Advancing care through innovation

Pushing the boundaries of medicine to improve patient care – UT Southwestern clinicians excel at this mission. Whether modifying immune cells to fight cancer, editing genes in search of a disease cure, or surgically repairing an aneurysm with less invasive techniques, these efforts by our caregivers are saving lives and building hope.

Dr. Neelan Doolabh performs a revolutionary minimally invasive heart valve replacement surgery.

Simmons Cancer Center researchers part of CAR-T breakthrough

UT Southwestern cancer researchers are leading the way toward a possible cure for patients with difficult-to-treat acute lymphoblastic leukemia (ALL), the most common type of cancer in children.

In a pathbreaking study published last year in the *New England Journal of Medicine,* researchers from UT Southwestern's Harold C. Simmons Comprehensive Cancer Center and others found that genetically modified immune cells can be harnessed to treat children and young adults when ALL recurs or does not respond to therapy. The study demonstrates the effectiveness of CAR-T (short for chimeric antigen receptor T-cell) therapy, which uses modified immune cells.

"It was gratifying to be part of this pioneering effort using a genetically modified version of the patients' T-cells to attack their cancer cells." – *Dr. Ted Laetsch*

In acute lymphoblastic leukemia, the bone marrow makes too many white blood cells. With approximately 3,500 new cases a year in children, it is the most common childhood cancer, according to the National Cancer Institute.

In the global trial, 75 young patients who had a form of treatment-resistant ALL received CAR-T therapy. Of those, 81 percent went into remission – an impressively high success rate. All of the participants had previously relapsed or failed to respond after standard therapy.

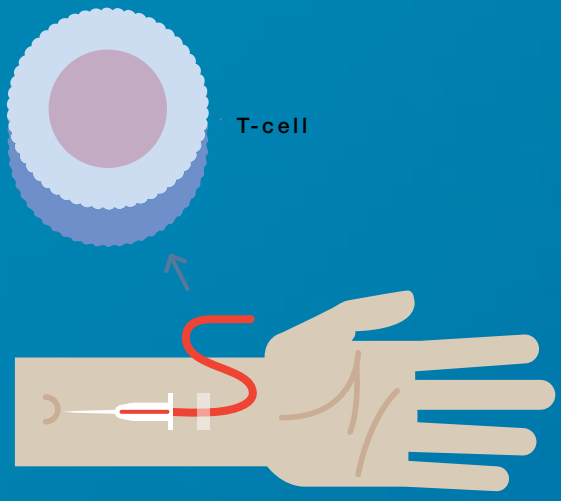
Based on those promising early results, the U.S. Food and Drug Administration in August 2017 approved the use of CAR-T therapy for patients age 25 and under suffering from relapsed or difficult-to-treat ALL. A year later, in August 2018, the European Commission approved the therapy.

"This is a new frontier in cancer treatment," said Dr. Ted Laetsch, Associate Professor of Pediatrics with the Simmons Cancer Center and lead investigator on the study.

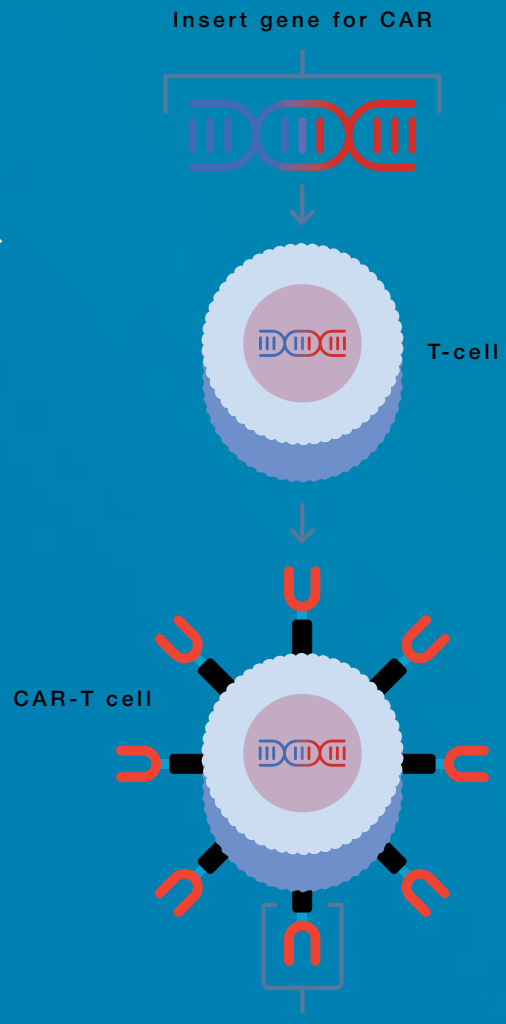
Dr. Laetsch is now providing CAR-T treatment at the Pauline Allen Gill Center for Cancer and Blood Disorders at Children's Health for young patients whose leukemia did not respond to therapy or who have relapsed more than once. Dr. Laetsch is an unpaid consultant for Novartis, which makes the CAR-T drug for ALL.

