

2023 CBID YEAR IN REVIEW



We are thrilled to share with you the exciting work of the students, faculty fellows and staff of the Johns Hopkins Center for Bioengineering Innovation & Design (CBID). CBID'23 was our 14th year, and one of our most creative and productive. We started June 2022 with Boot Camp Week, and wrapped up with final presentations and graduation in May 2023.

From our first year in 2009, CBID has been guided by our two-fold mission: (1) the education and development of the next generation of leaders in healthcare innovation, and (2) the creation and early-stage development of solutions to major healthcare challenges that have a high potential for impact. For both wealthy healthcare systems like Johns Hopkins, and for some of the lowest-resourced regions of the world, we care deeply about education and innovation, and track our impact on both scorecards.

CBID has developed an effective model for early-stage healthcare innovation that incorporates best practices from successful academic programs, medtech companies, and design firms. Our method ensures our innovation teams build their ideas on a solid foundation that consider all of the factors essential for success, from engineering to medicine, to business, laws and regulations, and management. CBID students engage closely with clinicians, engineers, industry professionals, and global health experts to design, build, and test solutions with high potential for real-world impact. We empower our students with the skills, connections, and experience necessary to become influential leaders in healthcare innovation.

To all of our partners and mentors, our creative and passionate students and fellows, our dedicated faculty and staff, our donors and sponsors, and our active board members, we say thank you and congratulations on helping to make CBID'23 one of our best years so far.

Youseph Yazdi, PhD, MBA
Director

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264 GRADUATES
SINCE 2009

185
PROJECT
MENTORS

115
PROJECTS

65
ADVANCED
HEALTH

50
GLOBAL
HEALTH

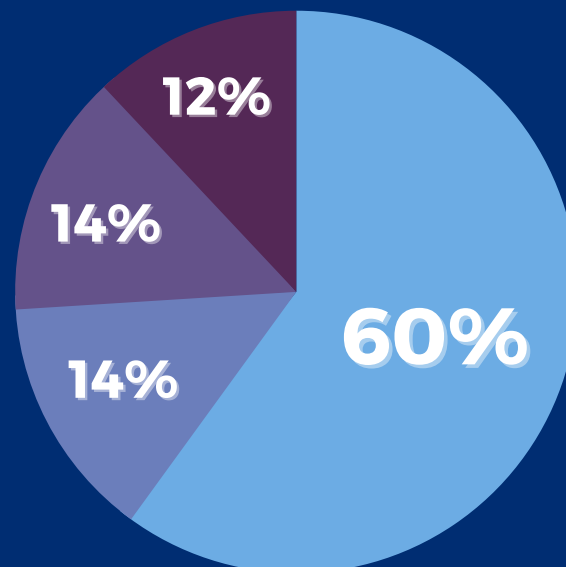
**SUCCESSFUL GRADUATES
IN MANY FIELDS**

STARTUPS

ACADEMIA
MEDICINE, GRADUATE STUDIES

INDUSTRY
MEDTECH, CONSULTING

OTHER
GOVERNMENT, NON-PROFITS



15

MEDICAL RESIDENTS
AND MEDICAL STUDENTS
GRADUATED FROM CBID MSE

SURGEONS & PHYSICIANS

DEVIN O'BRIEN-COON, 2013

ALISON WONG, 2016

ANDREW EISENTHAL, 2018

ALEXIS GRAHAM, 2021

ZACHARY PLONA, 2022

JOSEPH BURKETT, 2022

KHALIL MERALI, 2023

ANDERS SIDERIS, 2023

MEDICAL STUDENTS

DAVID GULLOTTI, 2017

REGINA CHO, 2018

ALLISON WALLINGFORD, 2019

SOPHIA DIAZ, 2020

SAMUEL WEINREB, 2021

ALEXANDRO CHARA, 2021

ROHAN VERMA, 2022

AN EXPERIENCED AND DIVERSE TEAM



Youseph Yazdi joined Johns Hopkins in 2009 as faculty in BME and head of CBID. He has 30+ years of experience in early-stage medical device innovation and design. Prior to JHU, he was in Advanced R&D, BizDev, and then Corporate Director, Science and Technology, at Johnson & Johnson. He earned a BS degree in Electrical Engineering from Rice University, MS acoustics, and PhD in Biophotonics from UT-Austin, and MBA from the Wharton School at UPenn.



Soumyadipta Acharya is an Assistant Professor in the Department of Biomedical Engineering, and the CBID Graduate Program Director. He is a physician and biomedical engineer by training. Dr. Acharya was the chief architect of the CBID MSE program including its global health innovation program. His research is focused on global health engineering, especially for the last mile of the health system in low and middle income countries.



Kunal Parikh is a serial inventor and entrepreneur working at the intersection of medtech and social enterprise to enable health equity globally. He serves on the faculty of the Center for Bioengineering Innovation & Design and Center for Nanomedicine at JHU where he leads multidisciplinary teams creating and commercializing biomedical solutions to significant, unmet healthcare needs. He earned his Ph.D. in Biomedical Engineering from Johns Hopkins University and has been recognized by Forbes 30 under 30 in Healthcare.



Clifford Weiss is a Professor of Radiology, Radiological Science and Biomedical Engineering. He serves as Medical Director of CBID, the Director of the Johns Hopkins HHT Center of Excellence, Director of the Johns Hopkins Vascular Anomalies Center, and Deputy Editor of Interventional Content for the journal Radiology. Dr. Weiss' clinical focus lies in the diagnosis and treatment of vascular malformations. His research focuses primarily on the development of Bariatric Embolization, on the development and of new embolic therapies and devices.



