn Transplant House opened.

The first adult bilateral hand transplant was performed at Penn.

2012-2016

2012 **Edward Cantu, MD,** performed the first lung transplant using *EX VIVO* Perfusion System.

Marking the 25th anniversary of the heart transplant program, Penn completed its 1,000th heart transplant in December 2012.

2013 The first Islet auto transplantation for chronic pancreatitis was performed at Penn.

2015 The first pediatric hand transplant was performed in collaboration with Children's Hospital of Pennsylvania.

2016 28-year-old Laura Nataf was the first international patient to receive a bilateral hand transplant at Penn.

Penn completed its 1,000th lung transplant in August 2016.

2018-2021

2018 Penn performed its 6,000th kidney transplant.

The first uterus transplant was performed as part of the Uterine Factor Infertility (UNTIL) trial at Penn.

2019 The first baby was born as part of the UNTIL trial.

Penn surpassed 3,000 liver transplants.

2020 PTI rapidly adapted to the COVID-19 pandemic with enhanced telemedicine and safety protocols to protect patients and continue providing care.

The first COVID-19 lung transplant was performed at Penn.

2021 The Clyde F. Barker Penn Transplant House celebrated 10 years.

The first baby was born from a uterus transplanted from a living donor.

LIFE CHANGING

Programs at Penn

WHERE IT BEGAN

> “We’re the first program in the world to transplant hepatitis C infected kidneys and subsequently cure the transplant recipient. We’ve demonstrated that this can be done safely and efficaciously. This is a huge advancement.”
>
> **—Roy Bloom, MD**
> *Medical Director, Kidney and Pancreas Transplant Program*

THE PENN KIDNEY TRANSPLANT PROGRAM

It all started with a kidney. A healthy kidney inside the body of Joe Mehl, who generously donated it to his sick brother Howard in 1966. Since that day, Penn’s Kidney Transplant Program has grown into the largest in the region, performing nearly 250 kidney transplants every year.

With almost 100,000 people currently listed nationally for a kidney transplant, kidneys remain the most sought after of all transplanted organs. The wait for a kidney from a deceased donor is between five and eight years in this region. To help our patients get on a faster road to transplant, Penn aggressively seeks ways to expand the donor pool, including working to increase living donor transplants. There are multiple benefits of living donation, such as improved long-term survival, a faster recovery and a reduced risk of rejection. The Penn Transplant Institute has one of the largest and most experienced living donor transplant programs in the region and is continually seeking ways to increase living donations.

One of the innovative ways Penn seeks to create living donor opportunities is through the Paired Kidney Exchange, which gives life-saving options for kidney recipients and their donors. Many people facing kidney transplants have willing friends or family members who would like to donate but aren’t a good match. The Paired Kidney Exchange finds a matching donor in a pool of donors, resulting in a living donor transplant for our transplant candidate. Our recipient’s donor then pays forward the gift of living donation to someone else, leading to two successful transplants.

Innovation through Research

Penn is also leading the way in redefining the criteria for useable organs from deceased donors through a groundbreaking clinical trial that seeks to increase the donor pool by as many as 500 kidneys a year — kidneys that are discarded because they are infected with hepatitis C. “Within the past several years there has been a proliferation of therapies incredibly effective at treating hepatitis C with cure rates of 95 to 100 percent,” says **Ty Dunn, MD, MS,** Surgical Director, Kidney and Pancreas Transplantation. Patients in the clinical trial here at Penn received kidneys from deceased donors infected with hepatitis C and were treated with antiviral therapies immediately after the transplant, curing them of the infection and transforming their lives with new, functioning kidneys. For more on this groundbreaking study, see our story in Research Highlights.

> “I HAD THE BEST CARE I COULD ASK FOR. ALL THE PEOPLE THAT WERE INVOLVED ENCOURAGED ME TO KEEP FIGHTING. I DID NOT GIVE UP. NEITHER DID MY TEAM.”
>
> **Linda Jackson**
> Kidney Transplant Recipient

THE HEART OF THE MATTER

> *Our highly specialized team continues to lead innovation with novel medical regimens, expanded donor criteria, ventricular assist devices and experimental cellular therapies to provide our patients with the best chance at long-term success.*
>
> **—Pavan Atluri, MD**
> *Director, Cardiac Transplantation and Mechanical Circulatory Assist Program*

THE PENN HEART TRANSPLANT PROGRAM

As the largest heart transplant center in the Mid-Atlantic region and one of the top three heart transplant programs in the nation, Penn Transplant Institute has helped nearly 1,500 patients receive new hearts since the program began in 1987 — more than all the other centers in the region combined. As a leader in transplantation technology since the program's founding, cardiologists and surgeons at Penn have also been leaders in testing the latest mechanical cardiac devices that support or replace heart functions while patients are on the transplant waiting list. Penn was the first heart transplant center to perform a Total Artificial Heart operation in the Northeast United States in 2007. That patient later went on to receive a full heart transplant and is alive and well today.

"Whether it's the use of mechanical circulatory support or using unique immunosuppression regimens, we're always aggressively seeking the best options for our patients," says **Michael Acker, MD,** Chief, Division of Cardiovascular Surgery and Director, Penn Medicine Heart and Vascular Center.

The secret of the team's success is the holistic approach to each patient. "Patients have multiple needs that come from multiple specialties and disciplines. The psychosocial needs for these patients are profound," explains Dr. Acker. "The financial strains are significant. So, in addition to the surgeons and cardiologists, the nurses and anesthesiologists, we have psychiatrists, social workers, nutrition specialists, addiction specialists and many other providers as needed, all in one place."

Creating optimal outcomes for heart transplant patients is also at the core of a collaboration between Penn and Children's Hospital of Philadelphia. Only 25 years ago, babies born with Congenital Heart Disease (CHD) wouldn't survive. Medical advances have turned those odds upside down. But, as many move into adulthood, they face another hurdle. "For many of these patients, their hearts give out in their 30s," says Dr. Acker. "The only alternative is a heart transplant. This is a growing area, unique to Penn because of the collaborative partnership with the pediatric cardiologists."

The team is also constantly working against another significant hurdle — the lack of donor organs. Each year in the United States, hundreds on the list die waiting," says **Rhondalyn McLean, MD,** Medical Director, Heart Transplantation. That is why researchers at Penn are actively investigating the transplantation of donor hearts infected with the hepatitis C virus (HCV), then curing it. Getting an HCV-positive donor heart is, tragically, getting easier due to the opioid epidemic. Ironically, opioids can destroy a life but do not directly affect the heart. As a result, there is a potential for up to 800 more heart transplants each year.

> I LIVE EVERY DAY LIKE MY DONOR'S WATCHING.
>
> **Derek Fitzgerald**
> Heart Transplant Recipient

BREATHING ROOM

> *You can't take care of a patient well unless you know who they are. What they value, what their challenges are outside the confines of medicine.*
>
> **—Maria M. Crespo, MD**
> *Medical Director, Penn Lung Transplant Program*

THE PENN LUNG TRANSPLANT PROGRAM

The spirit of Penn's lung transplantation program is one of experience, innovation and creativity. It's a spirit that has helped the lung transplant program become one of the most experienced in the nation, a destination for patients seeking transplants from across the country, and a home for patients facing the most complex of cases.

One innovative strategy at Penn is the use of extracorporeal membrane oxygenation (ECMO) as a bridge to transplant for individuals with severe end-stage lung disease. The ECMO machine gives a lifeline to patients in critical condition who may otherwise not survive to see their transplant. "We've had patients stay on ECMO support for up to five months before receiving their organ," says **Christian Bermudez, MD,** Surgical Director, Thoracic Transplantation, and one of the world's leading ECMO specialists.

Even though ECMO has been in use for about 40 years, few transplant programs have the comfort level to take on complex patients who require ECMO support before they undergo an even more significant surgical procedure. Penn's willingness to be aggressive and explore every avenue is part of what sets it apart as a leader in transplantation.

Penn is also leading the way in one of the most exciting areas of lung transplantation as the country's leading EXVIVO Lung perfusion (EVLP) center. In 2012, surgeon **Edward Cantu, MD,** performed the first lung transplant using EVLP at Penn. This method is revolutionary because it works through an ongoing problem in transplantation — not enough viable organs. There are many reasons why a lung would be considered unfit for transplant. But what if some of those lungs were salvageable? EVLP is an innovative therapy performed on donor lungs outside of the body to improve the organ's overall quality. "There are about 400,000 unexpected deaths in the United States every year. If we transplanted just one percent of them, that's 4,000 lung transplants," says Dr. Cantu. "It has the potential to make a lot of organs available."

Penn continued to demonstrate its ability to rapidly innovate during the COVID-19 pandemic. Though qualifying to be a transplant patient is not easy even under normal circumstances, the pandemic added the complexity of patients who were critically ill with COVID-19, a virus the medical community was still learning about. This translated to a new list of criteria for patients to be placed on the transplant list – guidelines developed and issued by **Maria M. Crespo, MD, Joshua Diamond, MD,** and **Christian Bermudez, MD.** With these guidelines, Penn successfully transplanted their first patient with COVID-19 on New Year's Eve 2020 and as of July 2021 had performed nine successful lung transplants on COVID-19 patients.

> PENN MEDICINE GAVE ME HOPE TO HAVE THE LIFE I WANTED, THE HEALTH I WANTED WAS POSSIBLE.
>
> **Kathi Clapham**
> Cystic Fibrosis Patient and
> Double Lung Transplant Recipient

THE POWER OF REGENERATION AND REPAIR

> *There are many behind-the-scenes discussions on how to best approach the situation to maximize the outcome for each patient. Everyone comes together to work for the same goal, and our outcomes speak for themselves.*

—K. Rajender Reddy, MD
Medical Director, Liver Transplantation

THE PENN LIVER TRANSPLANT PROGRAM

Penn is one of the top ten liver transplant programs in the country, with outcomes that consistently meet or exceed national averages. The team has a deep bench with expertise across several areas including end-stage liver disease, liver cancer, hepatitis C and congenital liver disease.

In the United States, more than 15,000 patients are waiting for a liver, and many patients die before they receive the life-saving transplant operation. In the spirit of expanding the donor pool and bringing more people to successful transplant sooner, Penn has continued to innovate and grow new areas to increase the number of potential donors, thereby increasing the number of patients receiving the gift of life.

