ADVANCED MEDICINE & HEALTHCARE SOCIETY

FALL 2026

ADVANCES

Newsletter on the frontiers of medicine



Locust Walk in autumn. Photograph by Civiclens123.

Editor’s note

While writing my pieces for this newsletter, I kept trying to ask myself what to say in the editor’s note. More importantly, what made me want to do this debut issue in the first place.

I remember that whenever I had random questions about science or biology as a kid, I would ask my older brother, borderline incessantly. He’d explain the ideas, CRISPR when it first emerged in 2012, or the immune system, in a way my 13-year-old self somehow grasped. Years later, when I learned the content on my own, I realized what he did was a skill of its own: translating the fascinating parts of science for a new learner.

Without him, I might have found the life sciences hieroglyphic, knowing they held something important, but just out of reach. I think that need for translation is in every stage of life.

This debut newsletter sets out to do that across a variety of fields. I hope it captures the curiosity I felt as a kid too.

— Sajid Huq

Class of 2027 · Chief Editor

IN THIS ISSUE

Cancer immunotherapy 03

Transplant science 04

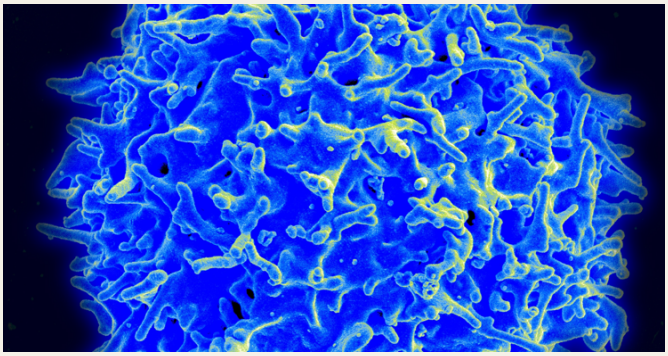
Neurotechnology 05

Pediatric cardiac care 06

Genomic medicine 07

01 / CANCER IMMUNOTHERAPY

Culturing Effective Lymphocytes: What's Different This Time?



A new streamlined standard to get tumor-infiltrating lymphocyte therapy towards broader clinical use

Healthy human T cell, colorized electron micrograph. NIAID / NIH.

Medicine has often been recognized by moments of discovery: Fleming's finding of penicillin in 1928,[1] or the use of insulin from an animal pancreas in 1921.[2] However, not as glamorous are the following years and decades of research to escape the bottleneck from intensive lab findings to large-scale distribution.

Iovance Biotherapeutics may have made that escape with its streamlining of a well-known immunotherapy, Tumor-Infiltrating Lymphocytes (TIL). Their novel standardized manufacturing process of TIL therapy, Lifileucel, became the first to receive accelerated FDA approval for a solid tumor.[3]

What exactly is TIL? The practice of extracting and culturing the effective white blood cells of cancer patients is not unheard of. In fact, the concept had been around from 1986 by Dr. Steve Rosenberg and his group.[4]

Rosenberg had found that these cells, lymphocytes, are often buried in cancerous tumors, yet remain effective against the cancer. As the extracted lymphocytes culture outside the body, chemotherapy would deplete the current immune system, creating "space" for the incoming lymphocytes. The team had continually scaled up clinical trials and found promising cases of tumor regression in humans.[4]

So what exactly made Lifileucel unique enough to attain accelerated FDA approval? Rather than a single pivotal change, its beauty lay in the compounding efficiencies at each step. To begin, a surgeon removed a portion of metastatic melanoma and sent it via cold transport to a central facility. This already reduced time compared to samples being sent to their various corresponding academic facilities. From then, the tumors are minced and the TILs are grown in a pre-set two-phase growth regimen instead of the previous "grow until ready" approach,[3] significantly reducing time spent. After which, the expanded TIL product is tested for viability before its delivery and final "one-shot" usage by the patient rather than a multi-round model typically used.

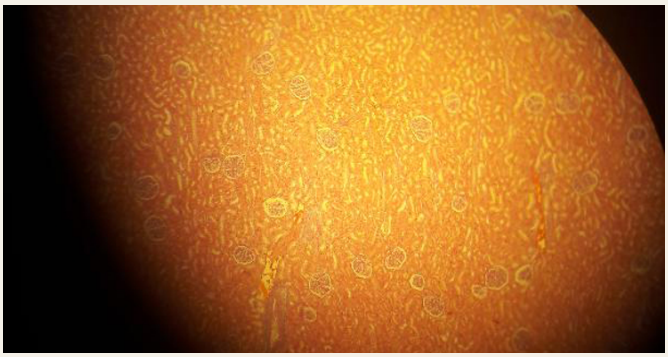
Currently, trials are sprouting following the Lifileucel framework for other solid tumors. Through further testing, perhaps the vast majority of solid tumors can be quickly combatted with a centralized system utilizing this framework.