Ashish Nimgaonkar is a gastroenterologist-scientist and an entrepreneur. He is an Assistant Professor of Medicine, medical director for the CBID program and adjunct faculty at the JHU Carey Business School. He is the founder & CEO of Glyscend Therapeutics, a venture funded, clinical stage company which had its origins in CBID. He graduated from Harvard-MIT HST program and completed his clinical training at Harvard and Stanford, where he was also a Biodesign fellow.



April Zambelli-Weiner is a Senior Healthcare Leader, Innovator & Entrepreneur with 25+ years of experience in medtech commercialization and translational epidemiology. Having helped to commercialize hundreds of diverse medical products, Dr. Zambelli-Weiner advises healthcare leaders on reimbursement, health economics and evidence generation to improve speed to patient. Dr. Zambelli-Weiner is founder and CEO of TTI Health Research & Economics, holding leadership positions in national and international non-profits focused on improving healthcare.



Taufiq Hasan is an Adjunct Faculty at the Center for Bioengineering Innovation and Design, where he supervises global health projects. His research focuses on applications of AI in health. Dr. Hasan has 20+ peer-reviewed papers and several US patents/patent applications. He completed his Ph.D. at the University of Texas at Dallas. He is also an Associate Professor of BME at the Bangladesh University of Engineering and Technology (BUET) and the Director of the mHealth Lab.



Aditya Polsani is Director of Business Development at CBID where he manages marketing, recruiting talent, mentoring teams, and corporate partnerships. Over the years, he held various roles at Johns Hopkins including in Biomedical Engineering, Brain Science Institute, and Johns Hopkins Technology Ventures where he managed technology incubation, IP management, licensing, and commercialization activities. He also co-founded CBID, Academic Drug Discovery Consortium (ADDC), and Hopkins Biotech Network (HBN).



Diana Carstens is the Senior Administrative Coordinator at CBID where she provides support to the Executive Director, faculty, students, clinicians, and industry partners within the CBID MSE program. Prior to joining Johns Hopkins in 2016, she held administrative positions at the University of Glasgow in Scotland, and the Max Planck Institute in Leipzig, Germany.



Harshad Sangvi recently retired as VP and chief medical officer for Jhpiego at Johns Hopkins University. He has dedicated his career to assisting 45 countries in adopting evidence-based guidelines, including spending two decades in Kenya to improve healthcare for women. Notably, he developed the single visit approach for cervical cancer prevention, implemented in 30 countries. Harshad received prestigious awards for his work in preventing postpartum hemorrhage and holds an Honorary Fellowship with the Indian College of Obstetrics and Gynecology.



Radha Tarlekar is an Associate Research Scientist in CBID. She is a physician and public health by specialty. Dr. Tarlekar has previously worked with multinational NGOs like World Health Organization, PATH, and Intellehealth on various public health programs and is currently working with CBID MSE team members on global health innovation programs with a focus on implementation sciences in resource-constrained settings.



Rawan Elshobaky is a rising junior majoring in Molecular and Cellular Biology and double minoring in Computer Science and Bioethics. She has been an administrative assistant at CBID for two years where she helps in preparing events, filing for travel reimbursements, and compiling databases for internal and marketing purposes.



Allyson Chiu is a rising sophomore majoring in Biomedical Engineering. She is most interested in pursuing the intersection between business and biotechnology. As a marketing intern at CBID, she manages social media accounts and engages with students in the studio to create content, supporting their ideas.



Lucy Wu is a rising sophomore double majoring in Applied Math and Computer Science, and is invested in exploring how data driven practices can improve healthcare systems. She is a marketing intern at CBID where she designs flyers and brochures and collaborates with curating the social media posts to effectively communicate student innovations to a public audience.

Class of 2023



Poplar Yang



Braden Barlean



Meagan Smith



Khalil Merali, MD



Anders Sideris, MD



Phoebe Dijour



Shri Prabha Shivram



Mitch Turley



Teja Sathi



Leanne Pichay



Pav Naicker



Kim Hwang Yeo



Bhavya Gopinath



Sam Dasari



Sunny Patel



Carter Gaulke

DigniFI: Providing Patient-Centered Solutions for Managing Fecal Incontinence

Students: Poplar Yang, Braden Barlean, Meagan Smith, Khalil Merali

Advisors: Peter Abadir, Youseph Yazdi, Soumyadipta Acharya

Clinical Mentors: Grace Chen, Hainee Chung, Susan Gearhart, Sunny Oh, Bryan Hansen

Abstract: Fecal incontinence (FI) is uncontrolled soilage on a spectrum from small volume leakage to more complete involuntary bowel movements. It becomes more prevalent with age, affecting 11 million older adults in the United States. Patients with incontinence have about a 30% increased risk of mortality, even after factoring for other comorbidities. Current fecal management systems (FMS), a rectal balloon and catheter system, only capture liquid and semi-liquid stools, which causes about 57% of patients within acute care settings to experience fecal loading. This problem is even more pronounced in nursing homes where 70% of residents experience fecal loading. The use of absorptive products like diapers and pads contributes to UTIs, incontinence associated dermatitis, skin breakdown, and high rates of caregiver burnout, costing the healthcare system \$13 billion dollars in community-based settings and \$4 billion dollars in acute care.

We are developing digniFI to better manage incontinence both in acute care and nursing home settings. It is comprised of a rectal catheter, collection bag, applicator, and irrigation system. To manage harder stools, we are developing a stool morcellator and an emulsification system. All components of the device are made of biocompatible and bioinert materials. We have identified a path to market which involves submission of a 510(k) application to the FDA with an identified predicate device. We aim to enter the market within the acute care setting and then expand to the long-term care setting where the need is greatest. Thus, we aim to improve the lives of older adults and their caregivers through patient centered solutions for fecal incontinence.