The Living Donor Liver Transplant Program at Penn is the most experienced in the area. "The beauty of living donation is that patients can receive a liver transplant before they get too sick, and the long-term outcomes are better than waiting for a deceased donor liver transplant," states **Kim Olthoff, MD,** Chief, Division of Transplant Surgery, who also leads the Living Donor Liver Transplant programs at Penn and Children's Hospital of Pennsylvania (CHOP). The very first living donor liver transplant between CHOP and Penn was performed in 1995, with a mother donating to her infant son. The first adult-to-adult liver transplant at Penn was performed in 1999. Penn has continued to grow the Living Donor Liver Program. Having performed more than 150 live donor liver transplants, Penn is the busiest live donor liver transplant program in the region. The liver is a unique and remarkable organ in its ability to regenerate, and a generous donor's liver will grow to its original size within weeks. "The living donor program is one of the best examples of how to bring science to patient care. It started years ago with the fact that we know how the liver regenerates and we studied liver regeneration in the lab," says Dr. Olthoff. "Taking something from basic concept to real-time work in a clinical setting is how we're able to advance medicine and advance transplantation."

Sarah Diehl
Living Liver Donor

Kathy Diehl
Sarah's Mom
Living Donor Liver Transplant Recipient

> IT'S A DEFINITE POSSIBILITY THAT I WOULD NOT HAVE SURVIVED UNTIL THIS POINT HAD THIS TRANSPLANT NOT HAPPENED.

Kathy Diehl
Living Donor Liver Transplant Recipient

HELPING HANDS

> “We’ve built one of the strongest programs in the country. Penn Transplant Institute is playing a critical role in the development of this new field, opening up an entire array of opportunities for patients to have reconstructive surgery and replace body parts that we once couldn’t reconstruct effectively.”
>
> **—L Scott Levin, MD, FACS**
> *Chair, Orthopedic Surgery*
> *Professor of Surgery, Division of Plastic Surgery*

THE PENN HAND TRANSPLANT PROGRAM

When you can turn what seems impossible into reality, that is the epitome of innovation. Today, Penn is on the cutting edge of the next wave in transplantation — vascularized composite allotransplantation (VCA), which refers to the transplantation of organs that contain multiple tissues including skin, muscle and bone.

Today, four people now have a pair of hands where they once had none. The first patient was Lindsay Ess, whose hands and feet were amputated due to an infection she suffered when she was 24. **L. Scott Levin, MD, FACS,** Chair, Orthopaedic Surgery, came to Penn Transplant Institute in 2009 to help patients like Lindsay. With the support of the Penn Transplant Institute, Dr. Levin built the Human Tissue Lab for his team to practice this extremely complicated surgery.

“We created a method for developing and improving complex surgical procedures with detailed planning, practicing in the Human Tissue Lab,” says **Benjamin Chang, MD,** Associate Chief of the Division of Plastic Surgery and Professor of Clinical Surgery in the Perelman School of Medicine at the University of Pennsylvania. “We’ve been routinely practicing new techniques and honing our skills.”

After four years on the waiting list, Lindsay received her transplant — from below the elbow to her hands — on both arms. For nearly 12 hours, two teams of surgeons worked on Lindsay — one team for the right arm and one for the left. The surgery was a success and Lindsay’s progress exceeded Dr. Levin’s expectations.

Lindsay’s surgery was followed by the first successful pediatric hand transplant in 2015 when 8-year-old Zion Harvey received his new hands. “It was unprecedented and it wouldn’t have been possible without the expertise and the legacy of the institute as well as my teammates at Children’s Hospital of Pennsylvania, partners, surgeons, nurses and anesthesiologists, who all came together,” Dr. Levin says.

In 2016, 28-year-old Laura Nataf — whose arms and legs had been amputated nine years earlier due to an infection — traveled from Paris, France, to Penn to receive a bilateral hand transplant. Following the successful almost 9-hour surgery with the 30-member team of surgeons, nurses and anesthesiologists, Laura recovered and returned home to Paris. “Laura represents not only our progress, but she is living proof of our ability to collaborate with medical centers around the world to improve the quality of life of both international patients and those in the United States,” Dr. Levin says.

> “I CONSIDER MY NEW HANDS A GIFT. DR. LEVIN AND THE PENN TRANSPLANT TEAM CHANGED MY LIFE.”
>
> **Laura Nataf**
> Bilateral Hand Transplant Recipient

LIFE FROM LIFE

> *The strength of Penn's research program and exceptional quality of care, particularly in transplant and women's health, make us uniquely positioned to be a leading clinical research program for uterus transplants in the United States.*
>
> **—Kathleen O'Neill, MD, MTR**
> *Assistant Professor of Obstetrics and Gynecology*
> *Perelman School of Medicine at the University of Pennsylvania*
> *Co-Principal Investigator, UNTIL Trial*

THE PENN UTERINE TRANSPLANT PROGRAM

The spirit of pioneering is a driving force in the newest field of transplantation at Penn – uterus transplant. In the fall of 2017, Penn Medicine announced our first clinical trial of uterus transplants led by Co-Principal investigators **Kathleen O'Neill, MD,** and **Paige Porrett, MD.** After helping lead this program successfully through its first three transplants, Dr. Porrett's departure from Penn for a new opportunity made way for the arrival of **Nawar Latif, MD, MPH,** Surgical Director, Living Donor Uterus Transplant Program. This promising field may give women with Uterus Factor Infertility (UFI) – an irreversible form of female infertility – a whole new path to parenthood. The Uterus Transplantation for Uterus Factor Infertility (UNTIL) trial is a joint effort between the Department of Obstetrics and Gynecology and the Penn Transplant Institute. The UNTIL trial is currently the only U.S. uterus transplant trial that is actively enrolling patients.

There was a time when there were no answers for women who couldn't have children, many of whom had heartbreaking stories and lifelong struggles. Now Penn can see uterus transplants as a promising avenue for women who otherwise have no option to carry children.

It Takes a Team

Uterus transplantation is a complex procedure that involves both surgical and medical components. Following an extensive evaluation, participants are followed for several years by a multidisciplinary team of specialists with expertise in transplant, obstetrics and gynecology, clinical trials, bioethics, nursing, social work, psychology, pathology and infectious diseases. Penn's depth of expertise across all these areas enabled us to build a team of more than 35 providers who will be involved in each participant's care over the course of a five- to ten-year period.

The Versatile VCA

The procedure is part of the highly specialized vascularized composite allotransplantation (VCA) field, which in recent years has allowed for the development of advanced procedures that require the transplantation of multiple tissues such as muscle, bone, nerve and skin, as a functional unit, such as hands and the face. "The results of the VCA surgeries performed here at Penn give us the foundation necessary to continue moving ahead with advancements in the field," says **Kim Olthoff, MD,** Chief, Division of Transplant Surgery.

"Leadership from OB-GYN and transplant have been incredibly supportive of our mission to help more women and their families realize their dreams of becoming pregnant, carrying healthy babies and becoming parents," says Dr. Olthoff.

Nawar Latif, MD, MPH
Surgical Director, Living Donor Uterus Transplant Program

Kathleen O'Neill, MD, MTR
Reproductive Endocrinology and Infertility

> OUR FEELING OF RESPONSIBILITY TOWARDS THE DONOR, RECIPIENT, AND THE ENTIRE PROGRAM IS TREMENDOUS.
>
> **Nawar Latif, MD**
> Surgical Director,
> Living Donor Uterus Transplant Program

DELIVERING HOPE FOR DIABETES

THE PENN PANCREAS AND ISLET CELL TRANSPLANT PROGRAM

The life of an individual with insulin dependent diabetes is complex. They struggle with frequent glucose checks and closely regulated food consumption and activity levels. Complications that develop as a result of the disease can further limit the quality of life. These life-threatening complications include severe hypoglycemia, kidney failure, blindness or peripheral nerve damage that can result in amputation. The team at Penn's Pancreas and Islet Cell Transplant Program has dedicated themselves to helping patients overcome these challenges. "The scientific advances we have seen in the last two decades make this an exciting time to prevent and cure type 1 diabetes", says **Ali Naji, MD, PhD,** Director of the JDRF-Penn Islet Transplantation Program.

For the past 35 years, Penn has been offering individuals with type 1 diabetes hope through transplantation. While whole pancreas transplantation has historically been the standard approach for severe insulin dependent diabetes, Penn transplant has had a major role in pioneering the development of islet transplantation, a minimally invasive potential treatment option. Dr. Naji and his colleagues have studied and refined this ground-breaking procedure for the last two decades at the University of Pennsylvania.

"What Dr. Naji is perfecting is the extraction of purified islets from a donor's whole pancreas which are then infused into a patient with type 1 diabetes where they produce insulin and normalize blood glucose," says **Roy Bloom, MD,** Medical Director, Kidney and Pancreas Transplant Program. For most patients with type 1 diabetes, the insulin-producing cells are dysregulated to the extent of destruction and dysfunction. This makes a cell-based form of insulin replacement therapy an attractive solution.

So far at Penn, over 30 patients with type 1 diabetes have received islet transplants as part of research sponsored by the Juvenile Diabetes Research Foundation and the National Institutes of Health. Dr. Naji and his team are hoping that this procedure will eventually replace the need for pancreas transplants altogether. "It would be a major advancement," says **Michael R. Rickels, MD, MS,** Medical Director, Pancreatic Islet Cell Transplant Program.

In 2020, Penn researchers shared the news of the invention of a method that has the potential to keep insulin-producing cells alive under the skin. In addition, Dr. Naji and his colleagues plan to continue their research by combining this method with novel immunotherapies to bring this technology a step closer to clinical translation.

> “*Our mission is to develop and fully leverage cutting edge cell-based and whole organ transplant opportunities that are tailored to the needs of the insulin dependent diabetic patient.*”
>
> **—Ty B. Dunn, MD, MS**
> *Surgical Director, Kidney and Pancreas Transplantation*

> “THE SCIENTIFIC ADVANCES WE HAVE SEEN IN THE LAST TWO DECADES MAKE THIS AN EXCITING TIME TO PREVENT AND CURE TYPE 1 DIABETES.”
>
> **Ali Naji, MD, PhD**
> Director of the JDRF-Penn Islet Transplantation Program

DOUBLE PARTNERS

> *Transplant is the epitome of a team.*
>
> **—Peter L. Abt, MD**
> *Surgical Director, Liver Transplant Program*

DUAL ORGAN TRANSPLANTS AT THE PENN TRANSPLANT INSTITUTE

Dual organ transplants are some of the most complicated procedures, requiring multiple teams across several areas of expertise. Due to the depth of proficiency in all organ transplants and the unique multi-disciplinary team structure of the Penn Transplant Institute, Penn has become the center of choice for very critical patients who need combined organ transplants. With the complex, interdependent nature of the human body's internal organs, Penn's transplant specialists are constantly developing new procedures for disorders that extend beyond a single organ. Multiple-organ transplantation is a rare event; very few programs in the U.S. and around the world offer multiple-organ transplant programs. With over 250 transplant centers in the United States, Penn is honored to be recognized as one of the top ten multi-organ transplant centers in the country.