CAR-T cell therapy

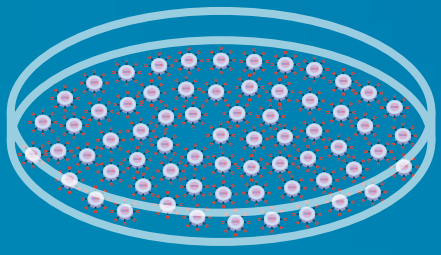
Get blood with T-cells from patient



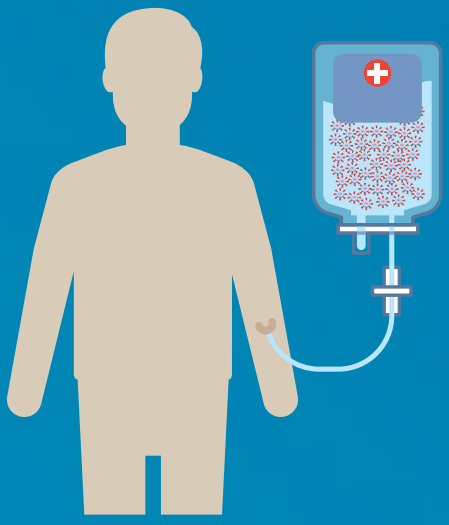
Create CAR-T cells that react to cancer cells



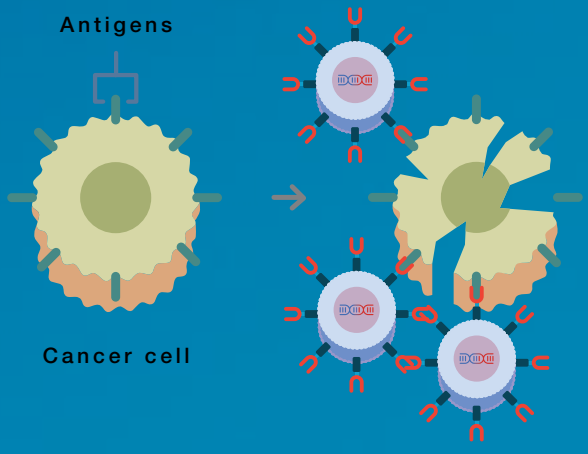
Grow many CAR-T cells



Inject CAR-T cells into patient



CAR-T cells attack cancer cells



How to join a CAR-T trial

Adult multiple myeloma patients interested in participating in UT Southwestern's CAR-T multiple myeloma trial can call 214-645-HOPE (214-645-4673) and ask for Julie Zuckerman.

Those interested in CAR-T cell therapy for ALL can call the Pediatric Oncology and Hematology Clinic at 214-456-2382.

"It was gratifying to be part of this pioneering effort using a genetically modified version of the patients' T-cells to attack their cancer cells, and to see such positive results for so many patients," Dr. Laetsch added. "While most children with ALL respond well to chemotherapy, the patients in this trial were patients whose cancer had returned, and they desperately needed an alternative."

In cases where ALL does not respond well to traditional chemotherapy – or the cancer returns – subsequent rounds of chemotherapy are effective less than half the time, Dr. Laetsch said.

Dr. Ted Laetsch uses genetically modified immune cells to treat cancer in young leukemia patients – giving new hope to children via a promising method called CAR-T.

In the future, even more cancer patients may benefit from this revolutionary form of immunotherapy. Dr. Larry Anderson, Associate Professor of Internal Medicine, is enrolling adults in a phase two clinical trial of a CAR-T cell therapy for multiple myeloma (another bone marrow cancer that is currently incurable) at the Simmons Cancer Center, one of only nine study sites in the U.S. and a top enroller. UT Southwestern has also joined a select group of medical centers providing CAR-T therapy for adult patients with relapsed large B-cell lymphoma, an aggressive cancer that starts in immune system cells.

First-of-its-kind cancer drug targets genetic abnormality

A new drug being tested at UT Southwestern is showing remarkable success treating cancers of many types in patients who have a specific gene fusion in the cancer cell.

The clinical trial demonstrates the power of using genetic information to develop tailored, more effective disease treatments – a hot area in biomedical research known as precision medicine.

This first-of-its kind drug, larotrectinib, zeroes in on a chromosomal abnormality related to the *TRK* gene that is found in many different types of cancers. Studies published last spring in *The Lancet Oncology* and the *New England Journal of Medicine* found the drug effective in 93 percent of pediatric patients tested and a 75 percent response rate in adult patients.

"In some cancers, a part of the *TRK* gene has become attached to another gene, which is called a fusion. When this occurs, it leads to the *TRK* gene being turned on when it's not supposed to be, and that causes the cells to grow uncontrollably," explained Dr. Ted Laetsch, lead author of *The Lancet Oncology* study and Associate Professor of Pediatrics with UT Southwestern's Harold C. Simmons Comprehensive Cancer Center.

Larotrectinib targets *TRK* fusions and blocks *TRK* receptors, Dr. Laetsch said. It is not an effective treatment for patients who lack the *TRK* fusion gene. A next step in the research is a clinical trial involving a similar drug for those patients who developed resistance. Dr. Laetsch is the national leader for that clinical trial in children.

Among those benefiting from the study at UT Southwestern and Children's Health is 14-year-old Briana Ayala of El Paso, pictured here. Three years ago, Briana was diagnosed with a tumor wrapped around the major artery in her abdomen.

Her hometown surgeons said it would be too dangerous to operate, so Briana's family took her to Children's Medical Center Dallas, where UT Southwestern Professor of Surgery Dr. Stephen Megison removed most of the tumor.

When it started to grow again, Dr. Laetsch sent the tumor for genetic testing and found it had the *TRK* fusion, meaning larotrectinib might help.

Today, Briana is back in school, playing with her dog Goofy and the family's seven parakeets – and dreaming of a future in fashion in New York.

