

FY2022

YEAR IN REVIEW

PENN CENTER
FOR INNOVATION



A MESSAGE FROM THE MANAGING DIRECTOR

Welcome to PCI's FY22 Year in Review! The past fiscal year at Penn and PCI was one of both continued success and momentous transition. PCI joined with the rest of the Penn community in welcoming a gradual return to more normal operating conditions as the worst of the COVID-19 pandemic began to ease over the course of the fiscal year. It has been wonderful to finally see staff, clients, and friends in person again! On a truly bittersweet note, FY22 also marked the close of an unprecedented era at Penn. After nearly two decades, President **Amy Gutmann** completed her tenure as the longest serving Penn President in the University's history. Dr. Gutmann's leadership, vision, and encouragement throughout her multiple concurrent terms as President resulted in enormous growth in innovation at Penn and made the creation of the Penn Center for Innovation possible. We owe an incalculable debt of gratitude to Dr. Gutmann for her leadership, support, and vision, and wish her the best in all her future undertakings.

This past fiscal year continued to prominently highlight the global impact of Penn's innovation prowess. Inside this report you will learn more about the many different ways that PCI catalyzed **another record-breaking year for commercialization activity at Penn** across multiple different technology sectors; further extending and expanding Penn's already prodigious global technology and innovation impact. As one highlight, Penn expertise and intellectual property directly impacts **over 20 currently approved drugs** that are providing life-changing benefits to millions of patients worldwide. This ever-growing list of approved treatments includes the two most widely-deployed COVID vaccines currently available, Comirnaty® and Spikevax®, both of which rely upon foundational mRNA technology discovered at Penn by Dr. Drew Weissman and Dr. Katalin Kariko.

At the time of Dr. Weissman and Dr. Kariko's discovery nearly two decades ago, it would have been nearly impossible to predict the immense and unprecedented impact their invention would eventually have on worldwide health in the context of a global pandemic. But that is precisely what is so important about academic technology commercialization in direct support of promising early stage technologies at world class research institutions like the University of Pennsylvania. **By encouraging, protecting, and seeking development partners for hundreds, if not thousands, of discoveries and inventions before it has become fully apparent that they will actually become products and make a societal impact, university programs like PCI play a critically important role in the overall continuum of technology development.** And when these types of activities in support of faculty innovation are effectively managed across decades of inventive output, the results are reflected in the contents of reports like this.

Of course, none of these accomplishments or successes would be possible without the incredible ideas and inventions generated every day by the faculty and other innovators across Penn, the incredibly hard work of the entire PCI staff, our outstanding clients and partners, and the consistent support and partnership from Penn's executive leadership and the board of trustees. A warm welcome to incoming President Liz Magill and a sincere thank you to all!



John S. Swartley, MBA, PhD
Associate Vice Provost and Managing Director of
the Penn Center for Innovation

MAJOR ACCOMPLISHMENTS

>2.5 billion

Penn-licensed mRNA vaccine doses administered globally

929

Highest numbers of Penn patents filed in a single year

>\$1B

Largest amount of annual revenue generated from the commercialization of IP in Penn's history

\$560M

Funds raised or received by Penn-affiliated startups

#1

Emerging Startup Ecosystem in the U.S.
(Startup Genome, 2020)

x2

New jobs created by Philadelphia-based companies in the field of cell and gene therapy have doubled since 2019 to 10,500

(Cell and Gene Therapy and Connected Health Workforce Analysis)

#7

On Top 10 List of Biopharma Clusters
(Genetic Engineering & Biotechnology News, 2021)

\$8B

Venture Capital Raised in the Greater Philadelphia Region in 2021
(Pitchbook NVCA Venture Monitor)

Recupero Robotics launches

Michelle Johnson, PhD, a faculty member affiliated with both Penn Engineering and Penn Medicine, along with two of her former students, Roshan Rai and Suneet Sharma, were awarded a patent for their foundational Robotic Physical Therapy System ([US 11,090,528](#)). The invention gathers data from a patient performing exercises using a robotic rehabilitation system and analyzes this information to help medical practitioners determine and optimize the patient's future course of treatment. Dr. Johnson and a team of collaborators have launched [Recupero Robotics](#) with the help of PCI Ventures to further develop this robotic system and hopefully bring it to market for broad patient benefit. Recupero Robotics recently won a fast track SBIR grant to support early development of the technology ([SBIR 1R42HD104325](#)) and has exclusively optioned the associated Penn patent rights.

