



**VANDERBILT**  
Technology Transfer



TURNING IDEAS  
INTO OPPORTUNITIES

**DRIVING**  
**INNOVATION**   
**FORWARD**

FALL 2022



# ONWARD AND UPWARD

TURNING IDEAS INTO OPPORTUNITIES

It is important for service providing units like CTTC to effectively communicate their accomplishments to the Vanderbilt community so that faculty and staff understand the importance of engaging in the supported activity. This Driving Innovation Forward publication seeks to do that by providing a summary of key technology commercialization metrics of CTTC and short stories illustrating outcomes achieved over the past year.

However, it is equally important to articulate where we are going and who is helping take us there. There is a great deal of excitement about where we are going. We are assisting in the launch and growth of the Industry Collaborations group – led by Dr. Christopher Rowe and co-located with CTTC, and charged with building upon CTTC’s efforts to structure collaborations and solicit sponsorship support from industry partners. Additionally, we are substantially re-inventing the support and assistance we provide to aspiring entrepreneurs within the Vanderbilt community, positively impacting new venture launch and growth in ways we have not been able to in the past.

Taking industry collaboration and start up support to a new level is a team sport, and coordination among institutional stakeholders is key. Perhaps our most impactful partner in this pursuit is the Wond’ry, who is also expanding its capabilities to support entrepreneurship, and possess goals highly aligned with ours. Other groups also play integral roles, including the Owen Graduate School of Management, Center for Entrepreneurship, and various efforts within the individual schools. But it is really the expectations created by leadership that is driving the exciting new focus on entrepreneurship across campus, from the Chancellor and Provost, to the Vice Provost for Research who is working every day to advance these goals, to the Deans of the schools.

Leadership and vision really make a difference, and groups like CTTC thrive when provided with the opportunity to contribute to this vision.

## Notable Transactions

- Parker Hannifin, IgGenix, Neumora

## Featured Inventor

- Anita Mahadevan-Jansen

## Master Innovator Award

- 2022 Inductees

## Startup Spotlight

- SkyNano, Arena Therapeutics

Page 4

Page 6

Page 8

Page 10

Research Support  
Generated:  
**\$ 24,649,750**

Licensing Revenue  
Generated:  
**\$ 90,412,169**

**1,014**  
MTA’s Reviewed  
778 Incoming  
236 Outgoing

**98**  
Licenses & Options Executed  
**227** End-User Licenses Executed  
**64** Confidentiality Agreements Executed  
**29** Clinical Trial Agreements Reviewed

## FY22 AT A GLANCE

# NOTABLE TRANSACTIONS

## Parker Hannifin

Parker Hannifin's Human Motion and Control (HMC) Division has now licensed a second technology developed at Vanderbilt's CREATE laboratory for commercial development. The Swing-Assist Microprocessor Controlled Knee (SA-MPK) will be developed for commercial use as a collaboration with Dr. Michael Goldfarb's lab at Vanderbilt. The Vanderbilt microprocessor-controlled knees are differentiated from incumbents in their market space by assistance in stair climbing and active stumbling recovery features. Initial discussions with potential users and payers indicate a very positive acceptance of this technology.

This collaboration is the continuation of Parker's previous collaboration, licensing and commercial release of the powered exoskeleton technology branded as the Indego™ series of products.

## IgGenix

In September of 2021, IgGenix, Inc. entered into an Exclusive Option Agreement and Patent License Agreement with Vanderbilt University to secure rights to novel antibodies discovered by Vanderbilt University professor Dr. Scott Smith, an Associate Professor of Pathology, Microbiology, and Immunology at Vanderbilt University.

The license agreement granted IgGenix rights to Smith's antibodies and methods of developing and using them for therapeutic applications. IgGenix uses single-cell techniques to isolate and characterize IgE-producing B cells that can produce anti-allergy antibodies. These therapeutic IgG antibodies are designed to alleviate and possibly prevent life-threatening allergic reactions, saving lives and reducing the constant fear affecting people with severe allergies.

IgGenix is an early-stage, venture backed biotechnology company founded based on research by Steve Quake, Kari Nadeau and Derek Croote at Stanford University.