Credit: Juan Pulido, Children's Health

UT Southwestern researchers making headway toward DMD cure

Researchers in the Hamon Center for Regenerative Science and Medicine are diligently working toward the goal of testing their gene-editing treatment for Duchenne muscular dystrophy (DMD) in humans – and potentially saving the lives of those diagnosed with this fatal, incurable disease.

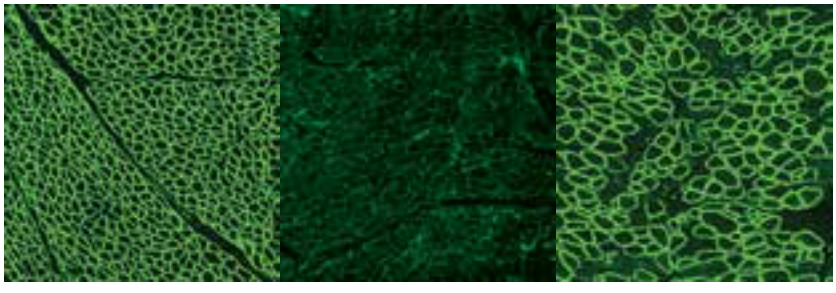
Already, the UT Southwestern research team led by Dr. Eric Olson, Director of the Hamon Center, has reported success treating DMD in human heart muscle cells, mouse models, and dogs.

A new biotechnology company called Exonics Therapeutics Inc. has licensed the technology from UT Southwestern and is working with Dr. Olson to further optimize his findings in hopes of winning government approval for clinical trials within a few years. (Dr. Olson is the scientific founder of and a consultant for Exonics Therapeutics, launched in 2017 to advance and commercialize research from his laboratory. He also has license and investment interests with the company.)

If successful in humans, the treatment developed at UT Southwestern would be a godsend to the 1 in 5,000 boys born with the mutation that causes DMD. This form of muscular dystrophy primarily affects boys and stems from defects in the gene that makes the dystrophin protein needed for proper muscle function. The defects lead to degeneration of skeletal and heart muscles, often forcing patients into wheelchairs and, after chest wall muscle loss, onto respirators. Most patients die by age 30.

UT Southwestern scientists developed a simpler gene-editing technique that uses the groundbreaking method known as CRISPR to target and edit the genetic defects that cause DMD. The UTSW technique could potentially correct a majority of the 3,000 types of mutations that cause DMD with a single cut at strategic points along the patient's DNA, Dr. Olson said.

Illustration courtesy of Ernesto del Aguila III, NIH



Scientists used CRISPR gene editing to halt the progression of Duchenne muscular dystrophy (DMD) in dogs. The images illustrate dystrophin (in green) in a healthy diaphragm muscle (left), absence of dystrophin in a dog with DMD (center), and restoration of dystrophin in dogs treated with CRISPR (right).

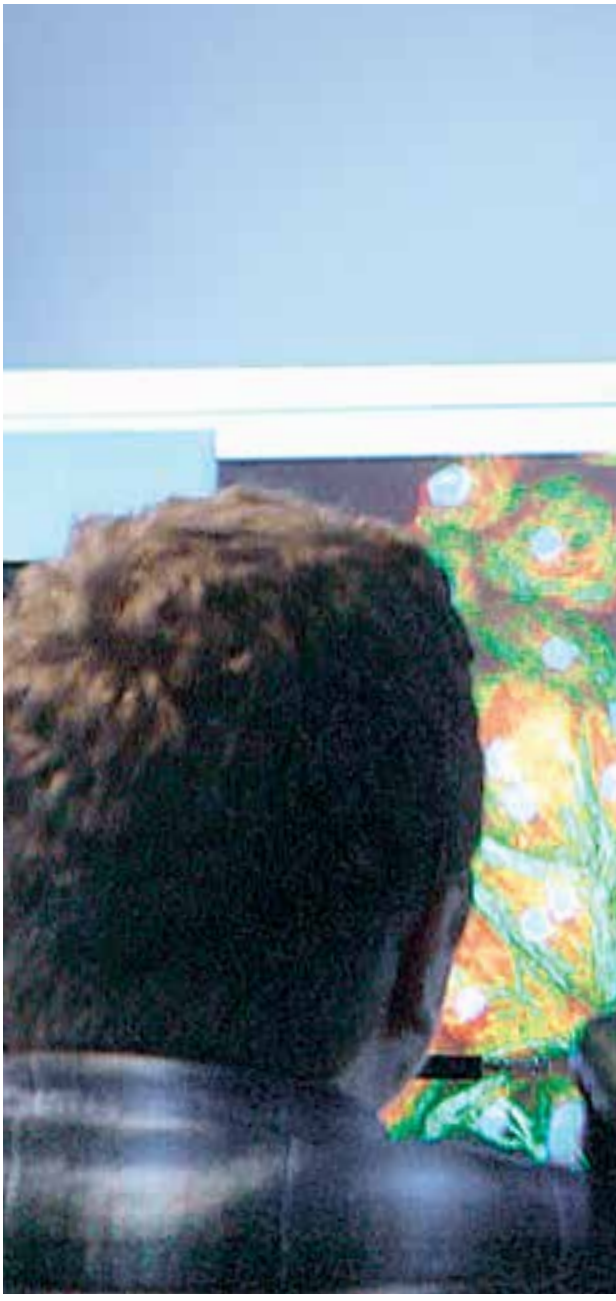
Scientists say the new technique enhances accuracy for surgical-like editing of the human genome, correcting mistakes in the DNA that cause devastating diseases such as DMD and opening up the possibility of less risky treatment approaches for other diseases as well.