Carisma Therapeutics continues to thrive and expand

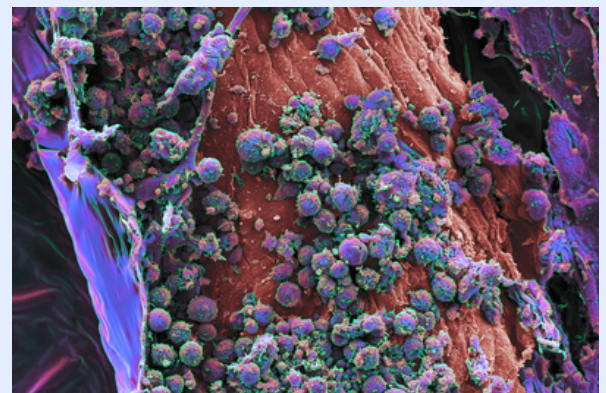
[Carisma Therapeutics](#) (Carisma), an exciting Penn startup developing engineered monocytes and macrophages for the treatment of cancer, had several notable accomplishments this past fiscal year. The company developed a strategic collaboration with Moderna to discover, develop and commercialize in vivo engineered chimeric antigen receptor monocyte (CAR-M) cancer therapeutics. Under the terms of the agreement, Carisma received a \$45 million up-front cash payment and an investment by Moderna in the form of a \$35 million convertible note. Carisma will also receive research funding from Moderna and is eligible to receive development, regulatory, and commercial milestone payments, plus royalties on sales of any products that are commercialized under the agreement.

Vivodyne named #1 “Small but Mighty” Company

[Vivodyne, Inc.](#), a Penn Bioengineering startup creating a platform technology to improve the accuracy, speed, and breadth of the modern drug development pipeline that was co-founded by Penn Engineering's Dan Huh, PhD, was named the world's most innovative company on [Fast Company's Small but Mighty Companies list for 2022](#). Launched in 2021, Vivodyne's lab-grown human organ tissue platform allows fully automated complex studies to be performed at a far larger scale and lower cost than manual experimentation. In addition, the platform has the potential to reduce, and possibly replace, pharmaceutical companies' traditional reliance on animal-testing as part of the drug-development process. The company, which raised \$4 million in seed funding from [Kairos Ventures](#) last year, has licensed the underlying technology from Penn, including two recently issued foundational US patents ([US 11,066,633](#) and [US 11,248,199](#)). Vivodyne's instruments may eventually play a pivotal role in the clinical testing of many different drugs and vaccines for the treatment and prevention of a variety of human diseases and conditions, including respiratory disease, cancer, diabetes, and maternal medicine.

929

Patent applications filed; 110 U.S. Patents issued



Vivodyne's lab-grown human tissues

Commercializing Innovation

Abrax Japan licenses technology from Penn

Abrax Japan, a company co-founded by Taku Kambayashi, MD, PhD, Associate Professor of Pathology and Laboratory Medicine at Penn Medicine, entered into an exclusive licensing agreement for certain Penn-owned inventions relating to the therapeutic effects of thymic stromal lymphopoietin (TSLP) developed in Dr. Kambayashi's laboratory at Penn. Under the terms of the agreement, Abrax Japan secured exclusive global rights to the technology for the treatment and prevention of skin and scalp ailments and disorders including eczema and for the treatment and prevention of lipid metabolism disorders, including hypercholesterolemia, hypertriglyceridemia, and obesity.

IBA partners with Penn Medicine to develop flash therapy

IBA, a company developing and marketing particle accelerator technology worldwide, partnered with a team of faculty from Radiation Oncology at Penn Medicine led by James Metz, MD, Chair and Professor of Radiation Oncology, to advance research in ConformalFLASH®, a novel method combining ultra-high dose rate of proton FLASH radiotherapy and the unique Bragg Peak properties of protons. This new initiative represents another important milestone in the long-term collaboration between IBA and Penn and it has the potential to deliver a true paradigm shift in radiation therapy and cancer treatment.

Cleantech innovation for CO2 capture moves forward through Heirloom Carbon Technologies

PCI, along with technology commercialization personnel from Columbia University & the University of British Columbia, completed a license agreement with Heirloom Carbon Technologies, a San Francisco based startup that recently announced the close of their \$53M Series A financing round. Heirloom is employing natural processes to engineer cost-effective direct air capture solutions for removing CO2 from the atmosphere. The Penn licensed technology, an enhanced weathering cycle that utilizes magnesite (MgCO3) feedstock for efficient CO2 capture and removal, was developed at Penn Engineering by Jennifer Wilcox, PhD, Presidential Distinguished Professor of Chemical Engineering and Energy Policy and PhD graduate Noah McQueen (co-founder & now head of research at Heirloom).