The first dual-organ transplant at Penn took place on Valentine's Day in 1984. Penn Medicine transplant physicians are at the forefront of this work, performing the second largest number of any transplant center in the U.S.

Dual organ transplants are often the only hope for individuals with complicated conditions such as cystic fibrosis, which can affect both the lungs and the liver, or advanced congenital heart disease, which affects both the heart and the lungs. Since the program's inception, Penn has performed hundreds of multiple organ transplants.

"We're able to take on some of these more challenging patients," says **Peter Abt, MD,** Surgical Director, Liver Transplant Program. "We have one of the largest thoracic and abdominal transplant experiences in the United States, whether it's a combined heart/liver, lung/liver, lung/kidney or heart/kidney."

> AT THE START OF MY TRANSPLANT PROCESS I WAS PARALYZED WITH FEAR. PENN DID NOT PERFORM A PROCEDURE THAT MARKED THE END STAGE OF MY LIFE BUT RATHER, THE BEGINNING. FOR THE FIRST TIME IN OVER 15 YEARS I AM ABLE TO LIVE THE LIFE I ALWAYS DREAMED WAS POSSIBLE.
>
> **Andrew Frankel**
> Liver and Bilateral Lung Transplant Recipient

A HOME AWAY FROM HOME

> *Supporting The Clyde F. Barker Penn Transplant House has given me a purpose and keeps my lost loved one's spirit alive. The Penn Transplant House was my sanctuary during an otherwise heartbreaking time. I choose to support its mission so that it can offer comfort for others in the way it did for me.*
>
> **—Donna Katz**
> *Family member of a transplant patient cared for at Penn*

THE CLYDE F. BARKER PENN TRANSPLANT HOUSE

Needing a life-saving transplant can upend your life in multiple and unfathomable ways. Traveling to receive that transplant adds the burden of finding suitable and affordable housing to an already challenging time.

Building a House to Create a Home

The Transplant House began as an idea by **Abraham Shaked, MD, PhD,** and **Kim Olthoff, MD,** when they recognized a need to have a welcoming and affordable place for transplant families to stay. The Penn Transplant Institute undertook nearly ten years of fundraising. In 2011, Penn opened The Clyde F. Barker Penn Transplant House. Named for Penn's world-renowned transplant surgeon, **Clyde F. Barker, MD,** the facility was built entirely on private donations. That generosity extended even to the building's design thanks to the architect, Rafael Vinoli, and contractor, LF Driscoll. Today, the Transplant House continues to operate largely thanks to the ongoing generosity of hundreds of philanthropic donors and volunteers.

The Transplant House, conveniently located a short distance from the Hospital of the University of Pennsylvania, is designed to meet the unique needs of transplant patients and their families. Guests can prepare their meals, do their laundry, exercise in the fitness room, and access transplant education and information about Philadelphia. But for many people who stay at the Transplant House, the most valuable experience is sharing experiences with other families in similar situations.

"It meant a lot to us that we didn't have to worry about a hotel or the costs," says Lindsay Ess, the first person to receive a bilateral hand transplant at Penn. "For my mom, she got to come 'home' to be with friendly people who were going through a similar experience. It helped her feel more comfortable, and since we feed off each other, that helped me as I was going through my transplant," she says. "I don't know what we would have done without the Transplant House. It was a game-changer. It was like sunshine on a cloudy day."

Barbara Groff
with her daughters
Corri and Codie

> WE WERE HERE FOR FOUR MONTHS WHILE MY HUSBAND WENT THROUGH HIS TRANSPLANT. EVERYONE AT THE TRANSPLANT HOUSE WAS SO HELPFUL AND CARING. THEY MADE OUR STAY LESS STRESSFUL AND WE MADE FRIENDS AND FOUND SUPPORT FROM OTHER FAMILIES GOING THROUGH A SIMILAR EXPERIENCE.
>
> **Barbara Groff**
> Transplant House Guest

10 YEARS

The Clyde F. Barker
PENN TRANSPLANT HOUSE

Making a House Feel Like Home

Nothing says home quite like a warm, hearty meal. One of the much-loved traditions of The Clyde F. Barker Penn Transplant House is the meals provided to guests through its Guest Chef program. Like so much else that the house stands on, this program is supported by volunteers who donate their time — and the ingredients — to create meals for Transplant House guests. Over the years, many community groups have cooked for the Transplant House — grateful families, local restaurants, area organizations like Saxby's, Penn's employees and volunteer organizations such as the Abramson Committee and Board of Women's Visitors. The Transplant House took the Guest Chef program to a whole new level in 2018, collaborating with The Restaurant School at Walnut Hill College. This partnership provides Transplant House guests with delicious, home-cooked meals prepared by culinary students multiple times throughout their stay.

Reflections on a Decade of Service

On July 18th, 2021, the Transplant House celebrated its 10th anniversary. In those ten years, the Transplant House has welcomed more than 4,000 families from around the world. Families have come from seven different countries and 40 of the 50 United States. While our guests come from many different places, our mission is always the same – to provide a home away from home, a place where transplant recipients and their family members are surrounded with comfort and compassion.

Guests and their families find solace and comfort in the open community the Transplant House fosters. Although a stay at the Transplant House is temporary, the impact and sense of community can last a lifetime.

The past decade would not have been possible without the incredible generosity of the many individuals, community organizations, foundations and corporations who support the Transplant House. One such organization — the Board of Women's Visitors (BWV) — stepped up and created a much-needed sustainable source of income for the Transplant House in 2016 with a generous $600,000 endowment gift. The BWV, a steady presence at the Hospital of the University of Pennsylvania since 1875, supports the hospital in many ways, but improving care and comfort for patients and their families remains its top priority. And for the Transplant House, the BWV's support is nothing new. The group donated $500,000 in 2007 as the naming gift in the building's initial fundraising efforts and also to encourage others to help the project reach its $3 million goal. "Very basic needs were required. I knew that even small amounts of money would help, but I really wanted to do more," says **Linda Schelke** of the BWV. "The endowment would also provide a vehicle that would encourage other donors to contribute."

The generosity of donors like the BWV, and many others, has helped sustain the House during even the most challenging times. During the COVID-19 pandemic the Transplant House stayed open. Knowing how much transplant patients go and all the challenges they already face, Penn knew they had to find a way to keep this source of comfort. "To know they had a safe place to land where they feel safe, secure, cared for — to have a sense of home — it makes a huge difference," says **Kirsten King**, former Manager for the Transplant House.

"The guests share their lives and journeys with us, and we get to be a part of that. Some leave here with happy stories, and others do not," says King. "Our staff and volunteers have the honor of walking with them through it all."

PANDEMIC PROTOCOLS

> *It was important to consider the long-term, everyday risk when weighing whether to move forward with a transplant. COVID-19 appeared to be with us for the foreseeable future, so we focused on nimbly developing best practices that allowed for safer transplants.*
>
> **—Ty Dunn, MD, MS**
> *Surgical Director, Kidney and Pancreas Transplantation*

PERFORMING TRANSPLANTS SAFELY AMID THE COVID-19 PANDEMIC

Shortly after the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic in mid-2020, Pennsylvania Governor Tom Wolf ordered hospitals statewide to suspend non-urgent and elective procedures to preserve resources and limit exposure to the disease. Organ transplantation — an urgent, often life-saving procedure — was allowed to continue. The Penn Transplant Institute (PTI) continued to perform procedures, but the pandemic posed unique challenges for both organ procurement and transplantation.

Unlike living donor transplant procedures, which can be scheduled weeks in advance, organs from a deceased donor need to be procured and used rapidly, representing a time-limited opportunity. But COVID-19 testing shortages, particularly early on, made it difficult to confirm that potential donors who died of something unrelated were not infected. "In order to protect the safety of patients, transplant centers needed to carefully vet all donors to ensure there is minimal risk of COVID-19," explained **Abraham Shaked, MD, PhD,** Director of the Penn Transplant Institute. The unique challenges, coupled with fewer organ donations, led to a tremendous reduction in transplant procedures in the United States throughout the pandemic. Deceased donor transplants — which accounted for about 80 percent of the nearly 40,000 transplants performed nationwide in 2019 — dropped by almost half in the United States from late February into early April.

Evaluating the Risks and Benefits

In early March, the directors of each organ transplant program within the PTI — heart, kidney, liver, lung and pancreas — met to devise guidelines for transplants. For every case, the team evaluated the potential risk and benefit of a transplant amid the COVID-19 outbreak versus the risk incurred by waiting. The team decided they would not delay transplants for patients critically in need when an organ became available. However, the PTI decided to pause its living donor (liver, kidney and uterus) transplant procedures — a decision that reflected a trend among transplant centers nationwide. The majority of living donor organ transplants can be safely postponed due to the availability of supportive care, such as dialysis.

"Living donor transplant procedures are life-saving operations," said **Kim Olthoff, MD,** Chief of Transplant Surgery. "However, the donors don't need surgery, so we had to balance the risk and benefit of the procedure for both the donor and the recipient." PTI leaders also implemented changes to the center's practices, ranging from how the team retrieves an organ all the way through to post-operative communication with the patient and family. Nearly all of the patients who received a call from a transplant coordinator amid the pandemic moved forward with the transplantation procedure.

> I'VE BEEN WAITING FOR THIS FOR A LONG TIME. I WAS A LITTLE HESITANT AT FIRST, GIVEN EVERYTHING GOING ON IN THE WORLD. BUT I TRUSTED THIS TEAM AND KNEW I COULDN'T PASS ON THIS OPPORTUNITY. I'M GLAD I WENT THROUGH WITH IT.
>
> **Darrell Merrit**
> Kidney Transplant Recipient during COVID-19

LIFE DISCOVERED

through Research

EXPANDING THE DONOR POOL:

Transplanting Hepatitis C Infected Organs, *Then Curing it*

Of all the challenges in transplantation, solving the organ shortage is one of the most paramount, especially when the wait for a deceased donor kidney could be up to seven years. Three years ago, nephrologist **Peter Reese, MD,** hepatologist **David S. Goldberg, MD,** and transplant surgeon **Peter Abt, MD,** started a conversation that would launch a groundbreaking study. The question they wanted answered: what if we transplanted kidneys infected with hepatitis C and cured the patients post-transplant?