"This is a significant step," said Dr. Olson, also Chair of Molecular Biology at UTSW and Co-Director of the Wellstone Muscular Dystrophy Cooperative Research Center, which helped fund the research. "We're hopeful this technique will eventually alleviate pain and suffering, perhaps even save lives, of DMD patients who have a wide range of mutations and, unfortunately, have had no other treatment options to eliminate the underlying cause of the disease."

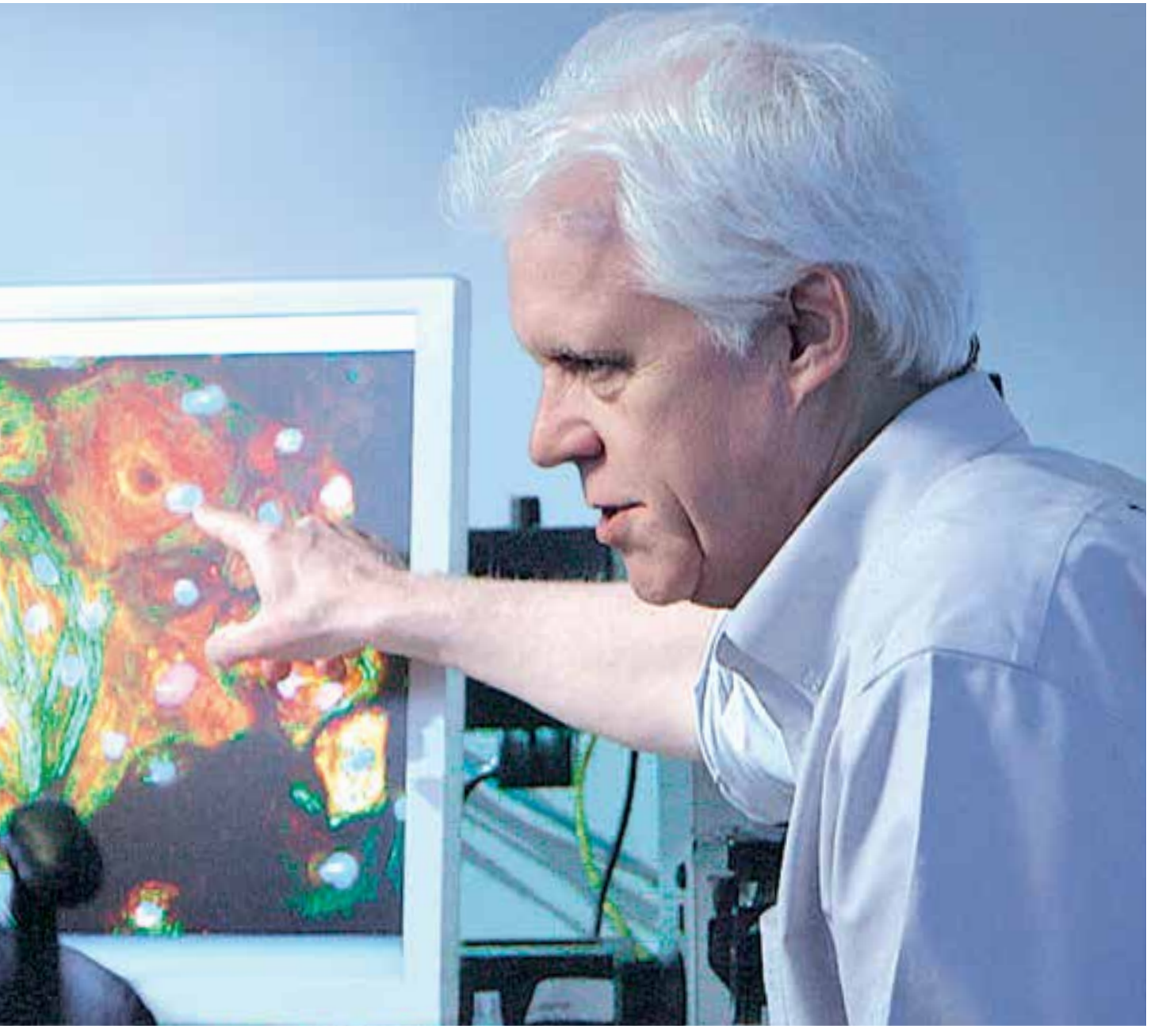
The research was supported by additional grants from the National Institutes of Health, Parent Project Muscular Dystrophy, and the Robert A. Welch Foundation.

Dr. Olson's latest findings build on his previous research using the CRISPR-Cas9 technique to correct the DMD mutation in mice. The new research demonstrates how a wide range of mutations can be corrected in human cells by eliminating abnormal splice sites in genomic DNA.

Once the gene is successfully edited, it produces a significantly improved dystrophin protein, enhancing muscle tissue. Cardiac function returned to near-normal levels in the lab's human-engineered heart muscle tissue after less than half the muscle cells were corrected this way, the researchers reported in *Science Advances*.



The image depicts a CRISPR-Cas9 gene editing complex from streptococcus pyogenes. The Cas9 nuclease protein uses a guide RNA (ribonucleic acid) sequence to cut DNA (deoxyribonucleic acid) at a complementary site. Atoms are shown as color-coded spheres. Cas9 protein is in red, RNA gray-green color, DNA light red.