SomnOSA: Relieving Complete Concentric Collapse in OSA

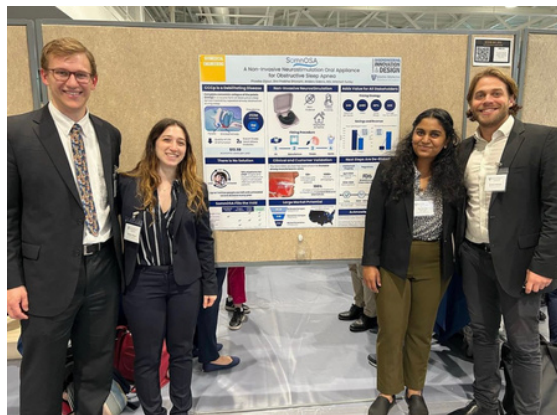
Students: Anders Sideris, Phoebe Dijour, Shri Prabha Shivram, Mitch Turley

Advisors: Nicholas Rowan, Youseph Yazdi, Ashish Nimgaonkar, April Zambelli-Weiner, Antony Fuleihan

Clinical Mentors: Robson Capasso, Stuart Mackay, Alan Schwartz, Kevin Motz

Abstract: Complete concentric collapse at the level of the palate (CCCp) is a severe form of obstructive sleep apnea (OSA), marked by repeated airway obstruction affecting up to 250 million people worldwide and 8 million in the US alone. Left untreated, it doubles risk of heart attack, stroke, and diabetes, and increases daytime sleepiness and neurocognitive dysfunction. OSA-related motor vehicle accidents alone kill 1400/year and contribute to \$150B in US economic burden. The current treatment options (CPAP, upper airway surgery, neurostimulation) are expensive, invasive, and have poor outcomes, leaving 1 million people suffering with untreated severe disease every year.

The SomnOSA solution is a novel neurostimulation platform that increases airway musculature tone to prevent airway collapse. The patient deploys a removable device that activates during sleep. Neurostimulation is timed to patient inspiration, opening the airway and restoring normal breathing, to maximize its effect. The SomnOSA solution sets a new standard for non-invasive, clinically effective treatment of OSA by providing therapy targeted at the root cause of disease.



DiscOva: Enabling Gynecologic Diagnostics through the Collection and Preservation of Menstrual Effluent

Students: Teja Sathi, Leanne Pichay, Pav Naicker, Kim Hwang Yeo

Advisors: Youseph Yazdi, Soumyadipta Acharya, April Zambelli-Weiner, Fred Walker, Aditya Polsani

Clinical Mentors: Brian Wildey, Christine Metz, Golsa Yazdy, Richard B. Roden, Thomas Pisanic, Mary Lynch

Abstract: DiscOva is a comfortable and convenient method to collect, store, and transport menstrual effluent samples, while maintaining the integrity of these samples to be useful for diagnosis. Menstrual effluent's composition makes it suited for the diagnosis of gynecologic diseases. More than 1 in 10 women suffer from endometriosis, which causes extreme pelvic pain and has no good method of detection. The only method of diagnosis is invasive surgery carrying the risk of complications. Live cells from menstrual effluent demonstrate high diagnostic potential for endometriosis. Mononuclear cells from menstrual samples also show a strong resemblance with endometrial mononuclear cells, suggesting other promising uses.

DiscOva seeks to take a menstruating person-centered approach to keep collection simple and remove extensive sampling handling. It preserves menstrual effluent components critical to diagnostics. Work taken to progress DiscOva has included validation of methods of preserving cell viability, specifically the stromal fibroblast cells used in endometriosis detection research. Analogs in sample preservation such as Streck Tubes and BD Vacutainer tubes have been studied. In parallel, DiscOva targets seamless at-home collection and preservation, including extensive customer discovery and exploration into menstrual products on the market. Each design considerations ensures that DiscOva will adequately address the need it seeks to fulfill.



MiraHeart: Monitoring Early Signs of Pediatric Heart Failure

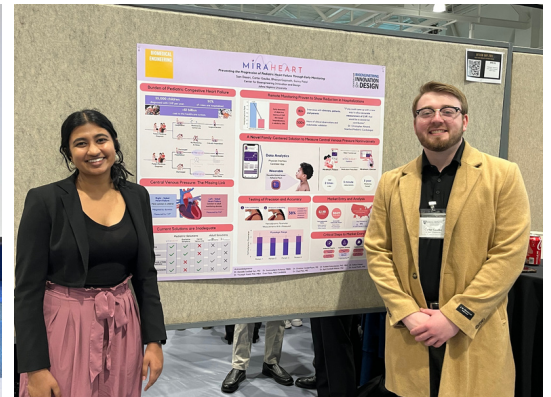
Students: Bhavya Gopinath, Sunny Patel, Sam Dasari, Carter Gaulke

Advisors: Youseph Yazdi, Soumyadipta Acharya, April Zambelli Weiner, Kunal Parish, Kolaleh Eskandarian, Aditya Polsani

Clinical Mentors: Danielle Gottlieb Sen, Christina VanderPlyum, Chad Mao, Anita Krishnan, Anitha John

Abstract: MiraHeart aims to improve the lives of children with heart defects who are at risk of congestive heart failure (CHF). Every year in the United States, 35,000 children are affected by CHF, a disease with a 6.3% mortality rate. The pediatric cardiomyopathy population is prone to developing CHF, as 60% of diagnosed patients receive CHF treatments within their first month. 50% of those diagnosed with CHF are hospitalized, and those with cardiomyopathy have 11% in-hospital mortality rate. With hospitalizations of \$70,000 per patient, CHF costs \$1B annually. CHF occurs when the heart fails to meet the circulatory demands of the body with increased intravascular fluid pressure, known as central venous pressure (CVP). CVP is critical to adjusting CHF medications, but can only be read in hospital settings. Families have no way to track their child's CHF, so hospitalization and more intensive treatments are used, resulting in higher treatment costs.

