



2022

# Technology & Innovation Development Office

ANNUAL REPORT



**Boston Children's Hospital**

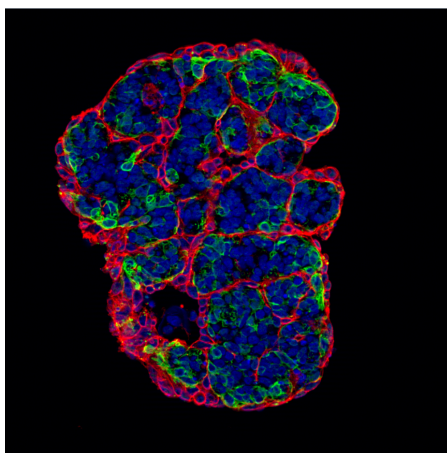
Where the world comes for answers

# TIDO in FY22

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RESEARCH EXPENDITURES	\$517M
NEW INDUSTRY-SPONSORED RESEARCH FUNDING	\$18M
RESEARCH AGREEMENTS	43
LICENSING AGREEMENTS	47
GROSS LICENSING REVENUE	\$55M

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## On the cover

### Mini Blood Vessel

Mini blood vessel derived from human stem cells. Red vascular endothelial cells outline the surface and infiltrate within, while the green vascular smooth muscle cells lay adjacent to the red cells.

Kai Wang PhD and Juan Melero-Martin PhD  
*Cardiac Surgery*  
Boston Children's Hospital

# From the Director

## **2022 WAS A REMARKABLE YEAR FILLED WITH SIGNIFICANT ACCOMPLISHMENTS AND MEANINGFUL PARTNERSHIPS.**

Despite the challenges posed by the shifting post-pandemic landscape, our dedicated team at the Technology and Innovation Development Office (TIDO) continued to work diligently to advance the mission of translating research into transformative products and therapies as we navigated ever-evolving commercialization trends.

One particular highlight that we are thrilled to share is the acquisition of Affinivax by GlaxoSmithKline (GSK). Affinivax, a company at the forefront of innovative vaccine technologies, emerged from our own research ecosystem. It was founded by Dr. Richard Malley and his colleagues Fan Zhang and Yingjie Lu, and validated through Technology Development Fund (TDF) awards. Its acquisition by GSK not only recognizes the immense potential of Affinivax's groundbreaking work but is also a significant endorsement of our institution's commitment to scientific excellence. We are excited about the future this technology holds for advancing the development and delivery of life-saving vaccines to people around the world.

Additionally, we are looking forward to an exciting new initiative to expedite the translation of promising therapeutics from the laboratory to clinical applications by unifying our various commercialization arms under a new Therapeutic Accelerator. By uniting our systems for comprehensive support, our funding mechanisms, and our mentorship programs, our new branch will empower our researchers to advance their discoveries rapidly. We firmly believe that this initiative will catalyze the development of groundbreaking treatments and therapies, ultimately improving patient outcomes and transforming healthcare.

At TIDO, we take pride in our role as a catalyst for innovation and an agent of change. The accomplishments and partnerships we have highlighted in this report exemplify our unwavering dedication to bridging the gap between academia and industry. As we embark on a new year, we look forward to continuing our mission of translating cutting-edge research into real-world solutions, creating a positive impact on human health and well-being.

