2019

Technology & Innovation Development Office

ANNUAL REPORT

Boston Children's Hospital

Where the world comes for answers

From the director

THE TECHNOLOGY AND INNOVATION DEVELOPMENT OFFICE (TIDO) USED 2019 TO EVOLVE AND GROW. We established a new strategy for the office and, in concert with the Research Strategic Plan, laid the foundation to launch programs directed at bringing the most value to Boston Children's Hospital and our patients through commercialization of our research.

The demands on the hospital and the commercialization landscape have changed and we have adapted in response. Specifically, changes in patent law over the last decade have eroded the value of early-stage biological discoveries and the need to diversify Boston Children's research funding has increased. TIDO created pathways to increase the value of our intellectual property, developed new partnerships with industry to increase research funding, and brought in new leadership with deep industry knowledge to build upon our success.

Our new leadership team brings strategic vision to our daily work of commercialization and is working closely with our faculty to create the best commercial paths for our discoveries.

Meet the new team:

Catherine Ives, PhD, Senior Director of Business Development and Licensing, oversees the licensing and contract teams.

Mikael Bristow, MBA, Director of Administration and Operations, leads the business and operational teams.

Tom Bishop, MS, MBA*, Director of Business Development & the Technology Development Fund, led business development and technology advancement teams.

Tamar Alon, PhD, MBA, Director of Business Development and Strategic Alliances, leads business development, strategic alliances, and marketing teams.

Some beneficial operational changes that faculty should now be familiar with are our updated MTA processes and our adoption of electronic signatures to increase efficiency. We are also working behind the scenes to update our database to provide additional pathways for information sharing with investigators.

While changing our approach to our work, we have also been busy exploring paths to further develop our technologies, adding value to our intellectual property as we go to market. These include exploring new internal funds, expanding the Technology Development Fund, increasing our strategic alliances with biopharma companies, and partnering with venture firms that have novel approaches to working with academia. In FY20 we hope to announce a number of new initiatives to develop our technology and bring more value to our investigators and our patients.

Superior faculty service, being the best partner for industry, and creating paths to develop valuable intellectual property for Children's are our top strategic goals to excel in the changing commercialization landscape.

Irene Abrams
Vice President, Technology Development and New Ventures
Technology & Innovation Development Office

*Sadly, Tom passed away in June 2020. Tom's contributions to TIDO and Boston Children's Hospital are reflected in this report.

TIDO in

FY19

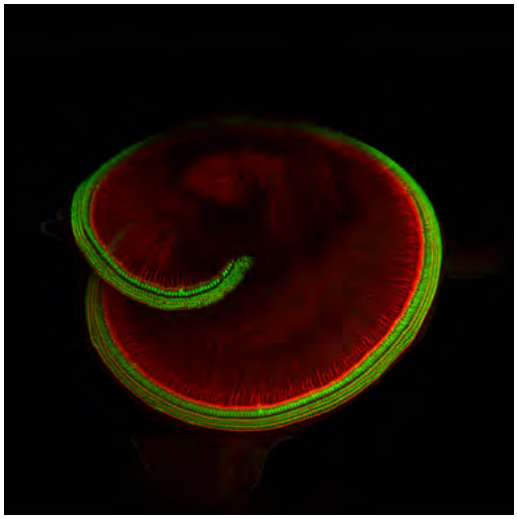
RESEARCH EXPENDITURES **$409,000,000**

NEW INDUSTRY-SPONSORED RESEARCH FUNDING **$9,946,158**

RESEARCH AGREEMENTS **47**

LICENSING AGREEMENTS **58**

GROSS LICENSING REVENUE **$43,044,493**



On the cover

The snail-shell-shaped part of the inner ear that houses hair cells.