MiraHeart addresses this gap. Our wearable, non-invasive device provides objective metrics of CHF by reading CVP and transmits this to physicians. MiraHeart has a small, optical sensor array and software system in a neck band worn by a child twice daily, for 5 minutes each. MiraHeart is prescribed by the patient's cardiologist and utilized by the child's caretaker, facilitating proper decision-making on CHF medications to transform care. Our team submitted porcine and pediatric human protocols to further validate the accuracy of our device in April 2023 upon approval.



ARISE: Expanding Global Access to Minimally Invasive Surgical Education

Students: Poplar Yang, Braden Barlean, Meagan Smith, Khalil Merali

Advisors: Harshad Sanghvi, Tigistu Adamu Ashengo, John Varallo, Swaroop Vedula, Youseph Yazdi, Soumyadipta Acharya

Clinical Mentors: Daniel Rhee, Lance Maybe, George Orerah, Steve Mutiso, Tsion Abdi, Adrian Park

Abstract: Five billion people lack access to safe surgical care with the majority of those living within low and middle-income (LMIC) areas. Laparoscopy is a better option for surgically treated conditions, reduces secondary healthcare burdens by shortening the length of hospital stay, minimizing pain and complications that lead to disability, and decreases post-operative infection rates. In Kenya, surgical equipment and surgical education are bottlenecks in increasing laparoscopic capacity. Simulation training has been popularized in developed healthcare settings to facilitate skill acquisition in non-surgical settings, but adoption of simulation still faces barriers as it relies on direct mentorship, trains only basic skills, and is not fit for independent use.

ARISE is a modular simulation training platform for laparoscopic surgery focused on accessible, mentor-facilitated training. It pairs a smartphone camera with a low-cost simulation box to deliver cost-effective skills training. Trainees independently develop skills in laparoscopy without an in-person mentor. We integrate best-practices including high frequency, low dose training, progression systems, and motivational content. This platform has been deployed at four Kenyan hospitals as part of a usability study, with unanimously positive feedback from surgeons and trainees. Future development areas include skills training at every step of competency development, facilitated by AR and VR environments. We are developing machine learning algorithms to provide tailored surgical training based on performance and deliver goal-directed feedback. ARISE will be a paradigm shift in surgical education to accelerate and democratize surgical training globally.



Visilant: Increasing Access to Eye Care through Community-Based Telemedicine

Students: Anders Sideris, Phoebe Dijour, Shri Prabha Shivram, Mitch Turley

Advisors: Kunal Parikh, Jordan Stuff, Nakul Shekhawat, Rama Chellappa, David Green, David Friedman, Nicholas Durr, Corey Simmerer, Marisa Morakis

Clinical Mentors: Shalinder Sabherwal, Umang Mother, Rengaraj Venkatesh, Dayakar Yadalla, Dr. Baharadwaj, Rashmirita, S. Vijay, Mr. Vignesh

Abstract: 90% of the world's 275 million blind and visually impaired people live in low- and middle-income countries (LMICs). Cataract, refractive error, corneal opacities, and other anterior eye diseases account for the majority of global blindness. In rural LMIC settings, lack of access to highly trained eye care providers, such as ophthalmologists (1:91,000 patients in India), is a key barrier to timely diagnosis and treatment for anterior eye diseases. There is an unmet need for accessible, ongoing screening of underserved patients in order to enable access to care and eliminate avoidable vision loss.

Visilant is an end-to-end eye screening and management system consisting of a low-bandwidth telemedicine platform and proprietary anterior segment imaging device. For eye care systems, Visilant's technology platform provides a way to improve patient outreach and increase revenue while reducing reliance on limited specialized eye care staff. For patients, Visilant enables timely treatment and sustainable, longitudinal integration into the healthcare system. Visilant's service is currently being used and evaluated by the largest eye care system in the world to diagnose, refer, and enable access to vision care in hundreds of remote communities in India.



Ekyallo: Enabling Accessible Breast Cancer Screening in LMICs

Students: Teja Sathi, Leanne Pichay, Pav Naicker Kim Hwang Yeo

Advisors: Youseph Yazdi, Soumyadipta Acharya, Harshad Sanghvi, Susan Harvey, Radha Tarlekar, Aditya Polsani

Clinical Mentors: Robert Lukande, Sam Kalugni, Susan Nabadda, Peter Waiswa, Dan Niwaha, Dan Milner, Chris VandenBussche

Abstract: Ekyalo is an AI-assisted method to interpret breast cytology from fine needle aspiration samples, increasing accessibility, speed, accuracy, and reliability of breast cancer diagnosis in low- and middle-income countries. In Uganda, breast cancer carries a 20x greater likelihood of mortality than the United States, with 1 in 2 Ugandan women diagnosed with breast cancer succumbing to the disease. Women in rural communities face barriers to accessing diagnosis as the cancer progresses. It takes well-over 60 days for a woman to receive diagnostic results, and many never do. Over 80% of women presenting for treatment in Uganda have late-stage disease which has a low survival rate even with treatment. There is a need to decentralize the method of breast cancer diagnosis to reduce diagnostic turnaround-time and reduce mortality.