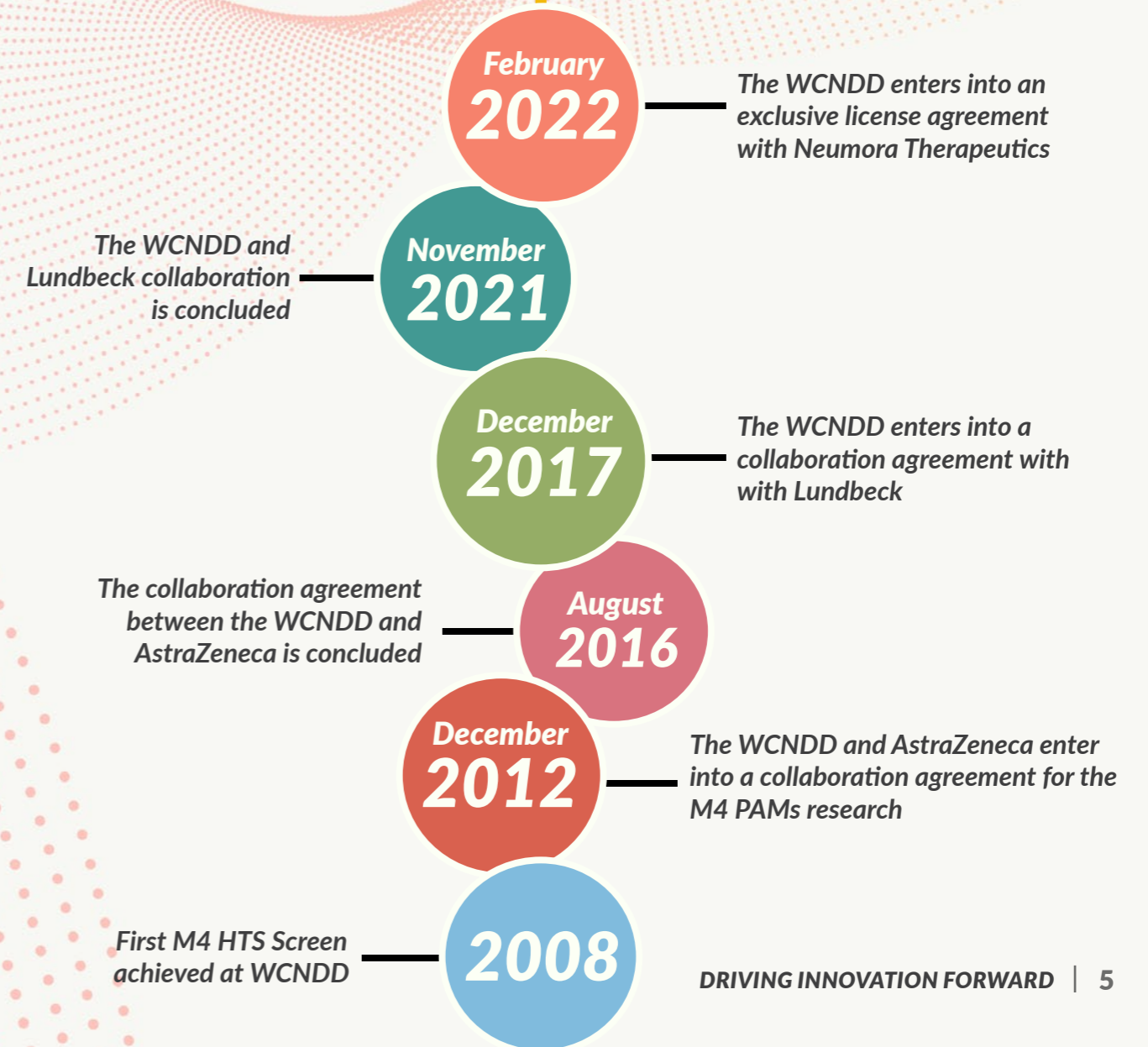
## Neumora Therapeutics

In early 2022, Vanderbilt University signed an exclusive, worldwide license and a research collaboration agreement with Neumora Therapeutics, Inc., a clinical-stage biotechnology company pioneering precision medicines for brain diseases through the integration of data science and neuroscience.

The licensed program centers around the M4 muscarinic receptor positive allosteric modulator (PAM) that targets neuropsychiatric disorders. These modulators boost the activity of a compound, naturally produced by the body, that binds to and activates a receptor at a different site than the modulator. Neumora is progressing the lead series toward the nomination of a development candidate and plans to develop the M4 receptor modulator program for the treatment of schizophrenia. The research collaboration supports ongoing preclinical work at Vanderbilt's Warren Center for Neuroscience Drug Discovery (WCNDD) to advance backup series of these highly selective M4 receptor PAMs.

The WCNDD, led by Director Craig Lindsley and Director Emeritus P. Jeffrey Conn, spearheaded the research effort at Vanderbilt University.

*The M4 portfolio has undergone several commercial advancement steps: partnering with AZ, Lundbeck and Neumora all playing critical developmental roles.*



# FEATURED INVENTOR

## ANITA MAHADEVAN-JANSEN

Since joining Vanderbilt University in 1996, **Anita Mahadevan-Jansen** and her research has changed the landscape of Biomedical Engineering.