Holt Lab

FY19

Agreements

LICENSE & OPTION **58**

CONFIDENTIALITY **200**

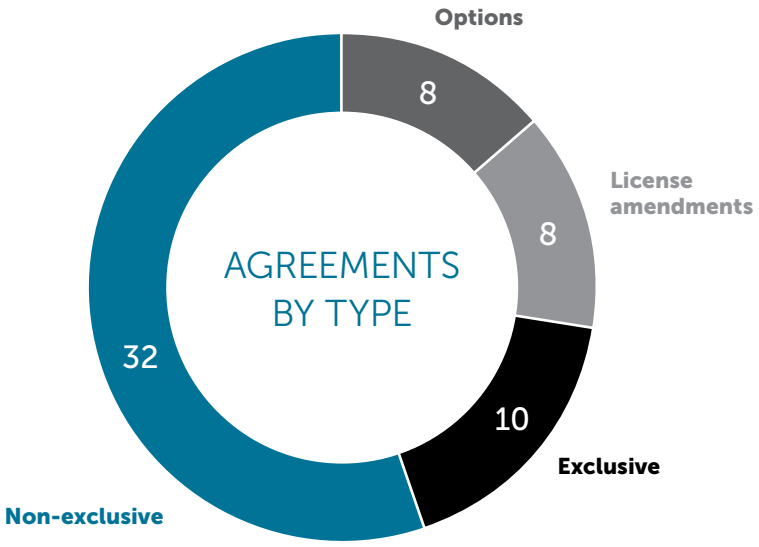
RECEIPT OF EQUITY **7**

MATERIAL TRANSFER **387**

INTER-INSTITUTIONAL INVENTION ADMINISTRATION **8**

CONTRACT RESEARCH ORGANIZATIONS **13**

OTHER **89**



Intellectual property

PATENTS ISSUED **269**

PATENT APPLICATIONS FILED **290**

Revenue

REVENUE FROM FY19 LICENSES AND OPTIONS **$593,200**

GROSS REVENUE **$43,044,493**

Impact

ACADEMIC PARTNERSHIPS **202**

INDUSTRY PARTNERS **270**

START-UPS CREATED **6**

CORPORATE SPONSORED RESEARCH **31**

OTHER RESEARCH COLLABORATIONS **16**

Start-ups

Neutrolis, Inc.
New Clone Limited
Edelweiss Immune, Inc.
Medumo
React Neuro, Inc.
Mediatrics, Inc.

LICENSE AND OPTION AGREEMENTS 5-YEAR TREND

FY19 HIGHLIGHTS

Start-ups

Edelweiss Immune

Eileen Remold-O'Donnell, PhD, senior investigator of the Boston Children's Hospital Program in Cellular and Molecular Medicine, and Lifei Hou, PhD, former postdoctoral fellow, have launched Edelweiss Immune, Inc. to address significant unmet needs in the field of immune system disorders.

Immune system disorders affect up to 23.5 million Americans. In autoimmune disorders, an increasingly common form of immune disease, T helper (Th) cells and other immune cells that are normally protective attack the body's own tissues. Inflammation, a natural immune protective mechanism, becomes aggressive and unregulated, contributing to tissue and organ damage.

Using a model of multiple sclerosis (MS), a classic autoimmune disorder, Remold-O'Donnell and Hou defined the small subset of T cells that initiate and drive neural injury. These highly differentiated Th cells express both cytolytic enzymes and inflammatory cytokines, proliferate extremely rapidly, and migrate to and expand in the central nervous system. Moreover, the investigators discovered that CXCR6, a chemokine receptor, serves as an exquisite marker of these otherwise elusive pathogenic Th cells. They further showed that antibodies to CXCR6 prevent or mitigate MS in a mouse model without broadly dampening the immune system.

With their ability to specifically target pathogenic T cells, Remold-O'Donnell and Hou believe that their methods will be an effective treatment for other autoimmune disorders where current standards of care can result in broad immunosuppression and compromised immune defenses. In support of this, Remold-O'Donnell and Hou documented the CXCR6-marked inflammatory Th cells in patients with inflammatory arthritis at affected sites.

Edelweiss Immune is now well advanced in an aggressive approach to developing humanized anti-CXCR6 treatments for further preclinical development and trials. Boston Children's Hospital has exclusively licensed the underlying technology to Edelweiss Immune.