Ekyalo will increase access to breast cancer diagnosis so women with symptoms can receive triage before being directed to next steps. Stakeholder feedback from 18 pathologists in Uganda establish moving preliminary diagnosis to lower-tier health centers can reduce late stage presentation of breast cancer. We aim to enable the use of fine needle aspiration cytology, which is minimally invasive, minimizes discomfort, requires non-specialized resources, and takes minutes to process; implement digital pathology to share information between health workers and pathologists; apply AI for on-site evaluation of accurate classification of malignancy; standardize workflow through hardware and software implementations.



VectorCam: Fighting Malaria One Image at a Time

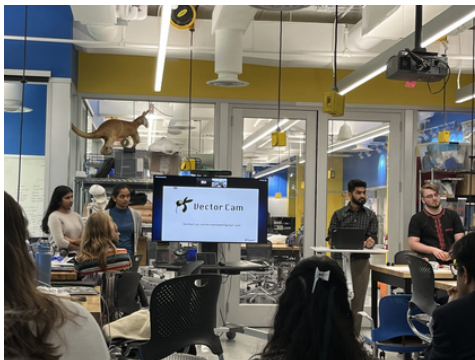
Students: Bhavya Gopinath, Sunny Patel, Sam Dasari, Carter Gaulke

Advisors: Youseph Yazdi, Soumyadipta Acharya, April Zambelli Weiner, Kunal Parish, Radha Taralekar, Aditya Polsani

Clinical Mentors: Soumyadipta Acharya, Youseph Yazdi, Neil Lobo, Doug Norris, Jane Carlton, Radha Taralekar, Peter Waiswa, Smisha Agrawal, Rama Chelleppa, Ali Madooei, Jimmy Opigo, Catherine Maiteki

Abstract: Each year, malaria infects 227 million individuals, resulting in over 400,000 deaths, most of whom are pregnant women and children under five in sub-Saharan Africa. Efforts to eliminate malaria rely on monitoring vector species composition, abundance, distribution, and behavior across different transmission geographies. For effective malaria control, targeted interventions and resource allocation should be driven by a robust vector surveillance system. For example, one primary vector of malaria has a different biting pattern than another, and therefore necessitate different intervention strategies.

Vector surveillance begins with mosquito specimens collected at sites across a country using methods such as CDC light traps. They are morphologically identified for sex, species, and abdominal status by vector control officers (VCOs), who study entomology and vector surveillance for 3 years. However, entomologists are limited and hard to retain where the burden of malaria is the highest. This shortage hinders larger surveillance efforts, especially where they are needed, as sites for specimen analysis are sparsely distributed across a target region, and treated as a representation of the entire country. This causes inaccuracies in interventions and worsened by the time lag between capturing specimens and reporting usable data. VectorCam will be the first low-cost AI-based tool that detects a mosquito's species, sex, and abdomen status, deskill the identification process. Task-shifting efforts to Village Health Teams (VHTs) generate widespread surveillance coverage, enabling better-informed malaria intervention decisions.