Hepatitis C was once a complicated condition notoriously difficult to treat. But new medications have made it easier to eradicate. The team met with **Emily Blumberg, MD**, Director, Transplant Infectious Diseases. "We laid out the ethics to make the argument to the community and explored the avenues for getting a trial funded," says Dr. Reese. "It moved beautifully with the complementary expertise in the room. It wasn't a project any of us could have done on our own." The *New England Journal of Medicine* published their ethics proposal, and from there, they had a series of meetings with all levels of staff in transplant to hear their concerns and bring everyone on board. The team secured funding from Merck, who agreed to provide the medication and fund a trial for ten people. The team identified ten patients to participate in the study.

A key factor in making this study successful was the support and participation of the molecular pathologists in the lab who run the genotypes. The drug used in the study doesn't treat every form of hepatitis C, just two out of the six genotypes. To find the suitable donor organs, the pathologists had to be available 24/7 to accept the specimens and genotype them. "They were so interested in the study and were incredible partners. They set up an on-call system and were taking calls from us at any hour," says Dr. Reese. "They were getting out of their beds at two in the morning in February because they were excited about the science."

All ten patients received antiviral medications post-transplant, and all ten patients were subsequently cured of hepatitis C. The team published the results in the June 2017 issue of the *New England Journal of Medicine.* "All of the patients have reached the one-year transplant mark. All have excellent renal function and are free of hepatitis C," says Dr. Goldberg. Patients were more than ready to take the chance to live a life free of dialysis.

"The patients were great partners and took a leap of faith. It was gratifying to work with them," says Dr. Reese. Because of the success of the study, the protocol was expanded and as of this writing, over 40 successful transplants have been performed.

Now, several years later, transplanting HCV-infected kidneys has proven to have promising outcomes and many transplant programs across the U.S. have implemented this approach. In 2020, a multicenter trial led in part by researchers at Penn further demonstrated the safety and efficacy of transplantation of HCV kidneys into HCV-negative recipients followed by early initiation antiviral drugs to cure HCV infection. "Being able to make use of these HCV-positive kidneys from relatively young and otherwise healthy donors should improve current wait times for would-be recipients and has real potential to improve quality of life," says Dr. Reese.

The Next Level: *Advancing this Breakthrough to Hearts and Lungs*

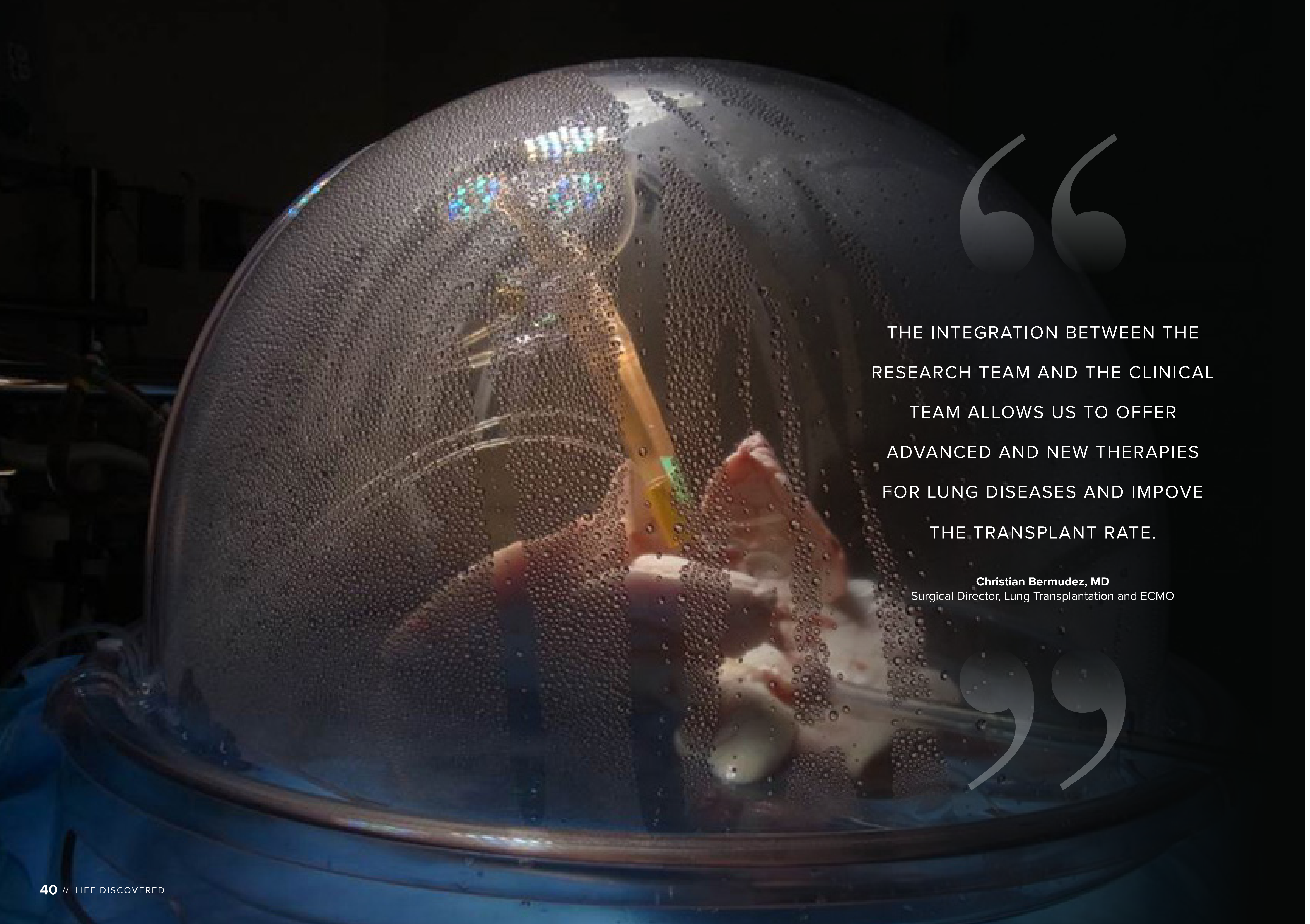
Penn specialists are investigating the efficacy with other organs, including the heart. Under the direction of **Christian Bermudez, MD**, Director of Thoracic Transplantation and Surgical Director of Lung Transplantation and ECMO, Penn is also having success with thoracic organs using hearts from donors infected with hepatitis C. So far, ten heart transplant patients have received organs infected with hepatitis C. "We have every reason to believe that cure rates will be high on heart," says Dr. Reese. Goldberg and Reese have also designed and submitted a protocol for lung transplantation.“Our goal is to do enough transplants that this could be the standard of care," says Reese.

"This isn't going to fix the organ shortage, but for lungs and hearts, it would make a much larger impact because of the smaller number of patients on those waiting lists," says Dr. Goldberg. "I'm not a surgeon, and I've never had a direct hand in getting patients transplanted. But, I run into patients in the hallway who hug me and thank me, and that's the best part."

"We have five transplant surgeons who are impressive people, and all five did one of these transplants," says Dr. Reese.

"University of Pennsylvania President, Amy Gutmann strives to advance knowledge by having people collaborate across disciplines, and this project is emblematic of what Penn wants its strategy to be." "This research has opened the eyes and raised the eyebrows of people around the world," says **Rajender Reddy, MD**, Medical Director of the Liver Transplant Program. "We're the first program in the world to transplant hepatitis C infected kidneys and subsequently cure the transplant recipient. We've demonstrated that this can be done safely and efficaciously. This is a huge advancement."

> ONLY AFTER THE TRANSPLANT DID I REALIZE HOW BAD I FELT BEFORE. I'M FEELING HOW I FELT 10, 12 YEARS AGO. IT'S LIKE BEING ALTOGETHER A DIFFERENT PERSON.
>
> **Kiran Shelat**
> Hepatitis C Liver Transplant Recipient



> THE INTEGRATION BETWEEN THE RESEARCH TEAM AND THE CLINICAL TEAM ALLOWS US TO OFFER ADVANCED AND NEW THERAPIES FOR LUNG DISEASES AND IMPOVE THE TRANSPLANT RATE.
>
> **Christian Bermudez, MD**
> Surgical Director, Lung Transplantation and ECMO

EXPANDING THE POOL of Viable Organs

Transplant surgeon **Peter Abt, MD,** is leading an investigation into using *EX VIVO* technology to purify damaged livers that would otherwise be discarded. (Pictured on the left.) "We're the only center in the region doing normothermic liver perfusion trials," he says. Much like the process of placing donor lungs on the *EX VIVO* machine, the livers are removed from deceased donors, infused with blood and purifying solutions to improve and repair the organ to make it suitable for transplant. "We're also the only program in the area that's doing any significant research related to organ donation in efforts to increase the number of usable donors," says Dr. Abt. "What drives medicine forward and what drives better care of patients is scientific exploration," says **Abraham Shaked, MD, PhD,** Director, Penn Transplant Institute. "We're part of many large NIH-funded studies to explore solutions to the organ shortage and we can do much of this in our own backyard. We want to repair livers to put better organs in patients. That's innovation."

IDENTIFYING Primary Graft Dysfunction and Promoting Lung Health

Primary Graft Dysfunction (PGD) affects approximately 30 percent of lung transplant patients and accounts for 50 percent of patient mortality. Penn researchers and physicians are searching for ways to better identify PGD and prevent those deaths. Surgeon **Edward Cantu, MD,** and his team are working on a classifier that can predict PGD with 82 percent accuracy.

"If we can get rid of the problem, we'll be able to transplant more organs and more people will have better outcomes," says Dr. Cantu. "I'm moving from most invasive, which is a tissue biopsy, to the least invasive, which would be a peripheral blood stick."

Dr. Cantu's lab can currently use bronchoalveolar lavage fluid to diagnose PGD. "This means I can tell whether or not a donor is at a high risk for developing the problem and we can use therapeutics that we're developing to treat the donor to make them low risk," says Dr. Cantu. The next step involves another way to protect recipients from PGD, which is to rehabilitate a high-risk organ on the EVLP machine prior to transplant. "The idea being we can make super organs or correct the injuries in organs that make them not transplantable," says Dr. Cantu.