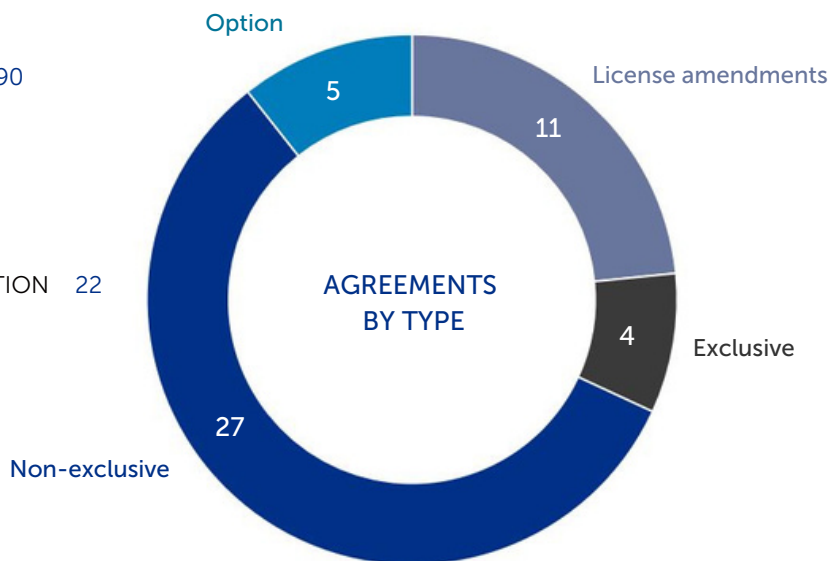


**Irene Abrams**

Vice President, Technology Development and New Venture  
Technology & Innovation Development Office

# Agreements

LICENSE, OPTION, & RESEARCH AGREEMENTS	90
CONFIDENTIALITY	145
RECEIPT OF EQUITY	3
MATERIAL TRANSFER	306
INTER-INSTITUTIONAL INVENTION ADMINISTRATION	22
CONTRACT RESEARCH ORGANIZATIONS	9
AMENDMENTS	46
OTHER	57



## Revenue

REVENUE FROM FY22 LICENSES AND OPTIONS	\$8,234,120
NEW INDUSTRY SPONSORED RESEARCH FUNDING	\$18,191,693
GROSS REVENUE	\$55,274,084

## Impact

ACADEMIC PARTNERSHIPS	239
INDUSTRY PARTNERS	215
CORPORATE-SPONSORED RESEARCH & COLLABORATIONS	43
STARTUPS CREATED	2

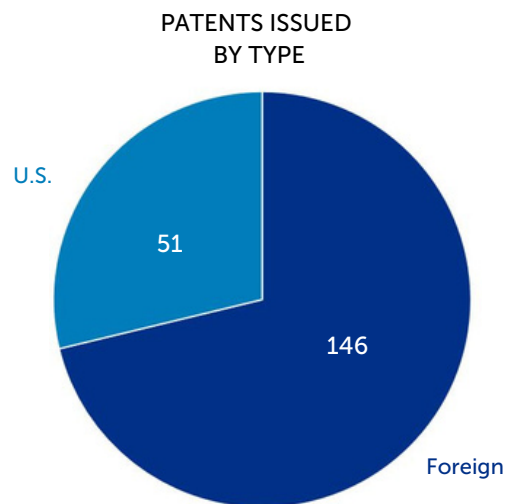
## Startups

GanNA Bio, Inc.

Blackbox

## Intellectual Property

NEW DISCLOSURES	148
PATENTS ISSUED	197
PATENT APPLICATIONS FILED	191





# Licences & Sponsored Research

## THE COMFORT ABILITY

**Comfort Ability Program non-exclusively licenses group-based cognitive-behavioral therapy program to various sites**

The Comfort Ability program, which was developed by Rachael Coakley, PhD, the Director of Clinical Innovation and Outreach in Pain Medicine, was non-exclusively licensed to several different institutions this year. The program is a therapeutic tool for children with chronic or recurrent pain and their parents, teaching them strategies to better manage pain and improve day-to-day functioning. Through the program, children and their parents are introduced to how pain functions in the body and are taught cognitive behavioral and biobehavioral strategies for improved pain management. In addition to the training, Comfort Ability also provides take-home workbooks, health chats, and other resources, such as a recently launched podcast to help support children and their families. The program has been licensed at over thirty sites and now includes special curriculum for sickle-cell pain with a program for cancer pain currently in development.