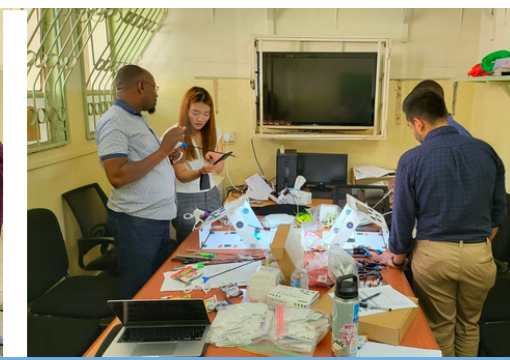
India



Kenya



Eye Care



Surgical Skills



Uganda



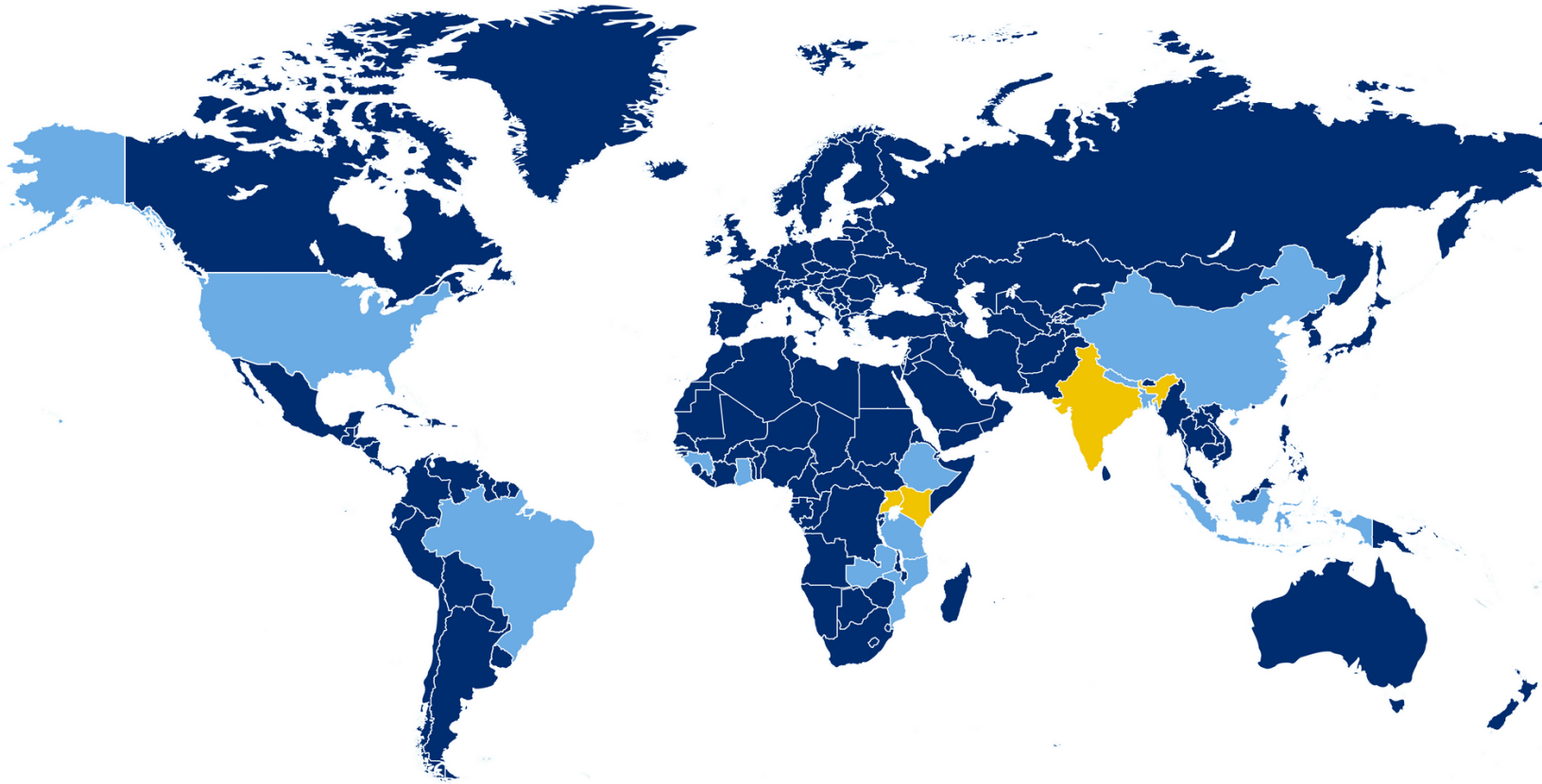
Uganda



Breast Cancer



Malaria Vector



2023 Travels - Kenya, Uganda, India



Past Travels - Bangladesh, Brazil, China, Ethiopia, Ghana, Guinea, Indonesia, Mozambique, Nepal, Tanzania, USA, Zambia



Johns Hopkins CBID - Abell Foundation Fellowship

We offer a second-year fellowship for students involved in our intensive one-year MSE program. The fellowship program which is funded by the Abell Foundation allows students to focus on building a new venture around the concept they developed during their first year. The fellows leverage the second year to raise funding, build and test prototypes, derisk the technology and build a team of advisors.



Evan Haas is a self-proclaimed scrappy mechanical engineer with experience in product management and entrepreneurship. He is a co-founder of CurveAssure, a company developing a novel spinal assessment tool to enable personalized interventions for deformity and degeneration patients. You will find him eating Thai food or playing golf when not working on his startup. Through many iterations around the CBID spiral model, he believes he has found the best Thai krapow and red curry dishes in Baltimore.



Antony Fuleihan is an engineer, entrepreneur, and Abell Fellow. Since graduating in the CBID Class of 2022, he is a co-founder of CurveAssure, a company developing a novel spinal assessment tool to enable personalized interventions for deformity and degeneration patients. He joined CBID after completing a Bachelor's in Mechanical Engineering with a minor in Biology from Northeastern University, where his research was focused on COPD patient quality of life improvement. As a former Florida native, he loves enjoying the outdoors and spending time in the Design Studio, where he is safe from alligators.



Spencer B. Shumway has a love for both engineering and entrepreneurship. He has co-founded 5 medical device companies and built them to various stages, including an acquisition and a recent FDA submission. He is currently nurturing the seedling spin-out of his CBID project - a neurostimulation technology to fight dementia. He is a Texan and has three very fun daughters.



Jordan Shuff is an Abell Fellow and member of the CBID class of 2021. She is the co-founder of Visilant, a digital health company working to enable access to eye care in low and middle income countries through telemedicine in order to eliminate avoidable blindness. She joined CBID after completing her Bachelor's in Biomedical Engineering at University of Delaware where she focused on research in medical imaging. In her free time, she enjoys any and all outdoor activities and exploring the Baltimore music scene.



Janis Iourovitski is the founder of Ovubrush. Her high-tech toothbrush utilizes changing saliva patterns as a biomarker to monitor the menstrual cycle, specifically identifying ovulation windows for conception. Her background in bioinformatics and mechanical engineering drives her mission to simplify and improve women's reproductive health. Outside of her academic pursuits, she enjoys surfing, backpacking, and expressing her creativity through painting.

CurveAssure: Maintaining Patient Postoperative Sagittal Alignment for a Better Future

Fellows: Evan Haas, Antony Fuleihan

Advisors: Nicholas Theodore, Daniel Lubelski, Amanda Sacino, Siri Khalsa, John William, Youseph Yazdi, Mohit Singhala

Abstract: CurveAssure is developing a remote monitoring and assessment wearable device to provide dynamic metrics and guide personalized treatment for the 26.5M Americans with chronic back pain. The core technology utilizes a three-part system that combines wearable sensors, deep learning, and an integrated clinical report to provide comprehensive spinal insights. Spine surgeons lack vital information about their patients function and dynamic spinal biomechanics outside of the clinic before making crucial decisions about patient pathways. This data gap leads to over 275,000 patients per year (17% of all spinal fusion surgeries) receiving unnecessary spinal fusion surgery and many more left searching for more than 6 months to find an appropriate treatment. Their product analyzes dynamic movement, muscular compensation, and pain over a 48-hour window, providing spine surgeons and pain management practitioners with revolutionary information about their patients in a natural environment in order to facilitate truly personalized spine care.