SOURCES AND NOTES

1. Science History Institute. "Alexander Fleming." sciencehistory.org
2. UMass Medical School. "The First Human Insulin Injection to Treat Diabetes." umassmed.edu
3. FDA. "FDA Approves First Cellular Therapy for Metastatic Melanoma." fda.gov (Feb. 16, 2024)
4. AACR. "Boosting the Immune Response to Cancer." aacr.org

02 / TRANSPLANT SCIENCE

Pig Kidney Bridge Transplant



The first case of human kidney to xenotransplant and back

Kidney tissue under light microscopy. Borislav Yanev.

Xenotransplantation can, at first, sound almost like science fiction. However, it's been done for more than a century, and successfully so in the recent past. The term itself means the transplantation of one species' cells, tissues, and organs to another species. With so many people waiting for life-saving organ transplants, the process provides a way, whether temporary or permanent, to meet the demand.

This means that even if the transplant doesn't pan out to be a permanent replacement for a patient's kidney, it can serve in its stead for the time needed to get a human donor kidney. This process of original patient kidney to kidney xenotransplantation back to human donor kidney had never been observed until recently.

Tim Andrews, 66, was the first case of a patient receiving a pig kidney xenotransplant and then returning to a human donor kidney. Andrews had end-stage kidney disease and received a pig kidney xenotransplant. The pig kidney functioned well, albeit with a T-cell mediated rejection early on that was negated with treatment. Andrews, in fact, became the longest person with a pig kidney without dialysis, at 271 days, approaching the record set in 1964 by Edyth Parker, a Louisiana teacher.

The team that developed the pig kidney, eGenesis, had three component strategies that assured the kidney was received well. Firstly, cells in any organism have sugar tags on their surface, important for the complex, coordinated cell-to-cell communication. However, while our body grew to recognize our own sugar tags, it hadn't done the same for pig cells. This led to the removal of these glycan xenoantigens from the pig kidney. Secondly, pigs coexist with certain viruses that are embedded in their genome, called Porcine Endogenous Retroviruses (PERVs). Bringing those viruses into human bodies would be catastrophic. Therefore, the team had to inactivate the scattered viral sequences from the pig's genetic data. Finally, in order for the pig kidney to be received well, "positive" or "friendly" signals need to be given by the pig. This was done by inserting human transgenes into the genomic data of the pig kidney.

Before receiving the human donor kidney, he underwent dialysis briefly, after which his new kidney functioned well post-operation. Concerns about an oversensitized immune system from the pig kidney were eased, and his immunosuppression regimen was cut down to a third of what it was for the pig kidney.

More than 100,000 patients wait on the national transplant waiting list for life-saving organ transplants. In fact, 86% of the list are waiting for kidney transplants. Andrews serves as a hope for current and future patients in serious need of a kidney transplant.

SOURCES AND NOTES

1. Donate Life America. 2025 NDLM Donation and Transplantation Statistics. donatelife.net

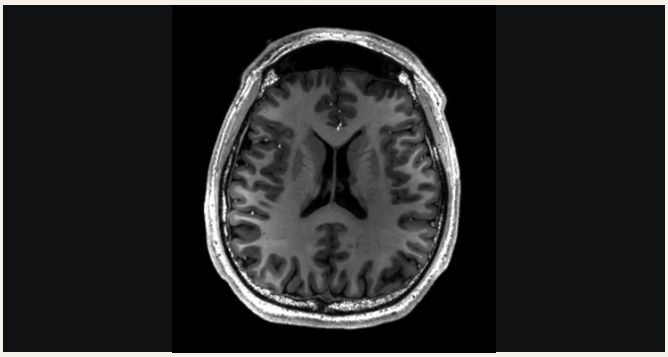
2. Riella LV, et al. "Pig Kidney Xenotransplantation as a Bridge to Human Transplant." The Lancet. Sept. 3, 2026. DOI: 10.1016/S0140-6736(26)01295-X

3. Reemtsma K, et al. Annals of Surgery, 1964; National Academies Press, Xenotransplantation: Science, Ethics, and Public Policy, 1996.

4. eGenesis. EGEN-2784 pipeline; The Lancet abstract, Sept. 2026.

03 / NEUROTECHNOLOGY

Synchron BCI’s: A Friendlier Cousin To Neuralink?



Synchron debuts a less-invasive brain-computer interface

Healthy human brain, 7-tesla MRI. Context image; no implant shown. Asnaebsa.