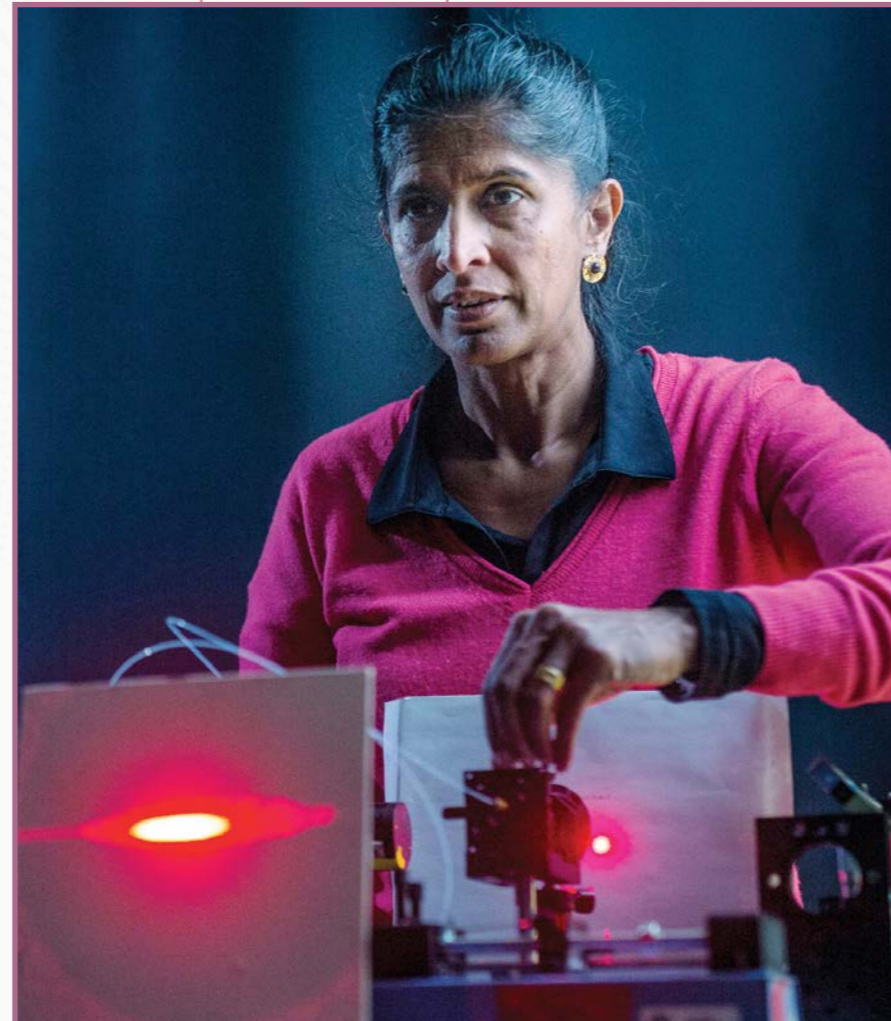
The Orrin H. Ingram Professor of Biomedical Engineering and Professor of Neurological Surgery began her career by studying physics at the University of Mumbai, and earned her Bachelor's and Master's degree there in 1990. However, discovering the field of biomedical engineering, Mahadevan-Jansen moved to the University of Texas at Austin where she completed a Master's and PhD in this discipline in 1996.

She began her independent research career in the Department of Biomedical Engineering at Vanderbilt University in 1997, where her lab focused on translating optical technologies into *in vivo* diagnostic tools. Mahadevan-Jansen's research follows a problem-solving approach where she develops the simplest light based technology (typically label free) that can solve the medical problem under consideration. Using this approach, she developed the application of laser speckle contrast imaging for monitoring the viability of the parathyroid gland, diffuse reflectance spectroscopy for intraoperative nerve imaging and spatially offset Raman spectroscopy for intraoperative evaluation of breast cancer margins.

Mahadevan-Jansen pioneered the use of *in vivo* Raman spectroscopy for non-invasive diagnostics as well as surgical guidance in many areas including pregnancy, bone quality, middle ear infection and eosinophilic esophagitis. Raman spectroscopy is a technique involving the use of a light particle that, when applied to tissue, gives information about the biochemical properties and activities occurring within that tissue.

“The light particle is a like a cue ball in a game of pool, and every time the cue ball hits the other balls on the table, those balls behave in a certain way,” she says. “When a light particle is aimed at tissue, the light reflects back, and in that reflection, we have all kinds of information about what is happening with those molecules.”