The CurveAssure team has made significant progress in the last year, including completing benchtop testing, beginning the National NSF ICorps program, receiving IRB approval to run on-patient studies at Johns Hopkins Hospital, and winning international business plan competitions like the Stu Clark New Venture Challenge and the Fast Forward University Fuel Demo Day.

Sequoia Neuovitality: Enhancing Slow-Wave Sleep with AI-Enabled Acoustic Stimulation

Fellow: Spencer Shumway

Advisors: Mark Wu, Adam Spira, Nicholas Reed

Abstract: Sequoia Neuovitality is developing a wearable technology that slows cognitive decline for older adults in the comfort of their own homes. Their digital therapeutic employs an EEG headband and closed-loop neurostimulation to enhance brain activity during sleep, specifically a sleep biomarker known as Slow Wave Activity. Slow Wave Activity is associated with memory consolidation, hormone regulation, and autonomic nervous system function, and enhanced SWA has been shown to improve clinical outcomes in each of these areas. By adapting this technology to the unique needs of older adults and packaging the complex sensors, circuitry, and algorithms into a comfortable headband, they are translating this laboratory technique into an accessible therapy.

Sequoia Neuovitality have refined their real-time sleep staging and stimulation algorithms and developed four form factor prototypes. The company has also received IRB approval for four studies to be conducted over the next 18 months, and has established partnerships with technical leaders including Senso Medical and Constellation Labs. Additionally, Sequoia Neuovitality has conducted over 150 customer discovery interviews and completed a thorough survey of the cognitive decline and sleep spaces to understand their product-market fit and competitive edge. With an eye towards the future, the company plans to file an initial provisional patent application and pursue SBIR funding, as well as continue to develop relationships with interested Angel and VC groups.

Visilant: Increasing Access to Eye Care through Community-Based Telemedicine

Fellow: Jordan Shuff

Advisors: Kunal Parikh, Nakul Shekhawat, Rama Chellappa, David Green, David Friedman, Nicholas Durr, Rengaraj Venkatesh

Abstract: 90% of the world's 275 million blind and visually impaired people live in low- and middle-income countries (LMICs). Cataract, refractive error, corneal opacities, and other anterior eye diseases account for the majority of global blindness. In rural LMIC settings, lack of access to highly trained eye care providers, such as ophthalmologists (1:91,000 patients in India), is a key barrier to timely diagnosis and treatment for anterior eye diseases. There is an unmet need for accessible, ongoing screening of underserved patients in order to enable access to care and eliminate avoidable vision loss.

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OvuBrush: A Saliva-Based Ovulation Prediction Device

Fellow: Janis Iourovitski

Advisors: Youseph Yazdi, Tony Singarayar, Sarah Della Ripa

Abstract: OvuBrush is a startup in the product development phase committed to providing comprehensive support for families seeking to conceive. We recognize that the inability to conceive poses a profound emotional and financial burden, ranking among the most daunting challenges in life. An annual expenditure of over \$4.5 billion USD and countless hours is dedicated to fertility care. At the core of OvuBrush's approach lies discreet and simplified fertility window tracking. Fertility window tracking helps couples accurately time intercourse and increases conception rates by 20%, however, existing methods of tracking are either inaccurate or time intensive.

Our solution employs an innovative toothbrush design integrated with a saliva-based ovulation sensor to facilitate discreet and simplified fertility window tracking. The toothbrush design ensures that users can effortlessly monitor biomarkers on a daily basis, resulting in precise and reliable outcomes with minimal inconvenience. With OvuBrush, families can embrace a newfound sense of control over their fertility journey, ushering in a more informed and empowered approach to conceiving a child.