Neuralert's first product receives FDA Breakthrough Designation

Neuralert Technologies, a startup spun out of Penn Medicine and Penn Engineering that was co-founded by Steven Messé, MD, Penn Medicine Physician and Professor of Neurology and James Weimer, PhD, Assistant Professor in the Department of Computer Science at Vanderbilt University (previously at Penn), is developing technologies and products to help address the problem of late or undetected stroke in hospitalized patients. The Penn co-founders created technology that uses non-invasive, wearable devices to continuously monitor at-risk hospitalized patients for stroke symptoms and, in the event of a potential stroke, automatically alert clinical staff resulting in more rapid assessment and treatment of the patient. The Center for Devices and Radiological Health (CDRH) of the Food and Drug Administration (FDA) has designated the lead Neuralert product candidate as a Breakthrough Device, further accelerating its clinical development as a device to “detect the onset of asymmetric movement in hospitalized patients with medical conditions or procedures that are established risks for stroke and who have no baseline asymmetric upper extremity weakness.”

739

Executed commercial agreements; >\$1 B in revenue received in FY22 from the commercialization of Penn-owned IP



Photo from Heirloom Technologies

Commercializing Innovation

Penn's Gene Therapy Program signs manufacturing partnership with the Center for Breakthrough Medicines

The [Center for Breakthrough Medicines](#) and [Penn's Gene Therapy Program](#) (GTP), led by James Wilson, MD, PhD, Director of the GTP and Rose H. Weiss Professor of Medicine and Pediatrics, entered into a multi-year collaboration focusing on the manufacturing and testing of modern gene therapy processes and products.

The renewable research and development collaboration facilitated by PCI combines Penn's expertise in gene therapy development with the King of Prussia-based center's growing manufacturing capacity. The partnership will also ideally help other small biotech firms, universities, and large pharmaceutical companies in advancing gene therapies from discovery to human testing with the potential for less risk and expense.

363
New invention disclosures



Daniell's chewing gum

Developing a chewing gum to reduce the incidence of Covid-19

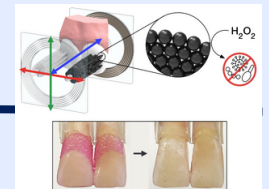
A chewing gum impregnated with a plant-grown protein may serve as a "trap" for the SARS-CoV-2 virus, theoretically reducing viral load in the chewer's saliva and potentially tamping down transmission, according to work led by Henry Daniell, PhD, Professor of Biochemistry at Penn's School of Dental Medicine and performed in collaboration with scientists at Penn Medicine, Penn Vet, The Wistar Institute and Fraunhofer USA. "SARS-CoV-2 replicates in the salivary glands, and we know that when someone who is infected sneezes, coughs, or speaks some of that virus can be expelled and reach others," says Daniell. "This gum offers an opportunity to neutralize the virus in the saliva, giving us a simple way to possibly cut down on a source of disease transmission." The discovery could lead to a low-cost preventative weapon in the arsenal against the COVID-19 pandemic, and PCI is now working with Dr. Daniell and the Penn School of Dental Medicine to spin the technology into a startup company.

Wellcome Leap Funds Penn to develop "on-demand" manufacturing technology for RNA-based vaccines

With support from PCI, Penn Engineering secured a multi-million-dollar contract with [Wellcome Leap](#) under the organization's \$60 million RNA Readiness + Response (R3) program, a jointly funded initiative with the Coalition for Epidemic Preparedness Innovations (CEPI). Through their participation in the program, Penn Engineers aim to create "on-demand" manufacturing technology that can produce a range of RNA-based vaccines.

The Penn Engineering team includes Daeyeon Lee, PhD, Evan C Thompson Term Chair for Excellence in Teaching and Professor in Chemical and Biomolecular Engineering, Michael Mitchell, PhD, Skirkanich Assistant Professor of Innovation in Bioengineering, David Issadore, Associate Professor in Bioengineering and Electrical and Systems Engineering, and Sagar Yadavali, a former postdoctoral researcher in the Issadore and Lee labs and now the CEO of Penn startup InfiniFluidics. Penn Medicine's Dr. Drew Weissman, whose foundational discoveries play a vital role in mRNA-based COVID-19 vaccines, is also a part of this interdisciplinary team.

Tooth-brushing microrobots



Penn researchers invent microrobots to brush teeth

Researchers at Penn, led by Michel Koo, DDS, MS, PhD, founding Director, [Center for Innovation & Precision Dentistry](#), and Edward Steager, Research Investigator in Penn Engineering's [GRASP Lab](#) have developed a hands-free system of shapeshifting microrobots to help automate the process of brushing and flossing teeth. In a fascinating proof-of-concept study, a robotic microswarm of nanoparticles, arranged in bristle-like structures, effectively cleaned plaque and decay-causing bacteria from both mock and human teeth.