FY19 HIGHLIGHTS

Licenses

AXONIS

Axonis exclusively licenses patents for promoting axon regeneration for spinal cord injury

Enabling long-distance axon regeneration in the adult central nervous system (CNS) is a crucial step toward functional recovery from spinal cord injury. To this end, Zhigang He, PhD, BM (Neurology, F.M. Kirby Neurobiology Center) has developed technologies to promote the regeneration of severed axons in the adult CNS by inhibiting PTEN (phosphate and tensin homolog), an enzyme that inhibits mTOR, a cell growth regulator. He has shown that PTEN inhibition activates mTOR, which can then enable axon regeneration in chronic injury.

Axonis Therapeutics, Inc. a biotechnology company founded by Robert Yant, Jr., a former director of the Christopher and Dana Reeve Foundation, has exclusively licensed He's patents for PTEN intervention for spinal cord injury and other CNS disorders. Axonis is using the IP developed by He to advance a novel neuro-regenerative gene therapy with the goal of restoring motor function in people who have suffered spinal cord injury, for which there is no current treatment.

LUMICKS
Capture Molecular Interactions

LUMICKS exclusively licenses centrifuge force microscope for single-molecule force experiments

LUMICKS, a biophysics analysis instrumentation company, has exclusively licensed technology developed by Wesley P. Wong, PhD (Program in Cellular and Molecular Medicine). Wong and his research team have developed a miniaturized centrifuge force microscope (CFM). The CFM, which consists of a light microscope and a camera system that are integrated into a centrifuge, enables scientists to observe the interactions of single DNA and protein molecules.

The ability to analyze the behavior of single molecules under mechanical force offers a better understanding of biological processes and can potentially aid the development of more accurately acting drugs. The CFM is able to perform thousands of single-molecule force experiments in parallel, enabling measurements to be made in minutes rather than days. Its power, low cost, and simplicity could lead to new discoveries in health and science research.

Bristol Myers Squibb™

Bristol Myers Squibb enters into an exclusive license for novel use of abatacept for graft-versus-host disease

Bristol Myers Squibb has exclusively licensed data from Boston Children's Hospital concerning a novel use of abatacept, marketed as Orencia. The novel use was discovered by Leslie Kean, MD, PhD, Director of the Stem Cell Transplant Center. Abatacept is a modified antibody developed by Bristol Myers Squibb that is currently used to treat autoimmune diseases such as rheumatoid arthritis by interfering with the immune activity of T cells.

Kean, who received research funding from Bristol Myers Squibb, was previously at Seattle Children's Hospital and at Emory University. There, and now at Boston Children's, Kean leads clinical trials testing the novel use of abatacept in graft-versus-host-disease (GvHD). GvHD occurs when donor T cells see a patient's healthy cells as foreign and consequently attack healthy tissues and organs, a potentially life-threatening medical complication of transplantation.

In December 2019, the U.S. Food and Drug Administration granted Breakthrough Therapy Designation for abatacept for the prevention of moderate to severe acute GvHD in hematopoietic stem cell transplants from unrelated donors. The designation is intended to expedite the development and review of the drug, as clinical trials have been promising and there are currently no approved therapies for the prevention of GvHD. The technology has the potential to become the first agent for preventing acute GVHD.

FY19 HIGHLIGHTS

Sponsored research

BridgeBio sponsors research to develop a gene therapy for hearing loss

Boston Children's Hospital has entered into a sponsored research agreement through a strategic alliance with Audition Therapeutics, a BridgeBio Pharma company, to develop a novel gene therapy to restore hearing loss caused by recessive *TMC1* mutations. Hearing loss is the most common neurological disorder and affects about 466 million people. Currently there is no available treatment that can completely restore hearing. Gene therapy is an avenue being actively explored for the treatment of hereditary hearing loss.