Dr. Eric Olson shows DMD patient Ben Dupree the dystrophin protein (red) produced in gene-edited heart muscle cells taken from Mr. Dupree's blood. A new study from Dr. Olson shows the CRISPR-Cas9 gene-editing tool can potentially correct a majority of the 3,000 types of mutations that cause DMD.

The CRISPR-Cas9 gene-editing tool uses an RNA strand to guide an enzyme called Cas9 to cut a specific area of DNA. Dr. Olson's lab worked to develop and test various guide RNAs that could lead the Cas9 enzyme precisely to 12 designated splice sites and avoid errant edits.

The researchers will continue testing their method to improve the precision of the guide RNAs and to ensure there are no adverse side effects, said Dr. Olson, who holds the Pogue Distinguished Chair in Research on Cardiac Birth Defects, The Robert A. Welch Distinguished Chair in Science, and the Annie and Willie Nelson Professorship in Stem Cell Research.

Children of hope

Patients with rare brain diseases help scientists open new doors for gene therapy

For children like 5-year-old Willow Canaan, UT Southwestern researchers are a last hope in their race against death.

Dr. Steven Gray searches for ways to use gene therapy to help children with extremely rare, deadly diseases.

The Mississippi girl has a rare genetic condition – multiple sulfatase deficiency – that kills many of its victims by age 10. The gene mutation prevents the body from filtering cellular waste, which then builds up, wiping out the nervous system as well as the ability to think and to walk.

Willow, along with children like Joseph Hann, 6, their parents, and supporters, are praying that faculty at UTSW's Peter O'Donnell Jr. Brain Institute can find cures for the rare but deadly neurological diseases that threaten their lives, but so often go ignored.

A UT Southwestern gene therapy program is playing a leading role in this effort, trailblazing a series of clinical trials for diseases in which a single gene missing from the patient's DNA can be packaged into a virus and delivered into brain cells.

The scientists have harnessed adeno-associated virus (AAV) as their best hope. Once the harmless virus is loaded with the missing gene, it is injected into fluid in the spine, allowing it to reach the brain.

To speed development and refinement of this therapy, the program has established one of the nation's few facilities to manufacture AAV for patient use.

"Our work here is changing medicine," said Dr. Steven Gray, who is coordinating with the Food and Drug Administration to arrange a clinical trial to test a treatment for Willow's disease, hopefully by late this year. "Now we're in a rather unique position to help families who may not have had much hope."

Dr. Gray, an Associate Professor of Pediatrics, Molecular Biology, and Neurology and Neurotherapeutics, is pioneering gene therapy treatments for other rare diseases as well. (Dr. Gray also has appointments in the Eugene McDermott Center for Human Growth and Development and the Hamon Center for Regenerative Science and Medicine.)

Joseph Hann, who suffers from a form of Batten disease that progressively takes away eyesight and mobility, is another of those young patients looking for hope at the gene therapy center.

Customizing a cure

UT Southwestern's gene therapy program is among the few of its type in the country that manufactures a special gene-delivering virus for clinical trials. The virus acts like a delivery truck to bring missing genes into a patient's cells to correct diseases. Here's how it works:

- **Geneticists manufacture an adeno-associated virus (AAV) in the lab.**
- **A gene missing from a patient's DNA is packaged inside the AAV.**
- **Two tablespoons containing trillions of viral particles are loaded into a syringe and injected into the spinal fluid of the patient.**
- **The virus solution spreads along the spinal cord to the brain. Along the way, individual virus particles bind to cells and get transported to the nucleus.**
- **The shell of the virus falls apart and releases the gene. The cell then converts the gene into a type of mini-chromosome that will reside permanently in the nucleus as its own piece of DNA.**

Willow Canaan, a 5-year-old gene therapy program participant

Success could lay the foundation for the more intricate gene editing of common brain conditions – ranging from epilepsy to autism – that involve multiple genes.

Dr. Berge Minassian, Professor of Pediatrics, Neurology and Neurotherapeutics, and Neuroscience, leads UT Southwestern's gene therapy program. Dr. Minassian also works with the Children's Medical Center Research Institute at UT Southwestern and holds the Jimmy Elizabeth Westcott Distinguished Chair in Pediatric Neurology.

"If we can fix one brain disease, it opens the door to treat literally thousands of diseases by delivering a single gene and essentially making the brain whole again," Dr. Minassian said.

A promising one-two punch to destroy deadly brain tumors

Cancer researchers at UT Southwestern may have identified a treatment for the most lethal and common form of brain cancer.

Their studies in mice show that a combination of two approved medications destroys glioblastoma, a difficult-to-treat type of brain tumor that is typically fatal in little more than a year. The drugs are currently used separately to treat lung cancer and arthritis.

"This could be a groundbreaking treatment," said Dr. Amyn Habib, a member of UT Southwestern's Peter O'Donnell Jr. Brain Institute and the Harold C. Simmons Comprehensive Cancer Center. "If it works in patients, then it will be an important advance."

The drug combination disables two proteins that help glioma cancer cells survive, the researchers found. The research, published in *Nature Neuroscience,* answers the decades-old question of why a treatment that can disable a protein common to various cancers and that has been effective in some forms of lung and colon cancer has not worked for glioblastoma.

Dr. Gao Guo, Instructor of Neurology and Neurotherapeutics, points to brain imaging that shows how a new treatment strategy destroys brain tumors in mice. Dr. Amyn Habib (right) led the research that he says may provide a groundbreaking treatment for glioblastoma.