Penn Engineering Lab develops next-generation drug delivery technologies

PCI is actively supporting the Penn Engineering research program of Mike Mitchell, PhD, the J. Peter and Geri Skirkanich Professor of Innovation in the Department of Bioengineering, who leads a lab focused on the interface of biomaterials science, drug delivery, and cellular and molecular bioengineering to target and overcome biological barriers. Current lab projects include the development of next-generation lipid nanoparticles (LNPs) for the delivery of mRNA, siRNA, and gene editing therapeutics. Dr. Mitchell's laboratory has numerous ongoing research partnerships facilitated by PCI to support new therapeutic solutions with several commercial entities.

Connecting Innovation

Press Highlights of FY22

Penn Today recognizes PCI for its landmark fiscal year in 2021 & celebrates Pennovation Works' 5th Anniversary

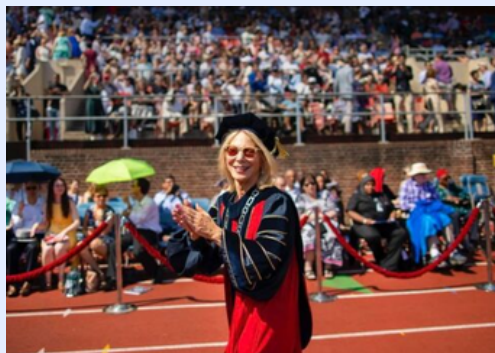
With its highest number of patents issued, commercial agreements, corporate-sponsored research funding, and licensing revenue receipts in a single period, PCI had a record breaking fiscal year in 2021.

The year's high number of issued patents is "a testament to the strength of the science and the creativity of Penn researchers," said John Swartley, associate vice provost and PCI managing director. "We would not be able to do that if we didn't have this exceptional, inventive talent at the University faculty level."

Moving forward, Swartley said he hopes to see PCI's successful model continue to prosper and build on the strong foundation put in place during the past decade, with specific goals that include finding new ways to support early-stage projects and expanding their physical sciences portfolio.

President Amy Gutmann Celebrates Record Tenure of Nearly 18 Years

Penn President Amy Gutmann celebrated a record tenure of nearly 18 years at Penn in 2022. Not only did Gutmann spearhead the creation of a broad and robust innovation ecosystem at Penn and in the Philadelphia region, but her support and vision was absolutely vital to the creation of both PCI and Pennovation Works.



Former President Amy Guttman

98
Press mentions
for PCI
programs,
startups and
partners

Philadelphia Inquirer shines its spotlight on Penn mRNA Research

In 2005, Penn biochemist Katalin Karikó and immunologist Drew Weissman published a paper detailing research focused on messenger RNA (ribonucleic acid). Years later, this mRNA technology was implemented by Moderna and Pfizer-BioNTech to create mRNA covid-19 vaccines, which have since saved an estimated 2 million lives in the United States.

The duo's hard work has not gone unnoticed. In September 2021, Karikó and Weissman were awarded a \$3 million Breakthrough Prize, an award sponsored by an international group of tech-industry titans, for their success in modifying the mRNA so it can instruct human cells to make customized proteins.

Karikó and Weissman's research has also helped contribute to the expansion of research at Penn. Thanks to patents facilitated by PCI on Karikó and Weissman's research, licensing revenues derived from certain vaccine products are being re-invested into Penn's research portfolio to support further discovery of life-saving therapies and technologies.

Penn-invented CAR-T therapy achieves unprecedented decade milestone

Ten years ago, Dr. Stephan Grupp, MD, PhD, launched the first phase 1 trial of Penn-invented CAR-T (chimeric antigen receptor T-cell) cell therapy with 6-year-old acute lymphoblastic leukemia (ALL) patient Emily Whitehead at the Children's Hospital of Philadelphia (CHOP). After that one CAR T-cell treatment in 2012, Emily has since been free of her leukemia and has remained in remission for more than 10 years.

Now, after a decade of CAR-T therapy, Grupp says that he is finally starting to use the "cure" word.

Emily
Whitehead
with Dr.
Grupp



Connecting Innovation

Programs & Events

PCI highlights innovation in Penn Robotics during Philly Tech Week

Last Spring, PCI participated in the 12th annual Philly Tech Week, a conference hosted by Technical.ly Philly showcasing some of the city's best technology and innovation. PCI, the Pennovation Center and other Penn organizations partnered together to represent Penn during the Penn Robotics Discussion and Showcase (see below for more information), Philly Startup Leaders Entrepreneur Expo, and the discussion-based Introduced conference.