The research study will be led by Jeffrey Holt, PhD (Otolaryngology and Neurology), who elucidated TMC1's role in auditory transduction in hair cells. TMC1 proteins form channels that enable electrically charged ions such as calcium and potassium to enter the hair cells of the inner ear. Through this function, cells are able to convert sound waves into electrical signals that are interpreted by the brain in a process known as sensory transduction. Mutations to the *TMC1* gene cause a loss in sensory transduction, resulting in recessive hearing loss. Holt's previous work in TMC1 lays the groundwork for a precision-targeted gene therapy that treats the hearing loss that occurs when the TMC1 molecular gate is malformed or missing. The study will explore a novel viral-based gene therapy approach for reversing hearing loss in mouse models with *TMC1* mutations.

BridgeBio is a team of experienced drug discoverers, developers, and innovators working to create life-altering medicines that target well-characterized genetic diseases at their source. BridgeBio's pipeline of over 20 development programs includes product candidates ranging from early discovery to late-stage development.

aTyr Pharma sponsors research to develop novel anti-neuropilin-2 antibodies to improve smooth muscle contraction

Boston Children's Hospital has entered into a sponsored research agreement with aTyr Pharma, a public biotherapeutics company focused on the discovery and development of treatments for various diseases with immune components. This project has come full circle — from the initial discovery of the neuropilins as vascular co-receptors by Michael Klagsbrun, PhD (Vascular Biology Program) 20 years ago, to the recently identified novel role of neuropilin-2 (NRP2) in controlling visceral smooth muscle function by Diane Bielenberg, PhD (Vascular Biology Program), Maryrose Sullivan, PhD (Urology Research, VA Boston Healthcare System), and Rosalyn Adam, PhD (Urology Research).

The team at Boston Children's Hospital is now exploring the therapeutic potential of NRP2-blocking antibodies for the treatment of diseases involving inappropriate smooth muscle contractility, starting with conditions such as urinary incontinence and motility disorders of the bowel. The research is addressing a significant unmet medical need since current treatments have limited efficacy and serious side effects. The goal of the collaboration is the development of anti-NRP2 antibodies to prevent, inhibit, or reverse smooth muscle decompensation.

New technology

Novel, targeted, *in vivo* CRISPR genome editing for triple negative breast cancer

Marsha A. Moses, PhD, Director of Vascular Biology at Boston Children's Hospital, and Peng Guo, PhD, in the Vascular Biology Program, have developed a novel, targeted nanolipogel platform technology, NanoEditor, for *in vivo* therapeutic CRISPR gene editing applications. This enabling technology could allow the development of targeted genetic therapeutics for multiple diseases including cancers.

The clinical translation of CRISPR gene editing into therapeutic applications has been held back by the lack of safe and effective non-viral delivery systems. The tumor-targeted NanoEditor is non-viral and is made of nontoxic fatty molecules and hydrogels encapsulating a CRISPR editing system inside a biodegradable, deformable nanolipogel. The system utilizes an anti-body-guided strategy to selectively recognize and bind to cancer cells while sparing normal tissues.

Proof-of-concept studies have demonstrated the utility of NanoEditor as a safe, precise, and effective delivery approach for therapeutic gene editing in triple negative breast cancer (TNBC). The studies explored the use of the nanolipogel for in vivo CRISPR knockout of *Lcn2*, an established breast cancer oncogene, in a TNBC mouse model. To allow targeted gene editing, the nanolipogel is combined with antibodies targeting intercellular adhesion molecule-1 (ICAM-1), a protein identified by the Moses Lab as a novel drug target for TNBC. The studies showed that targeted NanoEditor can halt TNBC tumor progression.

Although the study was focused on TNBC, which has the highest mortality rate and poorest prognosis of all breast cancers, the researchers believe that this platform could be adapted to treat other cancers, advancing precision medicine in cancer therapy.