The targeted protein – epidermal growth factor receptor – is found in the tumor cell's membrane and has been a traditional focus for fighting malignant tumors. But Dr. Habib's team found that when doctors use a medication that disables the protein/receptor, the brain produces a second protein to take over the receptor's function and keep the cancer cell alive.

The UT Southwestern study shows that blocking both the receptor and the tumor necrosis factor (TNF) protein produced in the brain destroys glioma tumors. It demonstrates how UTSW physician-scientists are using the genetics of disease – in this case the vulnerabilities of tumor proteins – to mine therapeutic targets.

UT Southwestern is working to fast-track this drug combination for clinical trials.

While Dr. Habib, Associate Professor of Neurology and Neurotherapeutics, is encouraged by the initial success of this protein-disabling strategy, he acknowledges that a cure may not be imminent since cancers tend to adapt to treatments.

"But if we can provide a remission or slowing of the disease and extend survival, that's a big advance in fighting this devastating disease," said Dr. Habib, also a staff physician at the Dallas Veterans Affairs Medical Center.

This research was supported by the National Institutes of Health and the Department of Veterans Affairs.

Pioneering less invasive surgical techniques

UTSW surgeons among world's first to heal aortic arch aneurysm with leading-edge technique

James Isbon, a 78-year-old from East Texas, made history last year when surgeons used an investigational minimally invasive procedure to repair his damaged aorta without cutting open his chest.

The surgery led by Dr. Carlos Timaran at UT Southwestern's William P. Clements Jr. University Hospital marked the second time this novel method had been used in the U.S. – and the seventh instance worldwide. Dr. Timaran is just one of two vascular surgeons nationally – and the only one in the Southwest – who has been granted an investigational device exemption by the Food and Drug Administration (FDA) to use the device involved.

Mr. Isbon, a grandfather from Payne Springs, had undergone a more invasive open-heart procedure in 1993 to repair a heart valve. He remembered the long and painful recovery that followed as his rib cage healed.

This time, Dr. Timaran, who performed the new procedure, repaired the aneurysm in Mr. Isbon's aortic arch through two small openings on Mr. Isbon's neck and two even smaller ones near the top of his thighs.

Credit: Cook Medical, Bloomington, Indiana

Image of aortic arch stent device

Using these openings, Dr. Timaran snaked small catheter tubes loaded with customized stent grafts through Mr. Isbon's arteries to his aortic arch and the three arteries that rise from it to carry blood to the arms, neck, and brain. The largest stent went into the aortic arch to carry blood past an aneurysm, or bulge, in that artery. Three smaller stents were placed in the three arteries branching off the aorta.

Making history last year, surgeons used an investigational minimally invasive procedure to repair a damaged aorta without cutting open the chest.

While Dr. Timaran can perform more of these surgeries, it may be years before the FDA approves it for general use. Dr. Timaran, Chief of Endovascular Surgery, also holds the G. Patrick Clagett, M.D. Professorship in Vascular Surgery. He has practiced at UT Southwestern since 2004.

"The traditional, standard repair involves open-heart surgery – splitting open the patient's breastbone, stopping the heart, connecting the patient to a bypass machine, cooling the brain, and then repairing the aneurysm," said Dr. Timaran, who performed the procedure along with Dr. Michael Jessen, who is Chair of Cardiovascular and Thoracic Surgery and holds the Frank M. Ryburn, Jr., Distinguished Chair in Cardiothoracic Surgery and Transplantation. "There's a prolonged recovery and a 10 to 15 percent mortality rate with that operation."

This new procedure is part of a trend to do more heart, valve, and artery repairs without cracking open the rib cage. Benefits include a shorter, less painful recovery; reduced scarring; and a safer procedure.

The four-stent device used was an improvement over an earlier version that allowed catheter-based repair of only two of the three arteries branching off the aorta. In that earlier procedure, in order to address the third branch, a surgeon would make an incision near the collarbone at the base of the neck and perform a bypass, increasing the risk of damage to the nerves, blood vessels, or lymphatic duct in that area, said Dr. Timaran, a UTSW Professor of Surgery.

The new device with three branches off the main one eliminates the need for that more invasive part of the procedure, he said.

Compared with his earlier open-heart surgery, Mr. Isbon's recent experience at UT Southwestern was remarkably easy. The only evidence of his May 18 surgery is small, roughly 1-inch scars on either side of his neck, and needle-sized scars on each thigh.

"I feel great for someone who has just gone through heart surgery," Mr. Isbon said as he prepared to leave the hospital five days later. "With this new procedure, the second day after the surgery I was up and moving around. It's amazing what they can do now."

Less invasive repairs for bypass open-chest surgery

Brad and Sharon Gale

Brad Gale had already endured open-heart surgery in 2003, along with the many weeks of recovery that followed. So when doctors told him he'd need more surgery – this time a heart valve replaced – he dreaded going through the ordeal again.

Fortunately, his cardiologist had heard about a surgeon at UT Southwestern who is one of the few in the country specializing in heart valve repair using less invasive techniques.

That surgeon, Dr. Neelan Doolabh, Director of Minimally Invasive Heart Valve Surgery, replaced Mr. Gale's aortic valve by entering through a 2-inch opening between the ribs rather than sawing down the sternum and cracking open the rib cage. "I didn't have any rib pain or chest pain," said Mr. Gale, a retired Lockheed Martin executive from Colleyville, Texas.

Dr. Doolabh, also Associate Professor of Cardiovascular and Thoracic Surgery, is among a select group of specialists who wield special, extra-long surgical tools through small incisions in the patient's side to replace valves, remove tumors, and repair holes and arrhythmias (irregular heartbeats) in ailing hearts.