PCI also partnered with the Philadelphia Alliance for Capital and Technologies (PACT) to organize the Penn Robotics Discussion and Showcase at the Pennovation Center focusing on the latest trends in robotics. The panel was moderated by Dean of Penn Engineering Dr. Vijay Kumar and included a discussion and demo with panelists from Penn-affiliated companies [Exyn Technologies](#), [Treeswift](#), [IQ Motion Control](#), and [Recupero Robotics](#).

Austin Alumni host SXSW Pitch Program

For the 5th year, PCI partnered with the Penn Wharton Austin Alumni group to host a startup pitch session in conjunction with the [South by Southwest \(SXSW\) Interactive Conference](#). The pitch format remained virtual but 12 Penn-affiliated startup companies from the life sciences and tech sectors were able to present their tech, engineering, and healthcare innovations to a national group of investors and partners as well as alumni. PCI is looking forward to returning in person to SXSW Interactive in Austin in 2023.

27

Programs and events hosted by PCI



Mike Mitchell, PhD

Faculty Innovators are Celebrated

The 6th annual Celebration of Innovation returned in a hybrid format in late 2021 with attendees and award recipients participating both in person and virtually. PCI's Managing Director John Swartley welcomed attendees and introduced the keynote speaker, Jean Bennett, MD, PhD, the F.M. Kirby Professor of Ophthalmology at the Perelman School of Medicine and the Director of the Center for Advanced Retinal and Ocular Therapeutics.

A world leader and pioneering physician-scientist in the field of retinal gene therapy, Dr. Bennett's discoveries led to the first FDA-approved gene therapy for a genetic disease, Luxturna®. Dr.

Bennett is also a co-founder of numerous companies, including [Spark Therapeutics](#) and the newly launched Penn spinout [Opus Genetics](#). Following remarks by Dr. Bennett, a number of special awards were presented, including:

- Deal of the Year: [Interius Biotherapeutics](#)
- Emerging Inventor of the Year: Dr. Mike Mitchell, Penn Engineering
- Startup of the Year: [Vetigenics](#)
- The Paul. D. Sehnert Memorial Partner of the Year Award: [Institute of Life Changing Medicines](#)
- Inventors of the Year: Drs. Drew Weissman and Katalin Karikó, Penn Medicine and BioNTech



Drs. Drew Weissman and Katalin Karikó



Accelerating Innovation

Team of Leading Scientists unite to launch Capstan Therapeutics

Penn spinout Capstan Therapeutics unites a world-class team of Penn Medicine faculty with decades of combined experience in medical research including the development of groundbreaking chimeric antigen receptor (CAR) therapies and mRNA technology. Capstan's modular platform will leverage the biological and technological expertise of these founding scientists and includes proprietary targeted lipid nanoparticles (tLNP) technology, a suite of targeting moieties to mediate cell type-specific uptake, and disease-specific mRNA payloads aimed at directly engineering or ablating pathogenic cells through in vivo generated CAR T cells. Capstan's scientific founders include Carl June, M.D., Bruce Levine, Ph.D. Drew Weissman, M.D., Ph.D., Hamideh Parhiz, PharmD, Ph.D., Steven Albelda, M.D., Ellen Pure, A.B., Ph.D., Jon Epstein, M.D., and Haig Aghajanian, Ph.D.

PCI supported the formation of Capstan, including implementing licenses with the company for certain Penn patent rights which helped the company raise \$165 million in combined seed and Series A funding. Participants in the company funding rounds to date include leading biopharmaceutical companies, including Pfizer Ventures, Leaps by Bayer, Novartis Venture Fund, Eli Lilly and Company and Bristol Myers Squibb, as well as top life sciences investors including OrbiMed, RA Capital, Vida Ventures, Polaris Partners, and Alexandria Venture Investments.

Peroxitech raises \$25M Series A

Peroxitech Inc., announced the successful completion of a \$25M Series A financing round that will help to advance its lead candidate, PIP-2, for the treatment of acute lung injury (ALI) into clinical development. The company was launched in 2016 through the UPstart program at PCI and was co-founded by Aron Fisher, MD, Director, Institute for Environmental Medicine and Sheldon Feinstein, PhD, Senior Research Director, Institute for Environmental Medicine. Peroxitech is also evaluating PIP-2 for several other high unmet need areas where modulation of oxidative injury signaling pathways may allow better treatment options for patients suffering from various types of inflammatory syndromes.