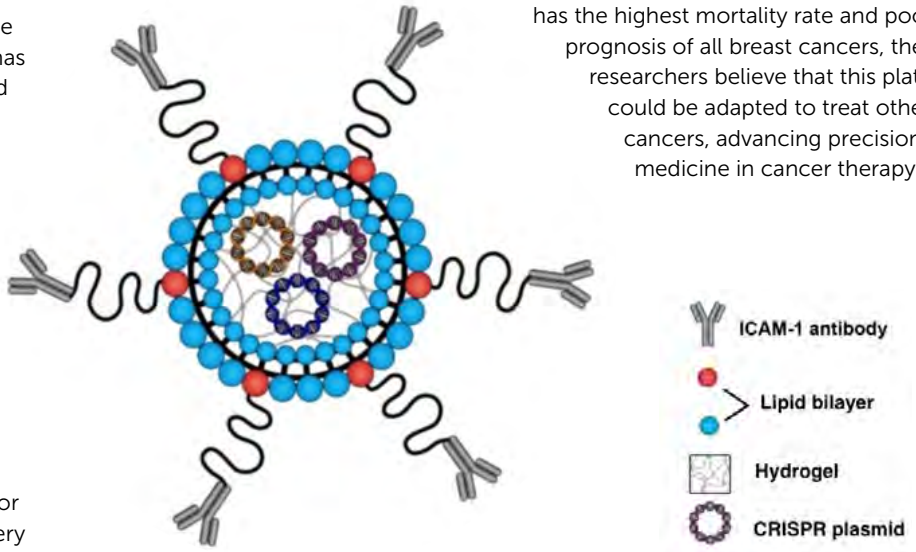


Image: from Marsha Moses, by Kristin Johnson, Boston Children's Hospital

Novel drug combination approach for drug-resistant leukemia

Alejandro Gutierrez, MD (Hematology/Oncology) has developed a novel drug combination approach for treating leukemia by discovering how leukemia cells become drug resistant. Leukemia is the most common form of cancer in children and teens. Treatments for leukemia currently involve asparaginase, an enzyme that has long been known to kill leukemia cells by depleting the amino acid asparagine that is required for cell growth. However, the development of asparaginase resistance is a major clinical problem resulting in a poor prognosis, and asparaginase treatment does not work in about 20 percent of the pediatric patients that Gutierrez sees.

The study led by Gutierrez is a result of a collaboration with the Broad Institute and the Dana-Farber Cancer Institute. The team applied CRISPR gene editing technology to elucidate the molecular mechanism of asparaginase resistance in human leukemia cells. This uncovered the key pathways responsible for asparaginase resistance and novel mechanisms by which drug-resistant leukemia cells overcome the lack of asparagine.

The key to this process is a kinase enzyme called GSK3α. Gutierrez's lab blocked the function of GSK3α using a drug developed by Florence Wagner, PhD, of the Broad Institute and Kimberly Stegmaier, MD, of the Dana-Farber/Boston Children's Cancer and Blood Disorders Center. The Gutierrez team found that drugs that block the function of GSK3α induce profound sensitization to asparaginase in acute leukemia and colorectal cancers that are resistant to asparaginase monotherapy.

In a humanized mouse model of leukemia, the team showed that mice given asparaginase combined with the GSK3α inhibitor lived four times as long as mice that received either treatment alone. The combination regimen was also much less toxic to normal cells in the mice, suggesting that it could be safer than current treatments. Gutierrez also believes that the combined treatment could be useful in other types of cancer, such as colon cancer.

FY19 HIGHLIGHTS

Milestones

Pneumococcal vaccine progresses to Phase 1/2 clinical studies

Affinivax, a clinical stage biotechnology company developing new approaches in vaccine technology, initiated Phase 1/2 clinical studies of ASP3772, a novel vaccine targeting pneumococcal disease, in February 2019. The vaccine was developed through a partnership with Astellas using Affinivax's proprietary vaccine platform, called the Multiple Antigen Presenting Systems (MAPS). MAPS was developed at Boston Children's Hospital by three researchers who are all scientific founders of Affinivax: Richard Malley, MD, Fan Zhang, PhD, and Yingjie Lu, PhD (Division of Infectious Diseases). The program advanced from the labs of Boston Children's Hospital to clinical testing in less than five years.