- Anita Mahadevan-Jansen



The chemical fingerprint that this technique provides allows it to be highly accurate and has the potential to be used not just for disease diagnosis but also in wellness such as quantifying hydration in high-performing individuals such as athletes and military personnel. One of the most remarkable discoveries made by Mahadevan-Jansen and her collaborators was the ability to modulate peripheral and central nervous system electrical activity label-free with short pulses of infrared light. This process, termed infrared neural stimulation (INS), generated an entire field of label-free neuromodulation which has evolved over the last decade, built on their initial findings.

In 2015, Mahadevan-Jansen was integral in the establishment and opening of Vanderbilt Biophotonics Center (VBC). She was appointed the founding director of the center which seeks to foster the next generation of biophotonics researchers and to push the boundaries of what light can do for fundamental discovery and clinical translation in medicine and biology. The VBC includes 8 faculty in-house and over 32 faculty members around campus and encompasses three principal areas of research: clinical photonics, neurophotonics, and multi-scale biophotonics. The VBC includes researchers in the School of Medicine and the College of Arts & Science and interfaces with existing centers and institutes such as the Vanderbilt Ingram Cancer Center, the Vanderbilt Institute of Nanoscale Science and Engineering, the Vanderbilt University Institute of Imaging Science, the Brain Institute, and the Vanderbilt Institute for Integrative Biosystems Research and Education.

In 2020, Mahadevan-Jansen was elected to serve as the Vice President of SPIE (the Society of Photo-Optical Instrumentation Engineers) and currently serves as the Society's President in 2022.

Continuing to recognize the impact she has had on innovation during her career, in 2022, Mahadevan-Jansen was inducted into CTTC's Innovator Hall of Fame as a part of the Master Innovator Recognition Program - acknowledging her contribution and demonstrated excellence in research and innovation at Vanderbilt University.

### AI BIOMED

In March of 2020, Medtronic acquired AI Biomed (a Vanderbilt startup and licensee) and since then has successfully launched the first product commercially, aptly named PTEye™. The PTEye™ system is an intra operative probe-based technology that aids surgeons in confirming suspected parathyroid tissue during thyroid and parathyroid surgery. AI Biomed was spun off from ANASYS INSTRUMENTS, Inc. who in 2012 licensed a photonics technique for discerning between parathyroid and thyroid tissue developed in Mahadevan-Jansen's laboratory in the Vanderbilt Biophotonics Center. The company successfully developed a hand-held product design that was subsequently approved by the FDA as a Class II device in 2018.

# MASTER INNOVATOR RECOGNITION PROGRAM

The Master Innovator program is an annual recognition program developed to acknowledge Vanderbilt's top innovators and entrepreneurs for their contributions to the development and commercialization of intellectual property. Awardees have demonstrated excellence in a select number of key commercialization categories, including new inventions disclosed, patent applications filed and issues, new companies formed, technology licenses executed, commercialization revenue generated, and products on the market - all based on the candidate's innovations created at Vanderbilt. Awardees are memorialized as a member of the CTTC Innovators' Hall of Fame.

## 2022 Recipients

### James Crowe, Jr

*Director*, Vanderbilt Vaccine Center  
*Professor*, Pediatrics and Pathology,  
Microbiology and Immunology  
*Ann Scott Carell Chair*



Left, CTTC licensing officer,  
Karen Rufus, presents the  
award to James Crowe, Jr



### Craig Lindsley

*Professor*, Pharmacology  
*William K. Warren, Jr. Chair*, Medicine  
*Professor*, Biochemistry  
*Professor*, Chemistry

### P. Jeffrey Conn

*Director Emeritus*, Warren Center for Neuroscience  
Drug Discovery (WCNDD)  
*Lee E. Limbird Professor*,  
Pharmacology and Biochemistry



### Anita Mahadevan-Jansen

*Director of the Biophotonics Center at Vanderbilt*  
*Professor*, Biomedical Engineering  
*Orrin H. Ingram Professor*, Engineering  
*Professor*, Neurological Surgery



Left, CTTC licensing officer,  
Ashok Choudhury, presents  
the award to Anita  
Mahadevan-Jansen

### Michael Goldfarb

*H. Fort Flowers Professor*, Mechanical Engineering  
*Professor*, Electrical Engineering  
*Professor*, Physical Medicine and Rehabilitation  
*Co-director*, Center for Rehabilitation  
Engineering and Assistive Technology



Right, CTTC  
licensing officers  
Taylor Jordan &  
Ashok Choudhury  
present the award to  
Michael Goldfarb