Innervace launches with \$40M to repair the brain

Innervace, a regenerative medicine startup co-founded by Penn Medicine's Kacy Cullen, PhD, Associate Professor of neurosurgery and Douglas Smith, MD, Director of Brain Injury and Repair, recently announced the successful close of its \$40 million Series A financing round. The company is developing the first implantable biofabricated neural pathway to restore damaged or diseased brain circuitry. The new funding will accelerate efforts to develop Innervace's lead program, which aims to reconstruct the lost nigrostriatal pathway in patients with Parkinson's Disease. Innervace's novel strategy of using certain dopaminergic phenotype cells in combination with a biofabricated scaffold pathway differentiates the company's products from other cell therapy approaches currently in development for the potential treatment of Parkinson's Disease. The financing round was led by Deerfield Management with participation from founding investor IP Group, Inc., Penn Medicine, WARF Ventures, and BioAdvance.

CAR-T startup Vittoria Biotherapeutics launches

Vittoria Biotherapeutics' seeks to overcome certain current limitations of chimeric antigen receptor (CAR) T-cell therapeutics through the application of its proprietary cell engineering and gene editing technology platform originally developed at Penn by Marco Ruella, MD, co-founder of Vittoria and Assistant Professor of Medicine at the Center for Cellular Immunotherapies at Penn's Perelman School of Medicine. Dr. Ruella is also scientific director of the lymphoma program at the Hospital of the University of Pennsylvania as well as a Penn hematologist who came to the United States 10 years ago to study under Penn CAR T-cell pioneer Carl June, MD, Richard W. Vague Professor in Immunotherapy and Saar Gill, MD, PhD, Associate Professor of Medicine.

24

PCI-facilitated Penn spinouts and Penn-affiliated startups cumulatively raised or received \$560M in venture capital funding in FY22

Accelerating Innovation

G2Bio launches with \$200M to invest in research and development of novel gene therapies

The G2 Bio Companies, co-founded by James M. Wilson, MD, PhD, Director, Gene Therapy Program, Rose H. Weiss Professor and Director, Orphan Disease Center and Professor of Medicine and Pediatrics, and the late Tadataka “Tachi” Yamada, MD, PhD, former executive at Takeda Pharmaceuticals and GlaxoSmithKline, launched with a \$200 million investment commitment from the global investment firm Temasek to accelerate the development of genetic-based therapies.

G2 Bio funds and develops potential next-generation gene therapy candidates emerging from research conducted at Penn’s Gene Therapy Program (GTP), whose broad research program is working to develop novel therapeutics against more than 50 different diseases and currently managing dozens of translational research projects using a variety of cutting-edge technologies, including gene therapy, gene editing, and mRNA therapeutic approaches using adeno-associated viruses and lipid nanoparticles.

ÖNÖCOR launches ÖNÖ system

Penn spinout ÖNÖCOR announced the first-in-human application of the ÖNÖ endovascular retrieval system during a recent medical procedure involving the removal of an intracardiac tumor. The ÖNÖ system is a novel catheter-based device designed to less-invasively receive, align, compress, and remove material from the vascular system. Intracardiac tumors (abnormal growth of tissues inside the heart) affect thousands of patients around the world, and, prior to ÖNÖ, open-heart surgery was the only way to effectively and safely remove them.

Using the ÖNÖ system in combination with electrocautery, a procedure that uses heat from an electric current to destroy abnormal tissue, Dr. James M. McCabe and Dr. Zachary L. Steinberg and their team at the University of Washington Medical Center were able to remove an intracardiac tumor from a 54-year-old patient without the need for open-heart surgery. This first-of-its-kind procedure opens the door to a range of new and less-invasive surgical procedures for patients around the world.

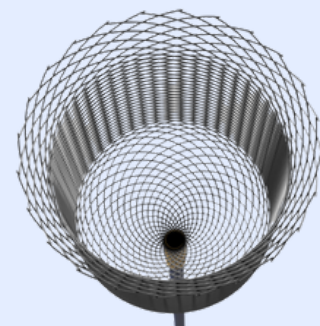
ÖNÖ received FDA clearance in May 2022.

iECURE Gets Early FDA Designation

Penn spinout iECURE launched with a \$50 million Series A led by Versant Ventures and Orbimed Advisors with a mission to develop its proprietary mutation agnostic in vivo gene editing approach. The Series A proceeds will be used to advance a slate of gene insertion programs for liver disorders discovered by Penn’s Gene Therapy Program led by Jim Wilson, M.D., Ph.D., Director, Gene Therapy Program, Rose H. Weiss Professor and Director, Orphan Disease Center, Professor of Medicine and Pediatrics, Penn Medicine. The company received a significant boost from the Food and Drug Administration (FDA) in September 2021 when GTP-506, its lead product candidate, was awarded orphan drug designation on the heels of having previously received rare pediatric disease designation in late August of that same year. GTP-506 is under development by iECURE as a potential treatment for ornithine transcarbamylase (OTC) deficiency, a rare genetic condition that can lead to irreversible neurological impairment, seizures, coma and death in children.