**Transcera exclusively licensed novel drug delivery system**

At present, reduced drug bioavailability and half-life are two major bottlenecks that limit the development of new peptide, protein, and oligonucleotide therapeutics. None of these large molecule therapeutics can be absorbed across mucosal surfaces (such as the intestine), which renders them clinically ineffective by oral administration, and they are restricted in delivery to many tissues even after parenteral administration.

To address these issues, Wayne Lencer, MD, and his colleague, Daniel Chinnapen, PhD, in the Division of Gastroenterology, Hepatology, and Nutrition, developed a novel drug-delivery system where the therapeutic agent of interest is covalently attached to a glycosphingolipid of the specified structure. The engineered glycosphingolipid acts as a trafficking platform carrying the biologic into the mucosal surface by endocytosis and then across the mucosal barrier by endosome trafficking through the epithelial cell barrier and release to the systemic circulation in a process termed transcytosis. This novel technology harnesses the endosome trafficking of complex sphingolipids so biologics fused to the sphingolipid carrier display enhanced permeability across mucosal barriers, enhanced biodistribution to tissues protected by tight endothelial barriers, and enhanced half-life. The research led to a portfolio of intellectual property now exclusively licensed by Transcera, a biotechnology company focused on harnessing biologic drugs for people living with chronic disease. Transcera has now modified the technology so the platform can be synthesized from scratch.

## Alcea Therapeutics

**Alcea Therapeutics exclusively licenses discoveries concerning Notch 4 and methods for treating allergic inflammation, asthma, and for treating coronavirus and other infectious diseases**

Alcea Therapeutics, a preclinical therapeutics company focused on treating airway inflammation through immune tolerance, has exclusively licensed research by Talal Chatila, MD, in the Division of Immunology, and Hani Harb, PhD, a postdoctoral fellow. The technology concerns a new biomarker and therapeutic target for pulmonary hyperinflammatory conditions—including COVID-19 infections and asthma—targeting the Notch4 pathway. Hyperinflammatory reactions, which can result from exposure to allergens, as in asthma, or from immunological reactions to infectious agents, as in COVID-19, involve the hyperactivation of immune cells. Targeting proteins in the Notch4 pathway is critical for halting this chain of immunological reactions and, unlike in current treatment regimens for these conditions, the new therapeutic could provide a common, molecularly-based treatment platform applicable to a broad patient population.



**Ono Pharmaceutical sponsors research concerning tools for the comprehensive functional characterization of mammalian tRNA genes**

Ono Pharmaceuticals, a Japanese company dedicated to the fight against disease and pain with specialized research in drugs that fight cancer, has sponsored research for tools for the comprehensive functional characterization of mammalian tRNA genes, under the direction of Richard Gregory, PhD, in the Division of Hematology and Oncology. The research will explore the roles of different tRNA genes, which are essential for the development of potential new cancer therapeutics, in regenerative biology, and which have applications in numerous other diseases.

# Milestones



## Affinivax acquired by GSK

GSK, a multinational pharmaceutical company focusing on infectious diseases, HIV, oncology, and immunology, acquired Affinivax in a \$3.3 billion deal. Affinivax was founded on the scientific discoveries of Richard Malley, MD, Fan Zhang, PhD, and Yingjie Lu, PhD in the Division of Infectious Diseases. The company pioneered the development of a novel class of vaccines, the most advanced of which are next-generation pneumococcal vaccines, and were initially developed at Boston Children's Hospital with early-stage funding provided by a TDF grant. There is a significant need to combat pneumococcal disease, which includes any infection caused by *Streptococcus pneumoniae* such as pneumonia, meningitis, bloodstream infections, as well as some milder diseases such as sinusitis and otitis media. There are many different pneumococcal serotypes, but the number of serotypes in current vaccines is limited due to the degree of immunological interference observed when using existing conjugation technologies. Affinivax developed the Multiple Antigen Presenting System (MAPS), a novel technology that supports higher valency than conventional conjugation technologies, enabling broader coverage against prevalent pneumococcal serotypes and potentially creating higher immunogenicity than current vaccines. Affinivax's most advanced vaccine candidate (AFX3772) includes 24 pneumococcal polysaccharides plus two conserved pneumococcal proteins (compared to up to 20 serotypes in currently approved vaccines). A 30-plus valent pneumococcal candidate vaccine is also in pre-clinical development.