Treatment for spinal muscular atrophy enters Phase 2 clinical trials

Scholar Rock is a publicly traded company discovering and developing new medicines to treat a range of serious diseases in which protein growth factors play a fundamental role. In 2014, the company exclusively licensed intellectual property from Boston Children's Hospital relating to modulation of activators of growth factors in the cellular microenvironment for therapeutic applications. The IP was developed in part by Scholar Rock co-founders Timothy Springer, PhD, an investigator in the Program in Cellular and Molecular Medicine, and Leonard Zon, MD, Director of the Stem Cell Research Program. Scholar Rock is developing SRK-015, which inhibits the activation of the latent form of myostatin, a member of the TGFβ superfamily of growth factors, for the treatment of spinal muscular atrophy (SMA). In the second quarter of 2019, Scholar Rock initiated dosing of patients with type 2 and type 3 SMA in the TOPAZ Phase 2 clinical trial.

Mesenchymal-stem-cell-derived exosomes enter Phase 1 clinical trials for bronchopulmonary dysplasia

United Therapeutics Corp. has launched Phase 1 clinical trials of Unexisome™, extracellular vesicles (EVs) derived from mesenchymal stem cells (MSCs), for the treatment of bronchopulmonary dysplasia (BPD). That trial builds on the groundbreaking research led by Stella Kourembanas, MD and S. Alex Mitsialis, PhD (Newborn Medicine). Kourembanas and Mitsialis have spent more than a decade discovering the potential of stem cell EVs to create regenerative therapies for BPD and identified a potential new BPD treatment using EVs derived from human MSCs. United Therapeutics exclusively licensed the intellectual portfolio of MSCs developed at Boston Children's Hospital in 2014, and the technology was further advanced through sponsored research collaborations.

Boston Children's Hospital spin-outs with IPOs in FY19

Orchard therapeutics

Scholar Rock

moderna

magenta THERAPEUTICS

FY19 HIGHLIGHTS

Bridging the translational gap

Technology Development Fund

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

The TDF provides:

» mentoring and coaching through an advisory board of industry leaders in 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 2019 Awardees

Selected from 25 applications

Lead adjuvant optimization via structure-activity relationship studies
David Dowling, PhD
Ofer Levy, MD, PhD
Infectious Diseases


Dowling


Levy

Neonatal chest approximator device
David Hoganson, MD
Peter Hammer, PhD
Cardiac Surgery


Hoganson


Hammer

AAV gene therapy for CPVT, an inherited arrhythmia
William Pu, MD
Vassilios Bezzerides, MD, PhD
Cardiology


Pu


Bezzerides

Metabolic mapping of the optic nerve head for early disease detection
Lois Smith, MD, PhD
Bertan Cakir, MD
Ophthalmology


Smith


Cakir

Genetically engineered, safe, food-grade bacteria for the long term, cost effective, side-effect-free treatment of inflammatory bowel disease
Zoltan Szallasi, MD
Computational Health Informatics Program (CHIP)


Szallasi

Development of a potential ALS treatment
Clifford Woolf, MB, BCh, PhD
Laurel Heckman, PhD
Neurology


Woolf


Heckman

FY19 HIGHLIGHTS

Strategic alliances

TIDO's mission is to advance novel therapeutics developed at Boston Children's Hospital from the laboratory bench to the patient 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. Some of our partners include:

BridgeBio

Boston Children's Hospital and BridgeBio entered into a strategic alliance in 2018 to advance novel therapeutics for genetic diseases and oncology. BridgeBio was founded in 2015 to identify and develop treatments that target well-characterized genetic diseases at their source. In service of its mission to bridge the gap between scientific innovation and unmet patient needs, BridgeBio has a pipeline of over 20 development programs ranging from early discovery to late-stage development. Our alliance supports innovative research into potential therapies by providing resources for proof-of-concept studies, with the intent of advancing promising candidates into the clinic.