Dr. Cantu explains that his lab can keep a lung alive on the EVLP machine for 6 to 12 hours, delivering various drugs to assess whether or not they are effective at reversing lung injury. "It allows us to quickly screen different drugs for their effects on lung injury. It's a faster translation of bench to clinic." In addition, Dr. Cantu's lab is acquiring a robust bank of tissue that allows them to create valuable libraries of different pathologic lung injuries. The implications for patients across the spectrum of lung injury are huge.

"What we find in the lung for transplant, we can eventually apply these therapies to patients with general lung injury, trauma, sepsis and burns," says Dr. Cantu. "The goal is eventually to never need transplant."

MONITORING KIDNEY REJECTION:

Transforming Protocols

The current gold standard in assessing kidney rejection has been through a biopsy. However, biopsies are invasive, associated with risk, costly and not practical to do weekly or monthly. "We generally do biopsies once there is overt evidence that the kidney function is deteriorating, and by then the damage may have reached the point of no return," says **Roy D. Bloom, MD**, Medical Director, Kidney/Pancreas Transplant Program. Penn's research team is looking at markers in the blood and urine that would not only eliminate the need for invasive biopsies but give early indications of rejection so physicians can take a corrective course by tailoring specific therapies or adjusting the immunosuppression regimen.

"We're looking at gene patterns and certain types of cell debris, metabolic signals and protein changes in the urine or blood that will show that even if the kidney is functioning, there is a risk for rejection," says Dr. Bloom. "We can then put a plan in place to intervene."

Creating an early window into a patient's immune status through non-invasive measures would be a seismic shift in dealing with organ rejection.

"We'll eventually get to the point where we'll look at the blood and urine tests and won't need a biopsy. We want to go that way, to be proactive rather than reactive," says Dr. Bloom. "This would be a real paradigm change."

MINIMIZING IMMUNOSUPPRESSION:

The Search for a Genomic Profile of Rejection

Immunosuppression drugs are what make transplantation possible, allowing foreign organs to survive in their new surroundings. However, these drugs can be harmful to the body. Side effects can include diabetes, high lipids and heart disease.

"We're getting sophisticated in understanding the immune system and how it works and are getting better at designing drugs and methods to control responses against the organ," says **Abraham Shaked, MD, PhD,** Director, Penn Transplant Institute. "What we must improve is knowing how to personalize immunosuppression."

Dr. Shaked is currently leading research to help tailor immunosuppressant regimens to each individual patient by studying predictive markers in the blood and urine. When administering immunosuppressant drugs to patients and designing regimens, physicians traditionally rely on a patient's physical response. "Today, we identify rejection when a patient comes down with symptoms. But before there is clinical rejection, there is molecular rejection," he says. That molecular rejection is full of clues that can help physicians tailor immunosuppressant regimens. Researchers are looking at what liver and kidney cells secrete as keys to personalization. Because the liver is regenerative and a more forgiving organ than the kidney, researchers are focusing their attention on examining markers of immune activation in the blood of liver transplant patients. "Based on levels in the blood, we can see when the rejection process is being activated. With this information, we can stop or adjust immunosuppression before we have clinical rejection," Dr. Shaked says.

Dr. Shaked credits the generosity of Penn's patient population in driving this study forward. "We are fortunate to have patients who trust us, donate their blood and allow us to follow them," he says. "All of this is aimed at restoring their natural immune systems to as normal as possible and preventing the side effects of long-term use of anti-rejection medication."

Roy D. Bloom, MD
Medical Director,
Kidney/Pancreas Transplant Program

Ty B. Dunn, MS
Surgical Director of
Kidney and Pancreas Transplantation

> WHEN I SIGNED UP FOR THIS TRIAL, I HOPED IT WOULD HELP MY HUSBAND AND ME START A FAMILY, BUT I ALSO STRONGLY BELIEVE IN HELPING OTHERS. MY HOPE IS THAT THROUGH THIS RESEARCH, OTHERS WITH SIMILAR STRUGGLES WILL HAVE THE SAME OPPORTUNITY.
>
> **Jennifer Gobrecht**
> Uterus Transplant Recipient

Jennifer Gobrecht
Uterus Transplant Recipient with her husband Drew and son Benjamin

A MILESTONE IN
Uterus Transplant Clinical Trial

In November of 2019 Penn Medicine and Jennifer Gobrecht celebrated an incredible milestone: Jennifer delivered her son Benjamin by cesarean section. This day defied expectation because when Jennifer was a teenager, doctors told her that she would never carry her own child because she was born without a uterus.

Benjamin is the first baby born as part of Penn Medicine's ongoing Uterus Transplantation for Uterine Factor Infertility (UNTIL) trial, which launched in 2017. He is the second baby in the nation to be born following transplantation of a uterus from a deceased donor. The Penn team caring for Jennifer performed the 10-hour uterus transplant procedure in 2018 using a uterus from a deceased donor.

The UNTIL trial hopes to help women who otherwise couldn't carry their own children and address a wide array of important biologic questions that persist in organ transplantation, female reproductive biology and pregnancy. This study is particularly remarkable because it offers hope to women unable to give birth because they lack a functioning uterus. It also is transplanting a functioning organ into a place where one is in many cases missing altogether, then applying a separate feat of medical science to coax new life into the world from that organ.

Living Donors: Help Close the Gap

Similar to liver and kidney donation, uterus donors can be deceased or living, but as with most transplants, "there's a discrepancy between supply and demand," says **Kathleen O'Neill,** a reproductive medicine specialist in OB/GYN and the trial's Co-Principal Investigator. Since Penn's trial began, over 200 individuals from 25 states have applied to receive the transplant. The wait could be two months, or over a year.

Penn Medicine's trial is one of the few in the world to explore donation from both living and deceased donors — an approach that has the potential to expand the pool of organs available for donation and allows investigators the opportunity to directly compare outcomes from the different types of donors. And while uterus transplants have not been available long enough to run long-time studies comparing living and deceased donors, there are distinct benefits of having a living donor. There is no clock ticking, as there is with a harvested organ from a deceased donor, and there is more time to do a thorough assessment of the donated organ to make sure it is suitable.

"Living donors allow us to select the best and most compatible candidate to help increase the success of the transplant," says **Nawar Latif, MD,** Surgical Director of the Living Donor Uterus Transplant Program and Co-Principle Investigator of the UNTIL trial.

A Patient’s

LIFE RESTORED

AMY AND ANN-MARIE'S KIDNEY LIVING DONOR STORIES:

Two Sisters, 1 Kidney Club

Many Philadelphians can tell you where they were on February 8, 2018. Especially Eagles fans. The Eagles Super Bowl Championship Parade was taking center stage that day in Philadelphia. But there's another big reason Eagles fan Amy Plourde remembers that day. Amy was in a hospital room on the transplant floor of the Rhodes Building at Penn Medicine with her younger sister, Ann-Marie. Two days earlier, Ann-Marie had donated one of her healthy kidneys to someone awaiting a kidney transplant.

Ann-Marie's road to kidney donation started back in 2000. She was a college student working as a dialysis technician. She realized then that medical education and advocacy were her passions. It was working there where she also learned living donation was not only possible but completely safe. So she decided if someone in her family ever needed a kidney, she would give one up without hesitation.

Fast forward to 2006 when Ann-Marie was invited to volunteer at a sleepaway camp for kids with cancer and thought it sounded like a meaningful way to give back. Ten years later, someone from her "camp family" posted on Facebook that they needed to find a kidney donor. Ann-Marie did not hesitate. Since then, Ann-Marie and her recipient are both living healthy, amazing lives. Her recipient became a grandmother three times. After her kidney donation, Ann-Marie has started running. She has an incredible career, volunteers and is a mom to two young children.

Ann-Marie also decided she wanted to create a "1KidneyClub" to provide education and raise awareness about living kidney donation. So, together the two sisters started the country's first local 1Kidney Club chapter for the National Kidney Donation Organization (NKDO), a non-profit organization that educates prospective living kidney donors about how to donate as safely and effectively as possible.

Amy wanted to support her sister, so she volunteered to be the Facebook page administrator. As she worked on the page and saw her little sister managing her whole busy life on one kidney — and not missing a beat — Amy started to wonder, "Could I be a kidney donor?"

From her research, Amy knew the National Kidney Registry (NKR), an organization that helps match donor kidneys to recipients in need, provided protection for all donors. For example, should a donor's remaining kidney ever fail, NKR will prioritize that person to receive a living donor kidney. They also offer donation disability insurance coverage, lost wage reimbursement during the donation period, and even travel and lodging reimbursement related to kidney donation. So Amy knew she would be in good hands if she decided to donate.

Months passed with the idea of kidney donation secretly living in her head. Amy kept thinking about it, and things would happen in her everyday life that kept pointing her in that direction. First, she ended up in the same elevator with delegates to a National Kidney Conference while attending a different conference in Boston. Then, in a book she read, a character died of kidney disease. Finally, a months-old NY Times newspaper caught her eye with a story of living kidney donation. All the coincidences gave her encouragement, and Amy was ready to move forward. She started the testing and met with the entire Penn Medicine Living Donor Kidney transplant team.

She was approved to donate. Amy remembers finally being confident in her decision and recalls, "My core team at the Penn Transplant Institute made me really comfortable. The Penn team, along with a strong community of other living kidney donors I found through social media, got me where I needed to be. I was ready."

Since she did not have an intended recipient, Amy was considered a non-directed donor - a living person who donates an organ and does not name or have an intended recipient. The medical compatibility and need of a patient determine who receives the transplant.

On July 15, 2020, Amy's left kidney was re-homed in a 30 something-year-old woman. **Peter Abt, MD,** Amy's transplant surgeon, said it started working as soon as it was transplanted. And, the NKR used her non-directed donation to begin a kidney chain in which four people got the life-saving kidney transplants they needed.

"When I woke up from my surgery, I felt completely elated. The incisions and my memories are the only lasting proof I did it. I am back to running and doing CrossFit, working and doing all the things I love." says Amy looking back on her experience. "I think some might think I was self-less or brave, but really, I was just able to see that I had something I could share to help someone else. People enjoy giving of themselves to help others in all kinds of ways. It turns out I was fortunate enough to be able to give away a kidney."