If the patient is not a candidate for surgery, other surgeons and cardiologists are turning to collapsible heart valves, stents, and other devices that can be loaded onto a catheter tube and delivered to the heart by snaking the catheter up from the groin, through the arteries, and to the heart. The result?

"You're seeing fewer and fewer open-chest procedures performed," said Dr. Mark Link, Professor of Internal Medicine and a nationally renowned heart arrhythmia specialist who uses minimally invasive catheter techniques to treat arrhythmias. Dr. Link holds the Laurence and Susan Hirsch/Centex Distinguished Chair in Heart Disease.

In 2013, UTSW surgeons performed their first aortic valve repair using TAVR (transcatheter aortic valve replacement), and since then have placed more than 275 valves with the procedure. UT Southwestern also offers another catheter-delivered device, the MitraClip, to coax leaky mitral valves to close more tightly.

While not every heart-related issue can be repaired the less invasive way, these types of surgeries are on the rise.

"As a result, patient satisfaction is substantially improved and recovery times are vastly shortened," said Dr. Joseph A. Hill, Chief of the Division of Cardiology, Professor of Internal Medicine and Molecular Biology, Director of the Harry S. Moss Heart Center, and holder of the James T. Willerson, M.D. Distinguished Chair in Cardiovascular Diseases, and the Frank M. Ryburn, Jr. Chair in Heart Research.

UT Southwestern surgeons insert a new stent device through the groin vessels to repair an aneurysm of the aortic arch.

The device is made of Dacron reinforced with stainless steel and an alloy containing nickel and titanium. Surgeons and engineers use computer models of CT scans of the patient's aorta to customize each stent to fit the patient's arteries.

Mr. Isbon said he wasn't afraid to undergo such an innovative procedure. "The biggest thing that went through my mind was the gratefulness I had for the opportunity – that's because the alternative was to cut my chest open and I didn't want that."

Today, Mr. Isbon said he looks forward "to just being home, mowing my grass, feeding the birds and the cantankerous squirrels in my yard, and getting a few more years with my daughters, grandchildren, and three great-grandchildren. I thank the Lord – and my doctors – for giving me more time to do those things."

Machinery with a human touch

Amputees participating in UTSW neural interfacing study may help change the way robotic hand biofeedback occurs

Michael "Shawn" Findley, 45, lost his hand after a factory accident. Now, he's helping a UT Southwestern researcher and U.S. collaborators improve the way robotic hand biofeedback occurs. Ultimately, he hopes this research may lead to the closest thing to feeling in the hands of every amputee.

UTSW is taking a lead role in this effort to use electrodes implanted in a patient's arm to send messages between a robotic hand and nerves still functioning in the limb.

"Feeling your hand is absolutely the purpose here," said Dr. Jonathan Cheng, Associate Professor of Plastic Surgery and the head of the UTSW portion of the study. "For all of my other patients, being able to feel with their hand is mandatory. It should be no different for patients using robotic hands."

Dr. Cheng and his colleagues from six teams across the country believe the body's neural communications pathway – even after it has been severed – can be tapped into using an artificial messaging bridge. In their research, electrodes placed within the nerves create that bridge, and testing has advanced from the laboratory to human clinical trials.

Mr. Findley, who lives in Mount Pleasant, Texas, was fitted with a prosthetic hand after a 2005 fabrication shop accident. The injury, which left him with mangled and amputated fingers on his left hand, eventually led to amputation at the midforearm.

He joined Dr. Cheng's neural interfacing study in late 2017. At UT Southwestern's William P. Clements Jr. University Hospital, Dr. Cheng implanted electrodes into Mr. Findley's residual limb. Afterward, the study participant drove to Dallas weekly to take part in the research. His tasks included relearning how much fingertip pressure it takes to pick up small weights.

Researchers believe the body's neural communications pathway – even after it has been severed – can be tapped into using an artificial messaging bridge.

With injured soldiers in mind, the U.S. Defense Advanced Research Projects Agency (DARPA) funds robotic hand research. Two promising robotic hands have emerged, Dr. Cheng said, but they have not yet proved practical because patients cannot feel with them or control them naturally. Dallas residents Jane and Bud Smith have given financial support for this research.