## BEAR Implant by Miach Orthopaedics now commercially available

Miach Orthopaedics, founded by Martha Murray, MD, in the Department of Orthopedic Surgery, announced the commercial availability of the BEAR implant in the United States this year. The BEAR implant was developed at Boston Children's Hospital with initial research funding provided by the NFL Players Association, the National Institutes of Health, and a TDF grant. The implant treats ACL tears, which are one of the most common knee injuries. Prior to the BEAR implant, ACL tears were treated with surgical reconstruction, which involved removing a torn ligament and replacing it with a graft of a tendon from elsewhere in the body or from a cadaver. Although effective, ACL reconstructions often led to early arthritis or other complications. Dr. Murray and her team, however, pioneered the development of a scaffold made of collagen and other extracellular matrix proteins that allows the patient to regrow their own ACL. The implant received a "Best of What's New" Award in Health by Popular Science and was listed as one of the top ten health and medicine breakthroughs of 2021. It was also selected for the 2022 Orthopedic Research and Education Foundation (OREF) Clinical Research Award.

## Bridging the translational gap

### Strategic Alliances

TIDO's mission is to advance novel therapeutics developed at Boston Children's Hospital from the laboratory bench to the patient's bedside. To support this vision, we have several multi-year strategic alliances with industry partners to significantly reduce the administrative and resource hurdles that can hinder collaborative scientific progress. Our partners include:



Pfizer CTI Program



BridgeBio



Autobahn Labs



Astellas



Sanofi iAwards



Blackfan Circle  
Innovations



ElevateBio



Takeda



Beam Therapeutics

### FY22 Alliance Team



**Sabrina Kamran, PhD**  
Assistant Director,  
Alliances & BD



**Matthew Powers, PhD**  
Strategic Alliance Manager

## Alliance News



### **ElevateBio launches new company co-founded by George Daley, MD, PhD**

ElevateBio, a company focused on transformative cell and gene therapies, announced the launch of a new company co-founded by George Daley, MD, PhD, of the Division of Hematology and Oncology. The company, which has yet to be named, will develop allogeneic immune cell therapies based on a novel platform that generates functionally mature immune cells from induced pluripotent stem cells (iPSCs). This proprietary differentiation process overcomes the tendency of iPSCs to generate immature, embryonic blood cell types, and enables the generation of multiple subtypes of immune cells that display mature molecular signatures similar to T cells from adult blood. Dr. Daley showed that iPSC-derived mature  $\alpha\beta$  T cells exhibited antitumor activity and cytokine secretion and could serve as an ideal source for the development of allogeneic "off-the-shelf" therapies. It is the first company to arise out of the five-year collaboration between ElevateBio and Boston Children's Hospital that was signed a year ago to accelerate the development of novel cell and gene therapies for patients.



### **Boston Children's Hospital announces collaboration with Autobahn Labs**

This year, Boston Children's Hospital and Autobahn Labs, an early-stage drug discovery incubator, announced a new collaboration to identify and support the advancement of academic research programs for important unmet medical needs by supporting promising early results through the development milestone of preclinical candidate selection in the drug discovery process. The collaboration will combine the cutting-edge life sciences research at Boston Children's Hospital with Autobahn Lab's innovative approach to effectively applying the most relevant drug discovery and development resources to advance these programs to the clinic. This combination of expertise is designed to accelerate the translation of early research findings into therapies that can positively impact the health of patients. Specifically, Autobahn Labs will facilitate the translation of this science into therapies and form companies foundationally derived from early-stage discovery programs in close partnership with the hospital, providing capital to fill the funding gap and de-risk individual early-stage drug discovery programs that require state-of-the-art drug development capabilities.