Selected Investigator for collaboration with BridgeBio:

Jeffrey Holt, PhD, *Otolaryngology and Neurology*

Holt

Astellas

Boston Children's Hospital and Astellas Pharma Inc. have had a strategic alliance agreement since 2019 to identify and fund promising research to advance novel therapeutics. Astellas is a Japan-based pharmaceutical company dedicated to improving the health of people around the world through innovative and reliable pharmaceutical products. The first call for proposals was run in conjunction with one of Astellas's research subsidiaries Mitobridge, located in Cambridge, Mass., and focused on autophagy and mitochondrial pathways. Boston Children's and Astellas are currently in the second-round call for proposals, focused on developing therapeutic strategies to repair or modulate perturbations in RNA homeostasis pathways.

Selected Investigators for collaboration with Astellas:

Mustafa Sahin, MD, PhD, *Neurology*

Darius Ebrahimi-Fakhari, MD, PhD, *Neurology*

Sahin

Ebrahimi-Fakhari

Sanofi

Sanofi is a leading global healthcare company engaged in bringing innovative therapeutic solutions to meet the needs of patients. 2019 marked the second call for proposals at Boston Children's Hospital for the Sanofi Innovation Awards (iAwards) program, which supports early-stage innovative and translational research. The iAwards program is a multi-institutional academic partnership program designed to accelerate the development of promising research towards the clinic. The company is focused on multiple therapeutic areas including oncology, immunology and inflammation, rare diseases, and neuroscience.

Four Boston Children's investigators were awarded a Sanofi iAward in 2019:

Tomas Kirchhausen, PhD, *Program in Cellular and Molecular Medicine*

Raif Geha, MD, *Immunology*

Hao Wu, PhD, *Program in Cellular and Molecular Medicine*

Richard Gregory, PhD, *Stem Cell Program*

Kirchhausen

Geha

Wu

Gregory

Takeda

Boston Children's Hospital formed a strategic research alliance with Shire in 2012. Following the acquisition of Shire by Takeda, the alliance will now focus on therapeutic areas such as oncology, rare diseases, neuroscience, and gastroenterology. Takeda is a global, values-based, R&D-driven biopharmaceutical leader headquartered in Japan that is committed to bringing better health and a brighter future to patients by translating science into highly innovative medicines. We are currently in discussions to expand the collaboration gearing toward a fruitful partnership.

FY19

Issued U.S. patents

10,314,833
Neosaxitoxin combination formulations for prolonged local anesthesia
Kohane, Daniel S.

10,233,447
Self-cleaving ribozymes and uses thereof
Mulligan, Richard

10,350,186
Treatment and prevention of liver disease associated with parenteral nutrition (PN)
Puder, Mark

10,272,110
10,278,990
Methods for promoting HSC engraftment and methods for promoting hematopoietic reconstruction
Zon, Leonard I.

10,159,754
Methods and compositions for regulating gene expression
Mulligan, Richard

10,259,862
VEGF binding protein for blockade of angiogenesis
Mulligan, Richard

10,267,799
Saposin-A derived peptides and uses thereof
Watnick, Randolph S.

10,100,359
Method for diagnosis of autism spectrum disorder
Wu, Bai-Lin

10,286,032
Pro-angiogenic fragments of prominin-1 and uses thereof
D'Amato, Robert

10,266,826
Modulation of BCL11A for treatment of hemoglobinopathies
Orkin, Stuart H.

10,463,729
10,307,478
Biochemically-stabilized HIV-1 Env trimer vaccine
Harrison, Stephen

10,159,697
10,092,599
Methods for enhancing hematopoietic stem/progenitor cell engraftment
Zon, Leonard I.

10,105,412
10,188,717
Vaccines and compositions against *Streptococcus pneumoniae*
Malley, Richard

10,190,160
Methods for predicting anti-cancer response
Szallasi, Zoltan

10,316,085
Therapeutic and diagnostic methods relating to cancer stem cells
Frank, Markus

10,465,234
10.323,269 B2
Selective oxidation of 5-methylcytosine by TET-family proteins
Rao, Anjana

10,344,265
Sustained polypeptide expression from synthetic, modified RNAs and uses thereof
Rossi, Derrick

10,420,645
Right ventricular papillary approximation
del Nido, Pedro J.