“Your soul is not in your body. Your body is in your soul.” — Alan Watts

The British-American philosopher spoke those words during one of his lectures. It makes one question what the body is. Is it the physical tissue that responds to our mind? Perhaps it isn’t. It could be whatever our mind extends to. This extension of one’s mind is a goal of Brain-Computer Interfaces (BCI).

In June 2026, the biotech company Synchron announced its Stentrode BCI had been implanted in 100 individuals across the United States, Australia, and the United Kingdom.[1] This was the first instance of triple-digit patients who’ve received BCIs without open-brain surgery. In that same summer, Nature Medicine published a study encompassing the story of Casey Harrell, a 47-year-old with ALS who was able to successfully use this BCI for two years.[2]

The concept of an interface between brains and computers has actually been around since 1924, from Hans Berger’s first EEG recordings.[3] However, the complexity of that interface and its functions have grown considerably in the recent past. In fact, the global count for BCI implants only crossed 40 this year.[1]

The main differentiating factor of Synchron’s Stentrode BCI is its non-invasiveness. The implant is applied endovascularly, where it is threaded through brain blood vessels to its desired location. This is instead of open-brain surgeries that other implants, such as Neuralink, use.[1] Such levels of invasiveness can introduce complications and accordingly run on a different regulatory track.

Another important feature was how Harrell’s implant massively increased the accessibility of the implant, as it didn’t require close supervision. Previously, using the BCI successfully needed a research team to set it up. In Harrell’s two-year use, the system had decoding algorithms that translated neural signals to text through a speech BCI and cursor movement through a movement BCI. The system functioned well and didn’t have any reported complications over its 3,800-hour usage.[2]

Synchron has a final trial before applying for pre-market approval of a permanently implanted BCI in the United States. It would be the first FDA-approved BCI for motor restoration.[1] Alan Watts’ words from earlier ring true. The body is wonderfully a dynamic idea, and BCIs attest to that.

SOURCES AND NOTES

1. Synchron. “Synchron Reaches 100-Patient Milestone.” neurotech.com (June 9, 2026)

2. Harrell C, et al. Nature Medicine. June 15, 2026.

3. Rossini PM, et al. “1924–2024: First Centennial of EEG.” Clinical Neurophysiology, 2025.

04 / PEDIATRIC CARDIAC CARE

Autus Valve: A Medical Device That Grows Along With Its User



An adjustable pulmonary valve could change the timeline of heart surgery for children growing into adulthood.

Anatomical heart etching by Charles Bell, 1811. Wellcome Collection.

Done too early, a chain of open-heart surgeries is started sooner than needed. Done too late, the heart can be damaged beyond repair. Parents and clinicians of children with congenital heart diseases are met with this challenging decision. How does one act when the treatment and the disease are both quite invasive?

The recent FDA approval of the Edwards Lifesciences Autus surgical pulmonary valve on October 1, 2026, may prevent that decision from being made in the first place.[1] It is the first approved adjustable heart valve that grows alongside the patient. Additionally, it is the first approved use of polymeric leaflet material in valves, as opposed to biologically derived material.

Usually, children with congenital heart diseases outgrow their implanted heart valves and, as such, have to replace them. Oftentimes, these children can have up to four open-heart surgeries before adulthood.[2] In a long-term outcomes study published in Congenital Heart Disease, children with more than three open-heart surgeries have a significantly higher risk of mortality compared to those with fewer than three.[3] The FDA also reported that previous valve models were prone to hardening and breakage due to being composed of biologically derived material.

The Autus Valve was developed at Boston Children's Hospital and first used on a patient in 2021 through a clinical study.[1] The Autus model also differs from other valves by having two leaflets instead of the usual three. Edwards Lifesciences purchased Autus Valve Technologies in February 2026 for $128.9 million.[1]

The combination of adjustability, more resilient polymer leaflet material, and a two-leaflet design provides a way to sidestep the practice of intermittent open-heart surgeries to replace valves and all the risk that comes with them. Emile Bacha, MD, surgeon-in-chief at NewYork-Presbyterian/Columbia University Irving Medical Center and a professor of surgery at Columbia University Vagelos College of Physicians and Surgeons, explains how "The Autus valve gives congenital heart teams a new way to think about long-term care planning for pediatric patients who may otherwise face multiple surgeries."[1]

The valve itself can be implanted with a diameter as small as 13 mm, designed for toddlers and preschoolers. The FDA mentions how an inflatable catheter can be non-invasively used to expand the valve up to a diameter of 22 mm, approximately an adult-sized valve.[1]

The FDA clinical trial enrolled 62 pediatric patients across 12 US sites. The six-month point showed 60 patients to have good hemodynamic performance. The valve implantation procedure itself did not result in any mortality, strokes, or clot-related complications. One-year follow-up data indicate the polymer leaflets hold up over time. Later complications that did not result in symptoms included three patients whose valve frames fractured and two others who had reduced movement of their leaflets.[1]

The Autus Valve provides a new opportunity. Furthermore, with patient monitoring over ten years, the results can refine other more resistant and durable polymer leaflet valves. In the coming years, the mass distribution of these valves to children's hospitals can help clinicians and parents avoid having to hedge clinical probabilities for these children.