Drs. James M. McCabe and Zachary L. Steinberg and their team at the University of Washington (UW) Medical Center using the ÖNÖ in combination with electrocautery



ÖNÖ device

Accelerating Innovation

Pennovation Accelerator's 2021 Pitch Day

In August 2021, the Pennovation Accelerator, an annual six week program that teaches local startups about business development, named two winners for its Pitch Day event. REGO, a door-to-door marketplace that simplifies online consignment and donation to prevent usable furniture from ending up in a landfill, was the overall 2021 Pennovation Accelerator Winner. REGO was awarded a \$5,000 cash prize, a 6-month Pennovation Center membership, and an accounting startup package sponsored by PCI Ventures' partner, Stephano Slack.

Shinkei Systems, a robotics-based system for minimizing waste in the fishing industry and recent President's Sustainability Prize winner, was awarded Best Pitch. They received a 6-month Pennovation Center membership, and an accounting startup package sponsored by PCI Ventures' partner, Stephano Slack.

Interius BioTherapeutics Moves to Pennovation Lab

In October 2021, Penn spinout Interius BioTherapeutics signed a 17,743 SF lease in the Pennovation Lab facility within the Pennovation Works innovation ecosystem. Interius, co-founded by Saar Gill, MD, PhD, Associate Professor of Medicine at the University of Pennsylvania, is developing new ways to transform cell and gene therapy through direct patient administration of genetic medicines to generate therapeutic immune and blood cells.

"The Interius team started its journey in an Inventor Garage with a few lab benches at the Pennovation Center, and in a matter of months, expanded into the Pennovation Lab building. Supported by their Series A raise, the company's growth over the past few months has been meteoric, and we are delighted to support the team as it grows within our ecosystem" said Anish Kumar, former Managing Director of Pennovation Works.

70+

Companies and growing at the Pennovation Works campus

A view of the new facility from the intersection of Grays Ferry Avenue and 34th Street on the Pennovation Works property

Pennovation Works Celebrates Five Years

November 8, 2021 marked the fifth anniversary of the launch of Pennovation Works, Penn's business and laboratory incubator campus located just south of the Penn Medical Center. President Amy Gutmann formally launched Pennovation Works in fall 2016 as a facility designed to align researchers, innovators, and businesses for the commercialization of discoveries. Since its opening, the Pennovation Center and the surrounding 23-acre Pennovation Works campus have been an essential part of Penn's goal of connecting entrepreneurs with world-renowned experts and state-of-the-art facilities.

At the time of its fifth anniversary, Pennovation Works had 10 Penn research entities located on site, 19 companies in the JPOD @ Philadelphia hub, 32 companies that completed the Pennovation Accelerator program, 75 active PCI Ventures portfolio companies, and 2 million square feet of development in the Pennovation Works master plan.

The Pennovation Center facility prominently featured on the Pennovation Works campus is home to a wide range of initiatives, including PCI Ventures, the General Robotics Automation Sensing and Perception (GRASP) Lab, Penn Vet's Working Dog Center (WDC), as well as numerous recent winners of the President's Innovation Prize (PIP).

In recognition of the 5th year anniversary of Pennovation Works, the Pennovation Center hosted The Power of Pennovation Works: Research and Development panel. In June 2022, Penn announced that Longfellow Real Estate Partners, LLC will be developing a 455,000 square foot facility along 34th Street and Grays Ferry Avenue to expand the life sciences hub at Pennovation Works.



Accelerating Innovation

Penn Medicine Co-Investment Program continues to thrive

Launched in March 2018, the Penn Medicine Co-Investment Program assists faculty entrepreneurs as they move along the path to venture creation and permanent financing through active support and early stage targeted co-investments focused on cell therapy, gene therapy, mRNA, lipid nanoparticles, and connected health technologies. The program helps to further incentivize faculty innovation while also capitalizing on Penn's strengths in key areas and spurring increased economic growth in the Philadelphia region.

Since its inception, the Co-Investment Program has co-invested over \$30M in 13 Penn Medicine spinouts that have gone on to cumulatively raise over \$1.36B in capital, created over 350 jobs, expended over \$224M in sponsored research funding, and spent over \$50M with local contract research organizations.