10,378,016
Composition and method for oligonucleotide delivery
Lieberman, Judy

10,086,043
Efficient protein expression *in vivo* using modified RNA (MOD-RNA)
Chien, Kenneth

10,357,450
Process for forming microbubbles with high oxygen content and uses thereof
Kheir, John N.

10,226,514
Methods and compositions for reducing blood glucose levels
Ozcan, Umut

10,195,247
Co-activation of mTOR and STAT3 pathways to promote neuronal survival and regeneration
He, Zhigang

10,287,588
Compositions and methods to treating hemoglobinopathies
Williams, David A.

10,192,025
Rotavirus particles with chimeric surface proteins
Harrison, Stephen

10,420,778
Calmodulin inhibitors for the treatment of ribosomal disorders and ribosomapathies
Zon, Leonard I.

10,369,255
Scaffolds comprising nanoelectronics components for cells, tissues, and other applications
Kohane, Daniel S.

10,278,608
Detection of epileptogenic brains with non-linear analysis of electromagnetic signals
Bosl, William J.

10,308,986
Cancer diagnosis, treatment selection and treatment
Szallasi, Zoltan

10,350,320
Magnetic separation using nanoparticles
Kohane, Daniel S.

10,293,023 B2
Method of altering vascular permeability and uses thereof
Ingber, Donald

10,175,243
Use of CD36 to identify cancer subjects for treatment
Watnick, Randolph S.

10,317,498
Methods and apparatus for modeling diffusion-weighted MR data acquired at multiple non-zero B-values
Warfield, Simon

10,238,085
Device and methods for analysis of rodent behavior using frustrated total internal reflection of non-visible light
Woolf, Clifford

10,245,039
Methods and apparatuses for applying tensile force to tissue
Dupont, Pierre

10,232,037
Supramolecular hydrogel of fMLF-based molecule and use thereof
Luo, Hongbo

FY19 ISSUED U.S. PATENTS

10,092,638
GP120 immunogens and methods inducing neutralizing antibodies to human immunodeficiency virus
Harrison, Stephen

10,385,343
Methods and compositions for the treatment of cancer
Lieberman, Judy

10,273,283 B2
Modified integrin polypeptides, modified integrin polypeptide dimers, and uses thereof
Springer, Timothy

10,208,319
Therapeutic uses of genome editing with CRISPR/Cas systems
Rossi, Derrick

10,172,791
Multi-layer hydrogel capsules for encapsulation of cells and cell aggregates
Langer, Robert S.

10,328,045
Dietary emulsion formulations and methods for using the same
Puder, Mark

10,517,899
PD-L1 expressing hematopoietic stem cells and uses
Fiorina, Paolo

10,266,848
Methods and compositions to increase somatic cell nuclear transfer (SCNT) efficiency by removing histone H3-lysine trimethylation
Zhang, Yi

10,365,267 B2
Methods and assays relating to sepiapterin reductase inhibition
Woolf, Clifford

10,395,369
Methods and apparatus for bone segmentation in magnetic resonance images
Mulkern, Robert

10,179,115
Methods for treating malaria using potassium channel inhibitors
Tubman, Venee

10,388,405
Systems and methods for predicting adverse events and assessing level of sedation during medical procedures
Krauss, Baruch

10,285,949
10,292,936
Modified alginates for cell encapsulation and cell therapy
Langer, Robert S.

10,280,225
Compositions and methods for non-myeloablative conditioning
Rossi, Derrick

10,370,458
Therapeutic use of mitochondria and combined mitochondrial agent
McCully, James D.

844,805
High throughput screening of small molecules
Wong, Wesley P.

10,265,349
10,391,131
Therapeutic microbiota for the treatment and/or prevention of food allergy
Chatila, Talal

10,403,007
Registration-based motion tracking for motion-robust imaging
Gholipour, Ali

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 in pharma/biotech, device, research tool, and digital health at all stages of development.

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.

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Where the world comes for answers

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