SOURCES AND NOTES

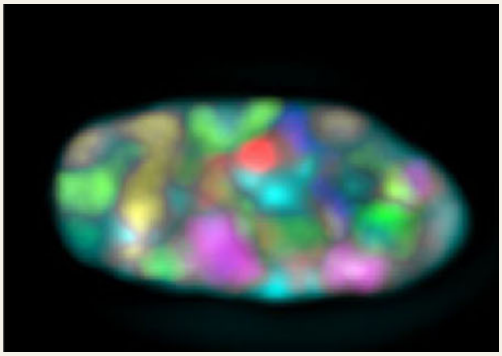
1. Fornell D. "FDA Approves First Heart Valve That Grows With Children." Cardiovascular Business. Oct. 1, 2026. cardiovascularbusiness.com

2. Burch G, MD. OHSU Doernbecher Children's Hospital. Via Medical News Today. medicalnewstoday.com

3. Techscience.com. Congenital Heart Disease, Vol. 17, Issue 3. DOI: 10.32604/CHD.2022.047611

05 / GENOMIC MEDICINE

Base-Edited Baby: A New Framework For Rare Genetic Disorders



A personalized base-editing treatment offers a new framework for addressing rare single-gene disorders.

Human chromosome territories labeled by fluorescence microscopy. Context image; not an edited patient sample. Bolzer et al.

CPS1 deficiency is a rare genetic disorder where a liver enzyme in our urea cycle, massively important for detoxification in our body, becomes non-functional. Without treatment, the condition is quickly lethal. Symptoms present as sleepiness, dysregulated breathing, seizures, or comas. The typical approach was to source a liver transplant; however, knowing the immense demand on the limited supply of organ donor lists, that option had its constraints.

Clinicians and researchers at the Children's Hospital of Philadelphia and Penn Medicine took a different route using CRISPR gene editing. They had initially discovered that baby KJ had CPS1 deficiency from CHOP's Baby Eagle Initiative, a test offered by the hospital that sequences the infant's entire genome.[1] The team's strategy differed from typical CRISPR gene editing. Instead, they used base editing, where only a single base pair of DNA was changed, akin to changing just a letter to fix a typo as opposed to trying to replace the whole word itself. This approach minimized unintended genetic changes.[2]

This process to create the personalized drug took just six months. KJ received the first dose in February 2025, when he was six to seven months old.[2] After follow-up doses in March and April, KJ's appetite normalized and his resilience to colds improved, as colds can worsen CPS1 symptoms. After spending his first ten months at CHOP, baby KJ was discharged in June, later spending his first birthday, first steps, and first Christmas at home with his family.[3]

A few aspects of the research team's strategy lend themselves to addressing rare genetic disorders in the future. The first, as mentioned, was base editing, where instead of cutting out DNA segments, a single base pair is chemically changed to the desired base pair. Secondly, the speed of the timeline, six months, is thanks to the lipid nanoparticle delivery system and the efficient manufacturing process.[2] These together comprise a generalizable framework that can be hopefully applied to other infants with rare single-gene metabolic disorders.

SOURCES AND NOTES

1. CHOP Omics Initiative. "Baby Eagle Program." chop.edu

2. Ahrens-Nicklas R, Musunuru K, et al. New England Journal of Medicine. May 15, 2025. DOI: 10.1056/NEJMoa2504747

3. CHOP. "KJ Stepping into the Holidays After a Milestone Year." chop.edu

The future of medicine is a work in *progress.*

ABOUT AMHS

The Advanced Medicine & Healthcare Society is a student organization at the University of Pennsylvania connecting students with emerging developments, innovators, and ideas across medicine and healthcare.

IMAGE CREDITS

Cover Locust Walk · Civiclens123 · CC BY 4.0

01 T cell · NIAID / NIH · Public domain

02 Kidney microscopy · Borislav Yanev · CC BY 4.0

03 Brain MRI · Asnaebsa · CC BY-SA 4.0

04 Heart etching · Charles Bell / Wellcome · CC BY 4.0

05 Chromosomes · Bolzer et al. · CC BY 2.5

Images cropped or resized; selected heart and chromosome panels. Image licenses apply to the images.

EXPLORE THE CLUB

groups.universitylife.upenn.edu/amhs/initiatives/