Sisters

Ann-Marie Hulstine
Kidney Living Donor

Amy Plourde
Kidney Living Donor

> MY DONATION STARTED A KIDNEY CHAIN IN WHICH FOUR PEOPLE GOT LIFE-SAVING KIDNEY TRANSPLANTS. SOME MIGHT THINK I WAS SELF-LESS OR BRAVE BUT REALLY, I JUST SAW THAT I HAD SOMETHING I COULD SHARE TO HELP SOMEONE ELSE.
>
> **Amy Plourde**
> Kidney Living Donor

> PENN'S CLINICAL BRILLIANCE WAS ONLY SURPASSED BY THEIR COMPASSION AND KINDNESS. I VOW NOT TO WASTE A TICK OF THIS BEAUTIFUL NEW HEART.
>
> **Kim Pimley**
> Heart Transplant Recipient

Photo credit: **Dave DeBalko**

KIM'S HEART TRANSPLANT STORY:

A Thirteen-Day Race to Survive a Rare, Deadly Heart Disease

January 5: Kim Pimley returned home from a wonderful vacation with her son. Within a few days, though, she was feeling "not quite right, but I figured it would pass," she says. However, when her shortness of breath had not improved by the following Monday, she decided to see her doctor.

January 13: An x-ray showed pleural effusion (water in the lungs), and she was admitted to Penn Medicine Princeton in Plainsboro, New Jersey. The following day her cardiologist identified that she had severe cardiac dysfunction and arranged a transfer to the Hospital at the University of Pennsylvania (HUP). Unfortunately, what she initially thought was a minor complaint turned out to be something much more serious. In fact, it almost took her life.

January 14: Kim arrived at HUP by ambulance and was immediately taken to the Cardiac Care Unit. Based on the appearance of her echocardiogram, the irregular heartbeat on telemetry, and how quickly Kim's condition seemed to be deteriorating, one diagnosis came to her cardiologist's mind: giant cell myocarditis. Giant cell myocarditis, an inflammation of the heart, is a very rare cardiovascular disorder that destroys the heart's ability to beat normally. There is no known cause.

Kim was brought to the cardiac catheterization lab, where a diagnostic heart biopsy and a right heart catheterization were performed to measure the pressures and flows of her heart. Tests showed she was in severe heart failure so an intra-aortic balloon pump was placed to help increase blood flow. While Kim was in the lab, her cardiologist got consent and arranged for her to undergo evaluation for a possible heart transplant. Kim was advised to have her loved ones come the following morning as early as possible to meet the other members of the heart transplant team. "When she told me to call my son to come home from Japan, I knew it was bad," Kim says.

January 15: Kim's condition continued to worsen. In the early morning, she began experiencing a life-threatening irregular heart rhythm and was stabilized on ECMO (extracorporeal membrane oxygenation), which provided both cardiac and respiratory support. By mid-morning, the confirmed diagnosis came back. Kim had giant cell myocarditis. That afternoon, a decision was made. She was listed for heart transplant as a status 1A, the most urgent category. She had been at HUP for less than 24 hours.

January 17: Kim had many things in her favor heading into a transplant despite the serious circumstances. "I was healthy as a horse," she says. Her blood type, small stature, and elevated status on the transplant list (due to her dire condition) improved her chances of getting a heart quickly. The call came in that night. There was a potential match based on initial testing, but they wouldn't know for sure until the organ was procured.

January 18: The team got the call in the early morning: the heart was a match. After successful cardiac transplant surgery by **Pavan Atluri, MD,** Surgical Director of Cardiac Transplantation, a new heart was beating in Kim's chest.

Kim describes her experience as "an education about how wonderful the caregivers are and how challenging their jobs are," she says, adding that her team showed "clinical brilliance and strategic decision-making prowess that was only surpassed by their compassion and kindness." Kim thinks a lot about her donor. She vows not to waste "a tick of this beautiful new heart." And she wonders what might have happened if she had continued to ignore the signals her body was sending.

MICHAEL'S LUNG TRANSPLANT STORY:

Going to Great Lengths for Great Care

More than 1,000 miles from Philadelphia, 68-year-old Michael Bolin was struggling both with his diagnosis of idiopathic pulmonary fibrosis and with the medical care he was receiving. His quest for a lung transplant took him from his physician in Pensacola, Florida, to specialists in Alabama and Ohio. His experiences at multiple transplant centers left him feeling less like a person and more like a statistic – and he kept getting the feeling he wasn't worth the risk.

"Thank god we found Penn," he says. "It was like night and day," adds his wife, Alexis. "Things had been moving so slowly, but at Penn, the wheels were turning."

Under the care of **Christian Bermudez, MD, Joshua Diamond, MD,** and their team in the Lung Transplant Center, Michael and his wife immediately felt a difference in the quality of care. "At Penn, they put us in one room, and everyone came to us. It was so impressive," says Michael.

"It's very taxing when you have pulmonary fibrosis and you're in year four of your diagnosis, and you're walking around with a machine, having to go to this building and that building and from floor to floor," says Alexis. "The moment we met the whole team, I knew we were in a place where people cared more about the patient than the numbers or the money."

Alexis and Michael speak as a team, and Michael is as grateful for his care as he is for how the team supported his wife through the process. "During the transplant, the person hit harder than the patient is the caregiver," Michael says. "It's a tough job and my wife did it extremely well."

Once they were accepted into the lung transplant program, Alexis and Michael decided to temporarily move to Philadelphia, renting an apartment in South Jersey. Alexis left her thriving real estate business in Florida to support her husband through the process. The quality of the lung transplant team made the decision to uproot much easier. "They're not punching a clock. They care about the patient, and that alone relieves the stress," she says.

Michael was listed for a transplant on the 18th of April 2016. On April 27th, they received a call — a lung was available, but it wasn't ideal. The night of the transplant they spoke with Dr. Bermudez, who told them that the donor's left lung was damaged and they would only be able to receive the right lung. Of Michael's two lungs, his left was in worse shape than his right. Michael and Alexis agonized over the decision, asking their physician from back home to speak with Dr. Bermudez and give his advice. "Take that lung," he told Michael.

After the operation, Michael worried that he should have waited for a better donor lung. The team reassured him he had made the right choice — he was much more critical than he realized. "I was told that if I had waited I wouldn't have made it. I would have been dead," Michael says.

A year and a half after his operation, Michael is doing well despite a few setbacks, including treatment for a virus. Fortunately for Michael, his transplant team at Penn was plugged in every step of the way. "Dr. Diamond's assistant was on the phone constantly with the doctors here at home. Even long-distance, they're taking care of him," Alexis says.

"Overall, I'm doing great," Michael says. "I'm alive, and I spend time with my family and my grandkids, and it's worth every bit just for that."

> THANK GOD WE FOUND PENN...
> IT WAS LIKE NIGHT AND DAY.
> THINGS HAD BEEN MOVING
> SO SLOWLY, BUT AT PENN, THE
> WHEELS WERE TURNING.

Michael Bolin
Lung Transplant Recipient

> THIS WHOLE THING HAS BEEN A MIRACLE. I WAS AT THE END OF THE LINE. THERE WAS NO EXPECTATION THAT I WOULD LIVE UNTIL PENN STEPPED IN.

Fred Rahmanian
First patient with COVID-19 to receive a lung transplant at Penn Medicine

FRED'S COVID-19 LUNG TRANSPLANT STORY:

An Innovative Team Approach to a Complex Case

On some of the worst days of his battle with COVID-19, Fred Rahmanian remembers waking up in his hospital bed to look at photos of his wife and three kids that someone had lovingly taped to the wall in his room. Fred was one of the millions of Americans who got sick from COVID-19. But when he first went into the hospital in October of 2020, it didn't cross his mind it would ever get so bad. But it did.

By November 11th, Fred's condition deteriorated so rapidly that doctors deemed him too unstable to even transport for more advanced care. That's when his local hospital called for assistance from Penn Medicine's Lung Rescue Mobile ECMO team, kicking off a long chain of Penn care that would see Fred through to a remarkable recovery.

Penn's Mobile ECMO team usually travels by helicopter to quickly pick up very sick patients. On that particular night, though, there was a major complication - a storm raging outside made flight conditions impossible. So, the team, led by **William Vernick, MD,** Co-Medical Director of the Penn Lung Rescue Program, pivoted. They drove to pick Fred up and take him back to the Hospital of the University of Pennsylvania by ambulance, hooking him up to the ECMO machine for the trip.

After a few weeks on ECMO, it was clear that Fred's lungs were not getting better. His team knew he had one option left to save his life: transplant. Once again, Penn's ability to innovate during even the most challenging circumstances was demonstrated. No one at Penn Medicine had ever performed a lung transplant on a patient with COVID-19. In fact, it was almost unheard of at that point in the medical community globally.

Qualifying to be a transplant patient is complex under normal circumstances, but here doctors were dealing with those complexities on top of a patient who was critically ill with COVID-19, a virus that the medical community was still learning about with a constant flow of new discoveries. This translated to a new list of criteria for Penn Medicine patients to meet before being placed on the transplant list.

"Fred's case was unique because although his lungs were severely injured by the virus, he was otherwise a healthy man. We all worked together to make sure we got every detail right," says **Maria M. Crespo, MD,** Medical Director of the Penn Lung Transplant Program.

These new lung transplant guidelines for COVID-19 related lung injuries were developed and issued by Crespo in collaboration with **Joshua Diamond MD, MSCE**, Associate Medical Director of the Penn Lung Transplant Program, and **Christian Bermudez, MD,** Director of Thoracic Transplantation at the Penn Transplant Institute.

On New Year's Eve, 2020, during more than six hours of surgery, Fred became the first COVID-19 patient in Pennsylvania to receive a lung transplant. With incredible mental and physical strength Fred was able to overcome adversity with the help of the team that surrounded him – infectious disease experts, ICU nurses, pulmonologists, physical and respiratory care therapists, his surgeon and many others.

Fred's driving force to recover was his family. He felt so fortunate to be alive to see his triplets turn 18 and graduate high school. "At the end of the day, I was grateful that I was given more time," he says.

MYA’S LIVER TRANSPLANT STORY:

A Lifelong Medical Journey, a Lifetime Partnership

When Mya Longacre was a young girl, she spent a lot of time in the hospital—time that was broken up by visits from her grandfather, Fred Biesecker, or “Poppy” to his grandchildren. “Every time he came,” Mya remembers, “he would take me to the gift shop and say, ‘Pick out twenty toys.” But those toys were not for Mya. Instead, Mya and Poppy would hand out the toys to other children staying on her floor. “If we can make their day better,” Poppy explained, “it’ll make you feel better too.”