### Stephen Fesik

*Orrin H. Ingram II Chair*, Cancer Research  
*Professor*, Biochemistry,  
Pharmacology, and Chemistry



### Benoit Dawant

*Cornelius Vanderbilt Professor*, Engineering  
*Director*, Vanderbilt Institute for Surgery and Engineering  
*Professor*, Electrical Engineering  
*Professor*, Computer Science  
*Professor*, Biomedical Engineering  
*Professor*, Radiology and Radiological Sciences  
*Professor*, Neurological Surgery  
*Professor*, Otolaryngology-Head and Neck Surgery



Right, CTTC licensing  
officer Taylor Jordan  
presents the award to  
Benoit Dawant

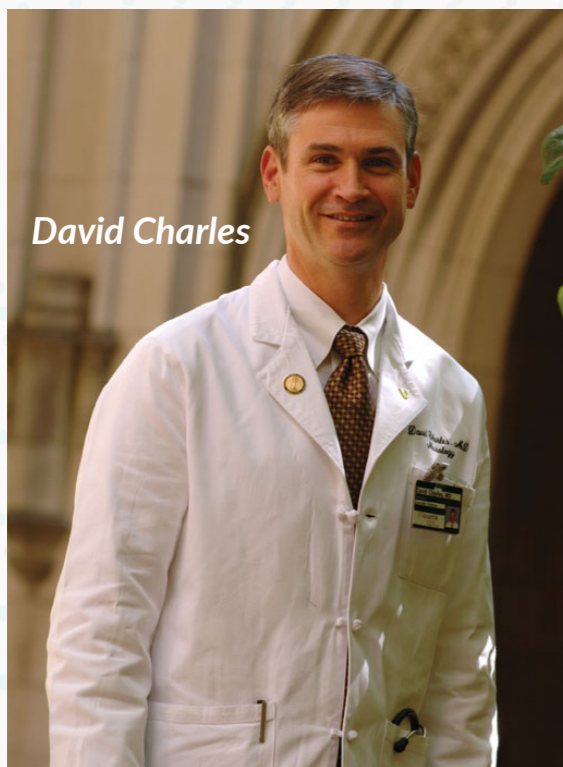
# STARTUP SPOTLIGHT

## WHERE ARE THEY NOW

### Arena-Therapeutics

Arena Therapeutics is a medical device company focused on advancing Deep Brain Stimulation (DBS) for the treatment of patients diagnosed with early-stage Parkinson's disease (PD). Arena's founders include David Charles, M.D., Professor and Vice-Chair of Neurology at VUMC, and Mallory Hacker, Ph.D., Assistant Professor of Neurology at VUMC.

Over 10 million people worldwide are living with PD, including 1 million in the US alone. 60,000 people are newly diagnosed with PD each year. Deep Brain Stimulation is currently used as a secondary treatment in mid- and advanced Parkinson's disease when first-line treatments using medications no longer control symptoms or produce intolerable side effects. While medications and later-stage DBS treatments help control Parkinson's symptoms, they do not reverse the effects of PD or slow its progression.



David Charles

A team of researchers at VUMC led by Dr. Charles conducted a randomized, controlled clinical trial to assess the feasibility of using DBS for early-stage PD. Data from that study suggest that early DBS may not only help control Parkinson's symptoms, but also slow progression of the disease itself.

Arena is currently seeking funding to conduct a definitive clinical trial that would pave the way for using DBS as a first-line treatment for early Parkinson's Disease.



Anna Douglas

### SkyNano

SkyNano is a science-based technology company that was founded in 2017 as a spin-out of Vanderbilt that was then incubated at the Department of Energy funded Innovation Crossroads program at Oak Ridge National Laboratory. Led by Anna Douglas (PhD '19), the company is focused on commercializing a free-market solution to carbon pollution. It specifically develops a novel electrochemical manufacturing technology for the capture and conversion of CO<sub>2</sub> from various sources (atmospheric, concentrated, flue gas) into valuable carbon-based materials such as carbon nanotubes.

SkyNano has received \$10M in funding from various federal, state, and commercial sources including the DOE, DoD, and the NSF, and the company employs 8 full-time employees in Knoxville, TN. Recently, the company also received the 2022 Governor's Environmental Stewardship Award from Tennessee Governor Bill Lee and the Tennessee Department of Environment and Conservation. The company is in the process of scaling up their production capabilities and continues to test their innovative technology with various sources, including the successful production of carbon nanotubes from flue gas obtained from the Tennessee Valley Authority, the largest public utility in the United States.

[www.vanderbilt.edu/cttc](http://www.vanderbilt.edu/cttc)



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