### **Blackfan Circle sponsors research gene therapy for Congenital Nephrotic Syndrome**

Blackfan Circle Innovations, LLC, a company created by Deerfield Management to facilitate biomedical research collaboration with Boston Children's Hospital, has announced its first project agreement to advance the development of a novel gene therapy for pediatric kidney disease, with Friedhelm Hildebrandt, MD, the Chief of the Division of Nephrology at Boston Children's Hospital. Congenital Nephrotic Syndrome is an inherited kidney disease that leads to irreversible terminal kidney failure by early childhood. The syndrome is characterized by its resistance to steroids, the ultimate regimen of treating and preventing renal failure; therefore, no successful therapeutic modality has been found beneficial to this tragic condition. Developing a gene therapy for this disease can prove as the first of its kind in molecularly interfering with and treating a steroid-resistant nephrotic syndrome, through the administration of gene therapy. It would also pave the way for other gene-replacement therapies for monogenic steroid-resistant nephrotic syndromes.



# Bridging the translational gap

## The Technology Development Fund

The Technology Development Fund (TDF), established in 2009, is Boston Children's Hospital's internal mechanism for translating high-impact new technologies into the independently validated, later-stage opportunities sought by industry partners and investors. Technologies funded by TDF range from therapeutics and devices to diagnostics and vaccines in both pediatric and adult indications.

### The Technology Development Fund provides:

- Mentoring and coaching through an advisory board of industry leaders in product development to identify and reach key milestones toward product development
- Funds to execute the scope of work agreed upon with the mentors
- Technical support and expertise through a network of service providers and collaborators
- Active project management to maintain focus on development goals

## The 2022 Awardees

Chosen from a pool of 11 applicants, the 2022 awardees are:

### Chimeric Antigen Receptors with Intracellular Signaling Domains Tailored for Use in Macrophages/Monocytes



**Christian Brendel, PhD**

Department of Hematology and Oncology

Despite the tremendous efficacy of chimeric antigen receptor (CAR) T-cells for some liquid cancers, CAR T-cell therapy is less efficient in most solid tumors because of the immunosuppressive tumor environment, which limits and suppresses CAR T-cell penetration. Macrophages are abundant in many solid tumors and are critical in shaping the tumor environment and modulating immune responses. Thus, key factors which limit CAR T-cell anti-tumor responses could be addressed by conferring anti-tumor activity to macrophages by introducing CARs into macrophages or their progenitors.

Previously, Dr. Brendel and his team evaluated intracellular signaling domains derived from cell surface receptors suggesting a TLR-derived ICD outperformed other established and novel configurations in phagocytosis assays. With support from Boston Children's Technology Development Program, Dr. Brendel and his team are looking to gather data showing their modified CAR structure to be compatible with a variety of different extracellular domains for the targeting of different solid tumor antigens in both in vivo and in vitro mouse models.

### Evaluating Short-term Efficacy of Novel Cartilage Implant in a Large Animal Model



**April Craft, PhD**

Department of Orthopedic Surgery

Osteoarthritis (OA) and post-traumatic osteoarthritis (PTOA) are debilitating degenerative diseases caused by the inability of the joint-lining articular cartilage to repair itself with aging or injury. Instead of healing, the tissue will progressively deteriorate causing lifelong pain and interference with daily living activities. The current therapies for cartilage degeneration, primarily pain management and joint replacement surgery, are inadequate, particularly for younger patients who face repeat joint replacement surgeries throughout their lifetimes. Successful repair of damaged articular cartilage would effectively prevent or delay the onset of joint degeneration, thus there has been much effort focused on developing cell and tissue-based therapies, many of which use autologous cells.

The Craft lab is looking to establish a novel, low-risk, cost-effective, single-step treatment to replace damaged tissue from human embryonic stem cells. With support from Boston Children's Technology Development Program, Dr. Craft and her team are planning to evaluate the efficacy of their hESC-derived cartilage implant in Yucatan miniature swine. This large animal pilot study will provide crucial proof-of-concept data needed to acquire sponsored research support to fund a large-scale preclinical study and initiate manufacturing efforts, as well as the ability to provide individuals with better treatment options that allow them to maintain a pain-free high quality of life.