Mya never forgot that experience—and the lesson that giving to others can be a balm for the mind, body and spirit. It’s a lesson that helped her cope with the challenges of her own diagnosis, biliary atresia: a progressive disease of the liver that today can only be cured with a transplant. It was after this diagnosis, made shortly after she was born, when Mya and her family began their journey with the teams at Penn Medicine’s Transplant Institute and Children’s Hospital of Philadelphia (CHOP). Since 1995, these two hospitals have partnered to conduct a joint liver transplant program under the leadership of Penn and CHOP transplant surgeons **Abraham Shaked, MD, PhD,** and **Kim Olthoff, MD,** alongside pediatric hepatologist **Elizabeth B. Rand, MD,** Medical Director of CHOP’s Liver Transplant Program.

Mya was just five weeks old when her family began this medical journey alongside her. Mya’s grandparents, Fred and Suzanne Biesecker, and her parents, Lissa and Jeff Longacre, were collectively dismayed in doing their own research to find that little was known about biliary atresia. It was a disease so rare, little to no funding was available for researchers to study it. “We asked ourselves, what could we do for this child?” remembers her grandmother, Suzanne. It was Fred Biesecker who had the idea: fund a program that would not just help Mya, but so many others like her. So began the family’s lifetime partnership with the Penn and CHOP liver teams. After careful planning, fueled by the vision and purpose of this generous family, the Fred and Suzanne Biesecker Pediatric Liver Center was dedicated in 2002 at the Children’s Hospital of Philadelphia.

Mya Longacre
Liver Transplant Recipient

Suzanne Biesecker
Mya’s Grandmother

Lissa Longacre
Mya’s Mother

> I WAS BLESSED WITH THE GIFT OF A LIFETIME. MY ONLY WISH IS THAT ALL FAMILIES AND PATIENTS CAN RECEIVE THE SAME CARE AND COMPASSION. SHOWING MY SUPPORT MEANS THE WORLD TO ME.

Mya Longacre
Liver Transplant Recipient

Building Teams and Breaking Down Walls

The partnership between Penn and the Children's Hospital of Philadelphia (CHOP) creates a vibrant scientific community that brings together world-renowned specialists who collaborate on ground-breaking research. "With Mya's family's support, we were able to build a center that crossed a lot of boundaries to work toward a common goal," says Dr. Rand.

As is common with much of the research done at CHOP and Penn, the work coming out of the Liver Center transcended the walls of these two hospitals."There are great brains everywhere—we thought, let's help them share their knowledge," Suzanne explained. Today, with continued support from the Biesecker and Longacre families, The Liver Center hosts national and international symposia where scientists share their research and collaborate on developing new treatments.

Dr. Rand points out that this family also understands the day-to-day realities of families coping with serious illness. "They're helping us push the boundaries of human knowledge," she says. "But they realize that making someone's day better is also important, so they're also attentive to the small things."

One of their gifts lives on at The Clyde F. Barker Penn Transplant House for patients and families who travel from afar for care at Penn Medicine. The Bieseckers funded the creation of a room for educational seminars for transplant families. It also provides a welcoming gathering place where the families of patients create a community of support for each other, where they can eat together, play games or work away from home and the hospital. "A lot of good has come out of that space over the last ten years," says **Kim Olthoff, MD,** Chief of the Division of Transplant Surgery at Penn and Co-director of the Transplant Center at CHOP.

A Happy Ending and a New Beginning

The Bieseckers understand, perhaps better than anyone, how important support and community can be for families awaiting a transplant. When Mya was twelve years old, after years of hospitalizations, she was placed on the list for a liver transplant. She waited eighteen months until, in the spring of 2013, she finally got her new beginning, a liver transplant.

Today, Mya is a happy, healthy college graduate with a degree in Health Science with a concentration in Health Promotion and Behavior. "My life has been forever changed," she says, "Now I want to spend the rest of my life giving to others as much as possible. I want to serve those in the same situation I used to be in." And Lissa, since her father passed away, has stepped into his role at the Liver Center. "I haven't replaced him because nobody can replace him," she says, "but I am continuing his work." Lissa has supported studies that will benefit the long-term well-being of her daughter and all transplant recipients, including innovative research studies led by **Abraham Shaked, MD, PhD,** and **Brendan Keating, PhD,** at the Penn Transplant Institute, focused on personalized immunosuppression management using innovative genomic technologies.

Fred Biesecker would be pleased: not just that his philanthropy has resulted in such valuable research but that his family continues to find joy in generosity. This ongoing generosity of donors who give in big ways and small continues to propel CHOP and Penn's discovery of better treatments for patients like Mya and the thousands of others battling liver disease.

> "THE COLLABORATION BETWEEN PENN'S TRANSPLANT SURGEONS AND CHOP'S PEDIATRIC CARE EXPERTS OVER THE LAST 20 YEARS HAS RESULTED IN SIGNIFICANT CLINICAL AND RESEARCH BENEFITS."
>
> **Abraham Shaked, MD, PhD**
> Director, Penn Transplant Institute

Deborah Calabro
Living Donor Liver Transplant Recipient

Kim Schadt
Deborah's Friend,
Liver Living Donor

> THEY FAR EXCEEDED OUR EXPECTATIONS. EVERYONE WHO CARED FOR US TREATED US LIKE FAMILY.
>
> **Kim Schadt**
> Liver Living Donor

KIM AND DEBORAH'S LIVING DONOR LIVER TRANSPLANT STORY:

Between Friends

When they met in 2009, Kim Schadt and Deborah Calabro had no idea just how important their friendship would become. In 2012, Deborah was diagnosed with primary sclerosing cholangitis (PSC), a chronic liver disease that slowly damages the bile ducts. She was told that she would eventually need a liver transplant. Kim, a nurse practitioner in the neurology department at Children's Hospital of Philadelphia (CHOP), was by her friend's side at every step. Kim also helped Deborah find her way to Penn.

"I learned a long time ago that when you get to this level of academic medicine, people don't do research in areas they're not passionate about. We looked to find physicians who took PSC as seriously as we did," Kim says. Her research led her to Penn and **David Goldberg, MD,** who was the Director of the Living Donor Liver Transplant Program at that time.

"CHOP and Penn are like brother and sister, and the care was outstanding. They far exceeded expectations. Everyone who cared for us treated us like family," Kim recalls.

Deborah managed for a few years with her deteriorating liver, undergoing a resection in 2012 and a series of infections that came to a head in the summer of 2016. Her liver had lasted as long as it could, and it was time for a transplant. Deborah faced several unique challenges to finding a donor. Because of her previous resection and the amount of scar tissue that remained, she required a large portion of a liver from the left side, not the more commonly transplanted right side. These types of challenges might ordinarily derail a potential liver transplant.

"Dr. Goldberg really believed in me and fought to make this surgery happen," says Deborah. Kim, who had been by Deborah's side since the beginning, didn't hesitate to offer herself as a liver donor. Kim wasn't the only person in Deborah's life willing to step up and volunteer for transplant, but in the end, she was the one whose body chemistry and liver size added up to the magic formula that made her an ideal donor. "The left lobe had to be big enough to support her and still leave enough to sustain me," says Kim, who went through extensive testing before donating.

"It gives you the chills. It was meant to be," says Deborah. The surgery was scheduled for January 2017, with **Kim Olthoff, MD,** performing the donor surgery on Kim, and **Peter Abt, MD,** and **Abraham Shaked, MD, PhD,** performing Deborah's. Kim describes her friend as the healthiest sick person you ever met because of her ability to push through and remain positive. But after the surgery, Deborah was blown away by how much better she felt.

"I got used to not feeling well. I got used to nodding off at work, looking gray," she says. "It's amazing how great I feel. I finally know what normal feels like."

Less than a year after her transplant, Deborah's new normal helped her get to the finish line of her first half marathon. And like so many others, the friends shared this experience with Kim completing the full marathon. Because the liver regenerates, Kim knew she would be back to 100 percent in enough time to train for and successfully achieve this goal.

Kim has absolutely no regrets about being Deborah's donor and wishes more people had the opportunity to have this experience. "It never felt like a decision. It felt like the right thing to do. Someone I knew needed help, and I was in a position to help," Kim says. "In the end, this is what life is all about, standing up for what you believe in and the people you love."

LINDSAY'S BILATERAL HAND TRANSPLANT STORY:

A Move to Independence

It was a big move for Lindsay Ess, packing up her home in Virginia and relocating to San Antonio. But as the first person to receive a bilateral hand transplant at Penn, it was necessary.

"It was my first attempt for me to be on my own," she says. Since she lost both of her arms and legs due to an infection when she was 24, she had been reliant on her mother, Judith Aronson, who has been by her side providing continuous care. Receiving the hand transplant in 2011, she's worked hard to make progress as far as she has. The rehabilitation process was often frustrating and painful. The move south was also to seek a change in climate — the cold weather was becoming intolerable.

For many years after her transplant, the nerves in her hands continued to zing as they reconnected. "The nerves were constantly growing. When I pet my dog, I had to stop after a bit because it was so sensitive," says Lindsay. Lindsay describes the feeling as similar to bee stings, or when a limb tingles as it wakes up after falling asleep.

The nerve pain wasn't the only challenge she faced. After she moved south, Lindsay developed diabetes, most likely caused by steroid use after her transplant. Judith, who has been a stalwart support for Lindsay, moved to San Antonio to help as Lindsay adjusted to her new diet and insulin injections. Lindsay built her new medical team in Texas, but she remains connected to **L. Scott Levin, MD, FACS,** who led the team that performed her landmark transplant. "I'm in constant contact with Dr. Levin. He checks on me to make sure I'm okay emotionally," she says. "We're family now. I don't think we'll ever not talk."

In addition to their patient/physician relationship, Lindsay helps Dr. Levin by consulting and mentoring potential hand transplant patients. "It's a full-time job and it's rewarding to see the growth of a patient who's considering a transplant like mine," she says.

Lindsay, who worked in the fashion industry before the infection that took her arms and legs, now works with athletes who have disabilities. She organizes cross-fit competitions between able-bodied athletes and adaptive athletes, with able-bodied athletes making modifications to their movements to level the playing field, such as playing sitting down when competing against those in wheelchairs. "It's the first competition of its kind and helps build relationships between adaptive athletes and non-adaptive athletes," says Lindsay.