In FY22, the Co-Investment Program helped to launch and fund two new companies, ViTToria Biotherapeutics and Dispatch Bio, made its first investment in CareAlign, and participated in follow-on financing rounds for Linnaeus Therapeutics and Interius Biotherapeutics.

New ASSET Center

Penn Engineering's newly formed ASSET (AI-enabled Systems: Safety, Explainability and Trustworthiness) Center, part of Penn Engineering's Innovation in Data Engineering and Science (IDEAS) Initiative, aims to act as a catalyst at Penn for new collaborations among groups researching machine learning, programming languages, natural language processing, robotics, and human-computer interaction within Penn Engineering and with other researchers throughout the University.

50+

Partner meetings with corporations and external partners

PCI Fellows Program trains future commercialization leaders

The PCI Fellows Program is an experiential education program open to graduate students, postdoctoral fellows, and in exceptional cases, junior research staff at Penn. Through this program, PCI Fellows are exposed to a wide range of emerging technologies and commercialization opportunities in the life sciences, physical sciences, nanotechnology, and beyond.

Twelve fellows were selected and admitted to the fiscal year 2022 cohort from a large pool of applicants. Upon graduating, PCI Fellows may decide to embark on careers related to technology commercialization, including intellectual property law, technology transfer, medical writing, consulting, industrial research, and startup creation. Many other PCI Fellows continue to pursue academic careers after graduation with a deeper understanding of commercialization opportunities that might be presented by their research findings.

FY22 President's Innovation Prizes Awarded

Penn's annual President's Innovation Prize empowers Penn students to design and undertake a post-graduation startup company that promises to make a positive, lasting difference in the world. PCI has served as a program partner for the prizes since their inception and provides support and technical assistance for applicant teams. Each Prize-winning project receives \$100,000, a \$50,000 living stipend per team member and space at the Pennovation Center where they can continue to receive support and technical assistance from PCI.



In Memorium

PCI mourns the passing of key innovation pioneers

John Trojanowski, MD, PhD

John Q. Trojanowski, MD, PhD, the William Maul Measey – Truman G. Schnabel, Jr., M.D. Professor of Geriatric Medicine and Gerontology in the Department Pathology and Laboratory Medicine, past Director of the Institute on Aging, and one of the foremost pioneers in the field of neuroscience, neuropathology and neurodegenerative diseases, passed away on February 8, 2022 at the age of seventy-five.

Trojanowski was consistently ranked as one of the “10 most cited neuroscientists in the world,” and was a prolific inventor whose groundbreaking work conducted in close partnership with his wife of over forty years, Virginia Lee, PhD, led to many fruitful industrial R&D collaborations as well as 18 US issued patents at Penn.



John Trojanowski, MD, PhD



Jiren Narendra Parikh

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Prior to his untimely death at the age of fifty-five in March of this year, Jiren was the CEO of Ghost Robotics in Philadelphia, PA, a spinout of Penn Engineering’s Grasp Lab which he co-founded with Penn graduate students Avik De and Gavin Kenneally in late 2015. Since its launch over five years ago, the company has grown quickly and is currently marketing several different product lines derived from Ghost’s agile, hardened, and programmable legged robotic platform. Jiren’s career spanned over 30 years as an entrepreneur, C-level and Senior Executive and included founding, scaling and supporting technology businesses covering robotics, software, telecom, content and platform technologies.

Tadataka “Tachi” Yamada, MD, PhD

Dr. Yamada, a long standing and steadfast supporter of the field of gene therapy and the Gene Therapy Program at Penn, died unexpectedly at the age of seventy-six on August 3rd, 2022.

Dr. Yamada led a distinguished career across multiple decades as a visionary leader in the life sciences industry. He headed up research and development at Takeda Pharmaceutical Co. and GlaxoSmithKline, and was a president of the Bill & Melinda Gates Foundation Global Health Program from 2006 to 2011.

Dr. Yamada was also co-founder and board chairman of the Philadelphia-based gene therapy company Passage Bio – a company focused on developing gene therapies for patients with central nervous system disorders that he helped to create and co-founded in 2017 with Dr. James Wilson, director of the gene therapy program and orphan disease centers at the University of Pennsylvania.

Wilson and Yamada teamed up yet again earlier this year, co-founding G2 Bio to support translative gene therapy research with GTP and to facilitate the launch of startups spun out of Penn to further develop next-generation gene therapy candidates and related technology. G2 Bio launched in May with a \$200 million financing commitment from Temasek, a global Singapore-based investment firm.



Tadataka “Tachi” Yamada, MD, PhD