# Bridging the translational gap

## A Novel Compound for Imaging and Therapeutic Targeting of Liver Cancer



**Khashayar Vakili, MD**  
Department of Surgery

Worldwide, liver cancer afflicts about 900,000 people annually and is the 3rd most common cause of mortality. Current treatments for liver cancer include surgery, liver transplantation, transarterial chemoembolization, and chemotherapy. The most effective treatment option has been surgical resection. However, for many patients, particularly adolescents and young adults with advanced metastatic disease, surgery is ineffective in achieving a cure and many eventually succumb to their cancer given the lack of an effective chemotherapeutic agent.

Dr. Vakili and his team have already established a method of synthesizing a PET tracer compound expected to be preferentially retained by liver cancer cells for the detection of metastatic liver cancer. With support from Boston Children's Technology Development Program, they are aiming to establish the kinetics of this compound in wild-type mice and demonstrate its efficacy in a PDX model.

## Drug Development for Arteriovenous Malformation: Determining the Therapeutic Index for Subcutaneous Injection of MEK Inhibitor Microparticles



**Arin Greene, MD, MMSc**  
Department of Plastic and Oral Surgery

Arteriovenous malformation (AVM) is a congenital vascular anomaly that over time can cause deformity, bleeding, pain, ulceration, and congestive heart failure. Patients are treated with embolization or excision, but almost all AVMs recur following these treatments; drugs have not been available for AVMs.

Previously, the Greene lab found the cause of AVM and was awarded IP for the treatment of AVMs with MAP2K1 inhibitors. Based on their discovery, AVM patients around the world have started to be treated with an FDA-approved MAP2K1 inhibitor from Novartis (trametinib). However, a major drawback to trametinib and other oral drugs available is their systemic toxicity. As such, patients require routine cardiac and ophthalmology screenings as well as having blood laboratory monitoring.

With support from the Technology Development Program, Dr. Greene and his team are looking to develop an injectable MEK inhibitor to treat AVMs and reduce systemic toxicity. Advantages of a subcutaneous delivery method compared to topical medications include: (1) the drug doesn't need to penetrate the integument which can be difficult and injure the skin, (2) the drug can be incorporated into microparticles for slow release to allow long term therapeutic effect, and (3) patient compliance and quality of life is improved. For example, instead of placing a topical cream twice a day or wearing a patch over their skin, a patient may only need 1 injection every few weeks or months.

## A Portfolio of Gene-up Regulating Oligonucleotides for Neurogenetic Diseases



**Timothy Yu, MD, PhD**  
Department of Genetics and Genomics

Recent years have seen great inroads into discovering the genetic basis of pediatric neurologic diseases with hundreds of single-gene disorders being discovered, but treatments remain scarce. Advances in genomic technologies are beginning to point not only to critical disease genes but also methods for intervening upon them. Viral gene replacement strategies are showing promise for some conditions but may also have significant challenges.

Previously, the Yu lab successfully developed antisense oligonucleotides (ASOs) capable of boosting levels of progranulin (GRN), a genetic cause of a childhood neurodegenerative disorder (Batten disease) as well as adult-onset frontotemporal dementia (FTD), leveraging the ability of ASOs to relieve naturally occurring inefficiencies in GRN RNA splicing. A similar ASO boosting SCN1A expression in epileptic children with Dravet Syndrome is already in Phase 1/2 clinical trial.

With support from Boston Children's Technology Development Program, they are aiming to (1) identify at least 10 potential gene targets for ASO intervention for a variety of pediatric neurogenetic disorders, and (2) generate a genome-wide catalog of therapeutic ASOs designs targeting their specific inefficiencies. By targeting existing gene loci, ASO-enhanced expression remains under the control of endogenous gene regulatory elements, allowing one to avoid potential toxicity caused by over- or misexpression.