Lindsay continues to look forward, restarting her hand therapy to expand the scope of her independence. "One thing I need to work on is cooking," she says with a laugh. Even though she doesn't yet have a handle on her skills in the kitchen, Lindsay remains deeply grateful to Penn for the things she can do with her new hands, like putting her arms around her mother.

"People underestimate the power of touch. Especially in my work with people with disabilities. When you're talking to someone and are able to lay a gentle hand on their back or pat them on the shoulder, it can really forge a sense of connection."

> "I ALWAYS FELT SAFE, EDUCATED AND WELL TAKEN CARE OF BY THE PENN TEAM. THEY HAVE GIVEN ME MY LIFE BACK. ALONG WITH THE LOSS OF MY ARMS AND LEGS, I LOST MY SENSE OF FEMININITY AND THE HOBBY THAT I LOVED (AMONGST OTHER THINGS). THE FACT THAT I CAN LIFT AGAIN, GRASP THE IRON, FEEL THE WEIGHT AND HAVE FAR MORE FUNCTION THAN I EVER DREAMED, IS A TESTAMENT TO HOW AMAZING THIS PROGRAM IS AND HOW NECESSARY IT IS IN IMPROVING THE QUALITY OF LIFE FOR PEOPLE AFTER COMPLETE LIMB LOSS."
>
> **Lindsay Ess**
> Bilateral Hand Transplant Recipient

Photo credit: **Matt Mendolsohn**

Cheryl Urban
Uterus Living Donor
Chelsea Jovanovich
Living Donor Uterus Transplant Recipient with baby Telden

> I NEVER THOUGHT IN MY WILDEST DREAMS THAT I WOULD EVER BE ABLE TO CARRY A BABY. AND WITHOUT CHERYL, TELDEN WOULD NEVER BE HERE. I FEEL LIKE IT'S ONLY FAIR FOR HER TO BE A PART OF HIS LIFE, TOO. WE'RE LIKE FAMILY NOW.
>
> **Chelsea Jovanovich**
> Living Donor Uterus Transplant Recipient

CHELSEA AND CHERYL'S UTERUS TRANSPLANT STORY:

A Living Donor, A New Life

On May 18th, 2021, Chelsea Jovanovich and her husband Jake welcomed their son, Telden, into the world. That incredible day was the culmination of a very long journey to motherhood for Chelsea, who was 15 when she found out she had Uterine Factor Infertility (UFI), a congenital disorder in which her uterus had never developed.

Two years before baby Telden came into the world, his story began with Cheryl Urban, a young mother from Pennsylvania. After having her own two kids, Cheryl had never given too much thought to her uterus again until one day in June of 2019 when she saw a story about uterus donation on the local news. "Whether it be faith, stars aligning or whatnot, something drew me to this story. I felt it in my heart that this was something I was meant to do." She was so inspired by the story, she decided right then and there she wanted to donate her own uterus. With the support of her family, Cheryl signed up online to be considered as a donor through Penn Medicine's Uterus Transplantation for Uterine Factor Infertility (UNTIL) trial.

More than 2,000 miles away in Montana, Chelsea Jovanovich was also looking at the Penn Medicine UNTIL trial website. After years of heartbreaking attempts to start a family, she was hoping to be accepted as a recipient. "The diagnosis I had received as a teenager was a lot harder on me emotionally as I got into my child-bearing years," Chelsea said. "Your friends are having babies, and you can't. It was pretty hard," said Chelsea.

Feeling out of options, Chelsea learned about uterus donation from her doctor and searched programs online, but it felt like a longshot."Even though I felt like this was something completely out of reach for me I applied anyway. I never thought I'd be accepted," she said.

As it turns out, Chelsea was accepted into the program, and following rigorous testing, Cheryl was accepted as a donor. Cheryl went ahead with the donation in February 2020 having no idea who the recipient was at that time. Thousands of miles apart, these two women didn't know they were soon to be linked forever by this selfless gift.

"Uterus transplant is the only option that allows women with UFI the opportunity to carry and deliver their own babies. Once the participant heals from their surgery, a single embryo is placed into the uterus. If the participant becomes pregnant, she is monitored closely by a team that specializes in high-risk pregnancies. Success required over 100 people from across Penn Medicine," says **Kate O'Neill, MD,** Co-Principal Investigator of the UNTIL trial.

Dr. O'Neill worked closely with **Nawar Latif, MD, MPH, MSCE,** Surgical Director of the Living Donor Uterus Transplant Program and Co-Principal Investigator of the Uterus Transplant trial, who performed this first-of-its-kind of surgery at Penn Medicine to remove Cheryl's uterus. "The feeling of responsibility towards the donor, recipient and the entire program was tremendous," Dr. Latif says.

Paige Porrett, MD, PhD, who has since joined the faculty at the University of Alabama Birmingham as the director of VCA Transplantation at the UAB Comprehensive Transplant Institute, performed the uterus transplant on Chelsea, together with **Kim Olthoff, MD,** Chief, Division of Transplant Surgery.

Almost a year after the transplant, with a baby boy on the way, Chelsea reached out to Cheryl through their social workers to thank her. Since that day, the two began talking more regularly and the two women met in person for the first time in May of 2021, soon after baby Telden was born.

"It's been like a fairytale," she says. "It's so unbelievable. I sit, think about it, and I can't believe it happened. I can't believe it worked," Chelsea says. Baby Telden is Penn's first baby born from a uterus transplanted from a living donor as part of Penn Medicine's Uterus Transplantation for Uterine Factor Infertility (UNTIL) trial.

JESSICA’S KIDNEY-PANCREAS TRANSPLANT STORY:

An End to a Lifelong Diabetic Battle

Jessica Bonkoski was entering ninth grade when sudden weight loss led to a shocking diagnosis: type 1 diabetes. Almost overnight, Jessica found herself juggling the norms of her 15-year-old life — school, homework, soccer and friends — with the new challenges of a strict diet, checking blood sugar, insulin injections and managing medical supplies. “It was hard. I just wanted to be ‘normal’ and not have to deal with it; just be able to enjoy life, like my friends did,” Jessica remembers.

Although type 1 diabetes can usually be managed, many underestimate its burden and the havoc it can wreak on the body and spirit. Unfortunately, this was the case for Jessica. In her mid-twenties, she began experiencing a series of diabetes-induced health complications.

“I just wanted to graduate and get started with my life,” says Jessica. Amazingly, despite many medical complications, she did. Jessica graduated from nursing school and was hired by Penn Medicine in 2014. Working at Penn Medicine, Jessica saw firsthand the quality of the care given to patients and decided to transfer her care to Penn’s Rodebaugh Diabetes Center.

Not long after transferring her treatment to Penn, bloodwork revealed a concerning result: Jessica’s glomerular filtration rate (GFR), an indication of kidney function, was a mere eight. Normal results range from 90 to 120. Her greatest fear had become a reality: she had stage 5 kidney failure. Jessica’s kidneys, damaged from years of fluctuating glucose levels, could not remove waste from her body. Without life-sustaining dialysis or a transplant, she might only live a few weeks. Jessica spent her 30th birthday at a dialysis center and soon after was referred for consultation with **Ty Dunn, MD,** Surgical Director, Kidney and Pancreas Transplant, at the Penn Transplant Institute.

Dr. Dunn explained to Jessica that the effects of prolonged dialysis could threaten a patient’s eligibility for a healthy donor organ due to further health complications. “Not many people live more than ten years on dialysis. On the other hand, patients can expect, on average, 14 to 16 years of kidney function from a living donor kidney transplant,” says Dr. Dunn. Dr. Dunn also stressed the value of a new pancreas in addition to a new kidney for eligible type 1 diabetes patients. A successfully transplanted pancreas eliminates diabetes, protecting the new kidneys against injury from diabetes. Jessica was added to the national transplant waiting list and, while she waited, would spend nine hours every night connected to a dialysis machine.

Finally, at 1:30 a.m. on October 27th, 2019, Jessica received the life-saving call. A healthy kidney and pancreas were being transported to Penn Medicine.

A little more than a year after her transplant, Jessica returned to work at Penn Medicine and celebrated five years as a registered nurse. “I remember waking up from surgery, and even though I had pain and discomfort, I had never felt better. I always tell people: I hadn’t realized how bad I’d felt for years until I woke up from my transplant and felt so good.”

> “I REMEMBER WAKING UP FROM SURGERY AND I NEVER FELT BETTER. I HADN’T REALIZED HOW BAD I’D FELT FOR YEARS UNTIL I WOKE UP FROM MY TRANSPLANT AND FELT SO GOOD.”
>
> **Jessica Bonkoski**
> Kidney and Pancreas Transplant Recipient

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WAYS TO GIVE

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To make a gift or learn more about how our physician-scientists are advancing the field of transplantation, and the many ways in which you can partner with us to support our efforts, please visit us online at **Pennmedicine.org/transplantgiving** or contact our development officer, **Andrew Deal** at **adea@upenn.edu** or **(267) 549-9063.**

With your support the Penn Transplant Institute will continue to offer the finest transplant care, translate breakthrough discovery into successful treatments and educate tomorrow's leaders.

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The Penn Transplant Institute would like to express our deepest gratitude to the many generous supporters who, for over 55 years, have enabled our transplant team to provide the highest quality transplant care, an unparalleled training environment and groundbreaking research. We are truly thankful for the partnership with each and every person who has supported us through financial gifts, volunteered time and provided thoughtful advocacy to advance the missions of the Penn Transplant Institute.

Thank you to our donors for the combined $6 million that you have provided over the last 55 years in support of the Penn Transplant Institute and The Clyde F. Barker Penn Transplant House.

Philanthropy plays a critical role in enabling our providers and scientists to advance medical discovery and provide exceptional patient care and support. The 13,000 lives saved at Penn through transplantation, and countless innovations that impacted the field far and wide, were made possible in great part thanks to those who understand the importance of donations to the Penn Transplant Institute.

Thank you for your generosity.

Kim Olthoff, MD
Associate Director, Penn Transplant Institute
Donald Guthrie Professor of Surgery
Chief, Division of Transplant Surgery

THANK YOU

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And finally, no testimonial on transplantation would be complete without recognizing those who have made the greatest contribution — the donors who so selflessly give of themselves to save another's life. Without our donors and our incredible partners at the Gift of Life Donor Program, our work would not be possible.

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