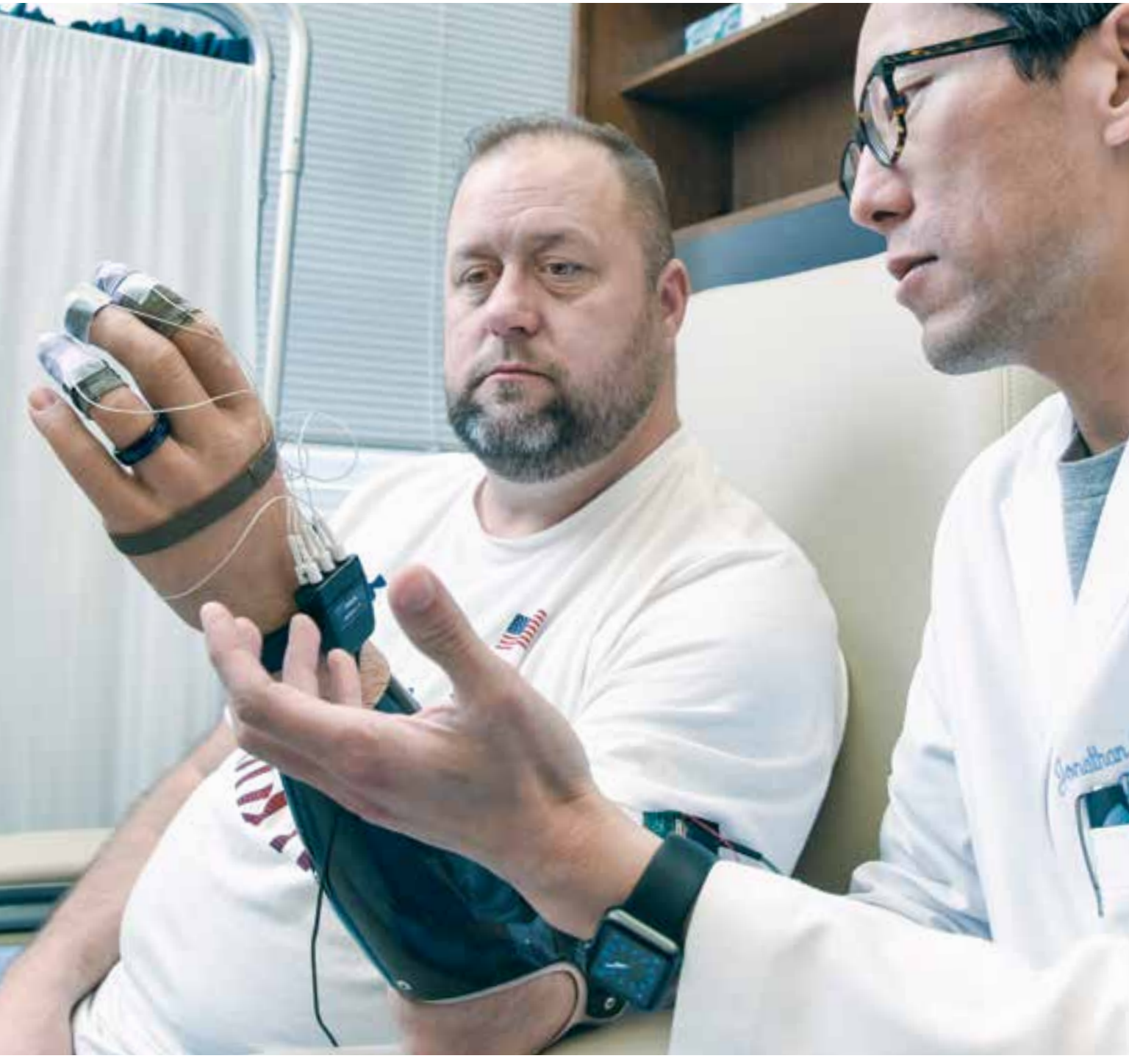
DARPA sponsorship of this project is part of the federally funded BRAIN initiative and comes to UTSW through Nerves Inc., a Dallas-based company that researches nerve injury and repair. Dr. Cheng is a founder and

investor in that company while Dr. Edward Keefer of Nerves Inc. is the Principal Investigator of the multidisciplinary team. The research is part of the federal government's Hand Proprioception and Touch Interfaces (HAPTIX) program.

For Mr. Findley, who served in the military from 1993 to 1999 and whose 20-year-old son is a Marine, his contribution is a duty and an honor.

"You hope they all stay out of harm's way, but you want to have done what you could," Mr. Findley said, his voice catching with emotion. "You've got to have someone willing to do this, and I'm here for as long as they want me."

Dr. Jonathan Cheng visits with Michael "Shawn" Findley, an amputee participating in the study at UT Southwestern. Dr. Cheng and his collaborators are investigating whether tying into residual nerves can serve as a bridge in re-establishing "feel" in prosthetic hands.



Kiara Connley, who woke up one morning paralyzed by a rare autoimmune disease, learns to walk again using an exoskeleton at UT Southwestern.

Exoskeleton technology enables those paralyzed to walk again

Kiara Connley was a thriving college student when she started noticing weakness, pain, tingling, and numbness in her joints, along with lost vision in her left eye. Soon after, she woke up paralyzed from the waist down.

The young woman was diagnosed with transverse myelitis, a rare inflammatory disease that damages the spinal cord. She was forced to put her studies on hold as she focused on recovery and had to use a wheelchair and rely on help from others to get through the day.

It took a strong resolve and spirit to reclaim her life – but Ms. Connley also gives credit to the physical therapy she received at UT Southwestern using a device called an exoskeleton.

An exoskeleton is a robotic suit used to treat patients with leg paralysis. The framework of braces and assistive technology does what a patient's own muscles and nerves cannot – support and move the legs. The suit assists a patient's leg muscles so they can relearn correct step patterns, walk with proper support and posture, and master other skills essential to regaining mobility.

It is one of today's most advanced and promising therapeutic rehabilitation tools.

UT Southwestern's Department of Physical Medicine and Rehabilitation recently acquired two exoskeleton robotic suits with support from the A.L. Chilton Foundation. Established in 1945 in Texas by A.L. and Leonore Chilton, the Foundation has made gifts totaling more than $6.25 million to support programs and research at UTSW.

"The exoskeleton has helped transform my body," Ms. Connley said. "My posture has done a complete turnaround. I no longer walk hunched over, and my leg muscles are stronger and allow me to stand more firmly on the ground."

Ms. Connley is back in college and able to walk slowly without assistance. She dreams of becoming a physical therapist and helping others, just like her care team at UT Southwestern provided guidance and support on her journey.