# Bridging the translational gap



## Drug, Device, and Diagnostic Accelerator

The Drug, Device, and Diagnostic Accelerator (D3A) launched at Boston Children's Hospital in 2020. D3A is an internal accelerator focused on the development of high-potential drug, device, and diagnostic inventions that may lead to advanced commercialization and significant patient impact. Building on the successful efforts of the Technology Development Fund (TDF) and Translational Research Program (TRP), D3A works with BCH physicians and scientists to identify innovations that will benefit from expert advice, additional investment of capital, program management, and external technical resources to fast-track ideas into full-scale development.

## Goals

- Enhance translation of science into novel and innovative new therapies, devices and diagnostics that meet a significant, unmet medical need for children while doing so in a capital and time-efficient manner
- Improve commercialization and expedited clinical development awareness and skill among faculty
- Increase value of BCH scientific discoveries and expedite the translation of these into our clinical mission and/or increase ROI of research investments to BCH
- Unite similar existing programs into one comprehensive new structure that will simplify and efficiently manage high-value discovery programs

## FY22 D3A Team



**William Clarke, MD**  
Faculty Director



**Mei-Mei Huang, PhD. MBA**  
Program Manager

For more information about D3A, please email [D3A@childrens.harvard.edu](mailto:D3A@childrens.harvard.edu) or contact Bill Clarke, MD, Faculty Director, at [William.Clarke@childrens.harvard.edu](mailto:William.Clarke@childrens.harvard.edu).

# Issued U.S. Patents

11,136,383

Methods and compositions for modulation of transforming growth factor beta-regulated functions  
Springer, Timothy

11,147,890

Stimuli-responsive particles encapsulating a gas and methods of use  
Polizzotti, Brian

11,147,828

Let-7 microRNA and mimetics thereof as therapeutics for cancer  
Lieberman, Judy

11,155,620

Method of detecting TIM-3 using antibody molecules to TIM-3  
Umetsu, Dale

11,167,042

Materials and methods for delivering nucleic acids to cochlear and vestibular cells  
Holt, Jeffrey

11,172,866

Pelvic muscle rehabilitation for treating urinary incontinence  
Estrada, Carlos

11,181,594

System and method for locally correlated spectroscopy for assessing medical disorders  
Waisbren, Susan

11,186,829

Isolated mammalian somatic cells containing modified RNA encoding OCT4, SOX2, and KLF4  
Rossi, Derrick

11,191,805

Cyclic prosaposin peptides and uses thereof  
Watnick, Randolph

11,191,823

Compositions and methods for treating arenavirus infection  
Harrison, Stephen

11,198,900

Nucleic acid-based linkers for detecting and measuring interactions

Wong, Wesley

11,207,375

Vaccines and compositions against Streptococcus pneumoniae  
Malley, Richard

11,208,683

Methods of epigenetic analysis  
Rao, Anjana

11,220,689

Modulators of telomere disease  
Agarwal, Suneet

11,213,316

Gasket with multi-leaflet valve for surgical port apparatus  
Del Nido, Pedro

11,229,696

Biochemically stabilized HIV-1 Env trimer vaccine  
Harrison, Stephen

11,236,147

Methods and compositions for the inhibition of TRPV4  
Ingber, Donald

11,234,657

Non-invasive measurement to predict post-surgery anterior cruciate ligament success  
Fleming, Braden  
Murray, Martha

11,235,047

Immunogens and methods for discovery and screening thereof  
Malley, Richard

11,242,553

MiRNA targets  
Lieberman, Judy

11,261,430

Hematopoietic stem and progenitor cells derived from hemogenic endothelial cells  
Daley, George

11,260,132

Engineered liposomes as cancer-targeted therapeutics  
Moses, Marsha

11,261,441

Vectors and compositions for treating hemoglobinopathies  
Williams, David

11,286,473

Botulinum neurotoxin and its derivatives  
Dong, Min

11,284,788

Instrument port with fluid flush system  
del Nido, Pedro

11,291,641

Prevention and treatment of diabetic nephropathy  
Fiorina, Paolo

11,299,782

Methods for predicting anti-cancer response  
Szallasi, Zoltan

11,305,001

Multiple antigen presenting system (MAPS)-based Staphylococcus aureus vaccine, immunogenic composition, and uses thereof  
Malley, Richard

11,304,767

Origami robots, systems, and methods of treatment  
Damian, Dana

11,324,634

Plug with isthmus anchor for treating patulous Eustachian tube  
Palushi, Jetmir

11,324,697

Methods and compositions relating to emulsions comprising fish oil and/or omega-3 fatty acids  
Puder, Mark

11,324,555

Instrument port including optical bulb secured to port body  
del Nido, Pedro

11,331,659

Pipetting devices and methods of using the same  
Pollock, Nira

11,339,222

KLRG1 antagonist signaling therapy  
Greenberg, Steven

11,344,498

Compositions and methods for on-demand high-efficiency triggerable anesthesia  
Rwei, Alina

11,351,250

Pro-inflammatory and anti-cancer functions of toll-like receptor 4 antagonists  
Kagan, Jonathan

11,357,780

Methods and compositions relating to the inhibition of IP6K1  
Luo, Hongbo

11,359,199

Antisense oligonucleotide-based progranulin augmentation therapy in neurodegenerative diseases  
Yu, Timothy

11,359,020

Agents that modulate immune cell activation and methods of use thereof  
Umetsu, Dale

11,384,356

Composition and method for oligonucleotide delivery  
Lieberman, Judy

11,390,885

Methods and compositions to increase somatic cell nuclear transfer (SCNT) efficiency by removing histone H3-lysine trimethylation  
Zhang, Yi

11,414,694

Nucleic acid nanoswitch catenanes  
Wong, Wesley

FY22

## Issued U.S. Patents

11,396,650

Nucleic acid complexes for screening  
barcoded compounds

Wong, Wesley

11,400,139

Anti-NET compounds for treating and  
preventing fibrosis and for facilitating  
wound healing

Wagner, Denisa

11,400,153

Pro-inflammatory and adjuvant  
functions of toll-like receptor 4  
antagonists

Kagan, Jonathan

11,400,136

Methods and compositions for treating a  
microbial infection

Ribeiro, Felipe

11,400,153

Pro-inflammatory and adjuvant functions  
of toll-like receptor 4 antagonists

Kagan, Jonathan

11,413,325

Neuronal survival and axonal  
regeneration through increasing  
mitochondrial motility

He, Zhigang

11,419,535

Nanomesh electrode structures and  
techniques for the formation thereof

Fagiolini, Michela

11,427,574

Compounds for treating Rac-GTPase  
mediated disorder

Williams, David

11,427,636

Methods and compositions relating  
to anti-PD1 antibody reagents

Alt, Frederick



## About the Technology & Innovation Development Office

The Technology & Innovation Development Office (TIDO) maximizes the impact of Boston Children's Hospital innovations on patient health while enhancing the research endeavor. The TIDO team is comprised of specialists in licensing, patenting, business development, marketing, startup formation and legal matters. We work closely with Boston Children's investigators and clinicians to develop innovations, protect and license intellectual property, and enable collaborations with companies at all stages of development.



## About Boston Children's Hospital

Boston Children's Hospital is ranked the #1 children's hospital in the nation by U.S. News & World Report and is the primary pediatric teaching affiliate of Harvard Medical School. Home to the world's largest research enterprise based at a pediatric medical center, its discoveries have benefited both children and adults since 1869. Today, 3,000 researchers and scientific staff, including 9 members of the National Academy of Sciences, 22 members of the National Academy of Medicine, and 12 Howard Hughes Medical Investigators comprise Boston Children's research community. Founded as a 20-bed hospital for children, Boston Children's is now a 415-bed comprehensive center for pediatric and adolescent health care. For more, visit our Discoveries blog and follow us on social media @BostonChildrens, @BCH\_Innovation, Facebook and YouTube.





## **Boston Children's Hospital**

Technology & Innovation  
Development Office

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