15+

PENDING
PATENTS

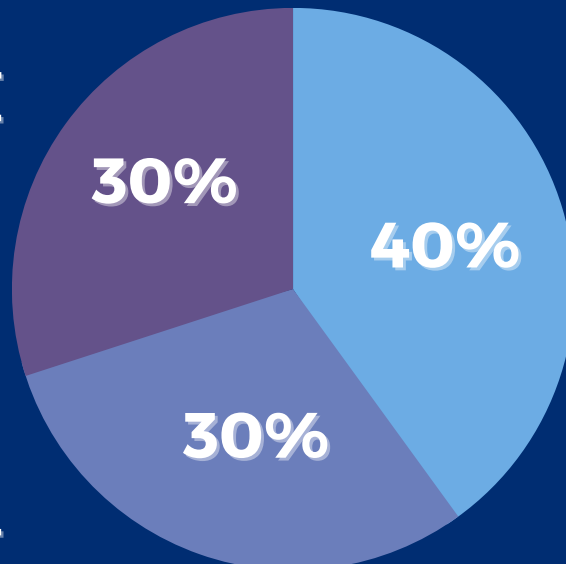
**30 FELLOWSHIPS
AWARDED**

BETWEEN 2016 AND 2022

**PRODUCT
DEVELOPMENT**

PRE-CLINICAL
DEVELOPMENT

CLINICAL
DEVELOPMENT



IN MARKET



Johns Hopkins President's Venture Fellowship

CurveAssure - Winner: \$140,000

Rice Business Plan Competition

MiraHeart - Pediatric Device Prize: \$25,000

Carey Business School Student Venture Showcase

CurveAssure - 1st place: \$25,000

SomnOSA - Audience Choice Award: \$3,000

Startup302

SomnOSA - 1st place and Blue Hen Prize: \$17,500

MiraHeart- 2nd place: \$6,000

Stu Clark New Venture Championship

CurveAssure - 1st place Business Plan and Elevator Pitch: \$16,000

SomnOSA - Semi-Finalist

Heartland Challenge

MiraHeart - 3rd place: \$10,000

SomnOSA - 1st place Elevator Pitch and Investor Roundtable: \$6,000

ARISE - Semi-Finalist

FastForward U Spark Showcase and Fuel Demo Day

CurveAssure - 1st place (Fuel): \$12,000

SomnOSA - Judge's Prize (Spark): \$2,500

MiraHeart- Audience Choice Award (Spark): \$500

Hopstone Capital

CurveAssure: \$10,000

The StarUp - Towson

CurveAssure: \$10,000

HopStart: Medical Technology and Life Science Ventures

SomnOSA - 1st place: \$5,000

MiraHeart- 2nd place: \$3,000

ARISE - 3rd place: \$1,000



VentureWell E-Teams Program

CurveAssure - Grant: \$25,000

SomnOSA - Grant: \$5,000

CurveAssure - Grant: \$5,000

\$325K+ IN AWARDS



CLASS OF 2023



2023 Johns Hopkins Healthcare Design Competition

2023 Johns Hopkins Healthcare Design Competition

Open to all student-led teams from around the world that have designed health-related solutions.

Medical devices, surgical tools, diagnostic devices, drug delivery devices, health IT solutions, mHealth solutions, global health innovations

APRIL 15, 2023 • 9AM-5PM (Virtual Event)

JOIN US!

- Finalist presentations
- Awards
- Networking

AWARDS for each track

1st Prize **\$5,000**
2nd Prize **\$2,500**

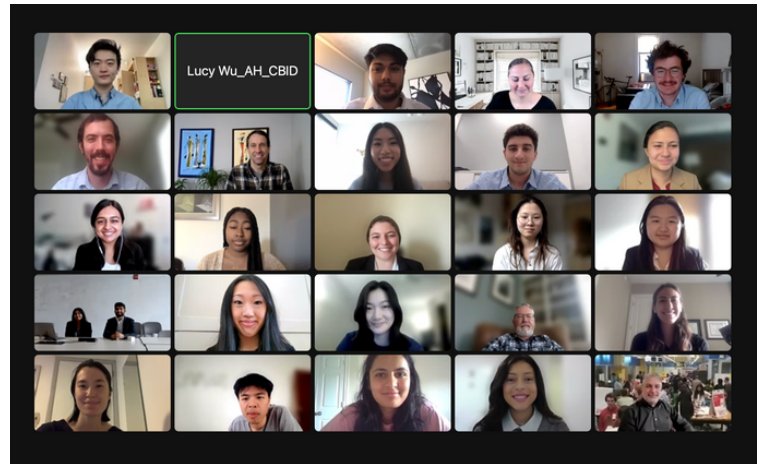
To register, submit a project, or get more info, please visit CBID.bme.jhu.edu or email cbid@jhu.edu

CHOOSE FROM 3 TRACKS

- Solutions for Advanced Health Systems
- Global Health/ Humanitarian Design
- Healthcare Apps/ Information Technology Design

FEBRUARY 10, 2023 Submission of 2-Page Proposals
MARCH 15, 2023 Finalists Informed
APRIL 15, 2023 Final Round (Virtual Event)

JOHNS HOPKINS UNIVERSITY
BIOENGINEERING INNOVATION DESIGN



119 TEAMS & 22K AWARDED

| 2023 Johns Advanced Health Track Winners | Hopkins Healthcare Global Health Track Winners | Design Competition Digital Health Track Winners |
|---|---|--|
| 1st PLACE | 1st PLACE | 1st PLACE |
| SONURA Penn | TEST TSH RICE UNIVERSITY | KORION HEALTH University of Pittsburgh |
| 2nd PLACE | 2nd PLACE | 2nd PLACE |
| PERISCOPE JOHNS HOPKINS UNIVERSITY | SMILE-GEIST Bangladesh University of Engineering and Technology | LOCAZE JOHNS HOPKINS UNIVERSITY |

| 2023 Johns Global Participation | Hopkins Healthcare Participating Schools | Design Competition Winners |
|------------------------------------|---|-------------------------------|
| | | |



Fall Innovation Showcase at Johns Hopkins Hospital 12.5.2022



Clinical Needs Poster Session at School of Medicine 7.29.2022



CBID Health Innovation 2022 Fall Showcase
 Monday December 5, 2022
 3:00 - 7:00 PM EST

| IN-PERSON | VIRTUAL |
|---|--|
| Johns Hopkins Hospital Zayed 2117 Chevy Chase Conference Room | JHUBliveJays.zoom.us/j/95021505272?pwd=NjVhR0ZlZzRlRldyQ1BmNidGQys1UT09 Meeting ID: 950 2150 5272 Passcode: 910695 |

| | |
|-----------------------|---|
| 3:05 - 3:45 PM | SomnOSA - Relieving Complete Concentric Collapse in Obstructive Sleep Apnea |
| 3:50 - 4:30 PM | MiraHeart - Monitoring Early Signs of Pediatric Heart Failure |
| 4:35 - 5:15 PM | digniFi - Providing Patient-Centered Solutions for Managing Fecal Incontinence |
| 5:20 - 6:00 PM | DiscOva - Detecting Early Stage Ovarian Cancer |
| 6:00 - 7:00 PM | Dinner |

WITH GENEROUS FINANCIAL AID AND SUPPORT FROM

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DOLPHIN Shark Tank
 Healthcare Innovation Showcase
 March 15, 2023
 3:00-7:00PM

FOOD + REFRESHMENTS PROVIDED!

Also on Zoom | 2119A Chevy Chase Auditorium
 ID: 913 5244 3383 | Sheikh Zayed Tower
 Johns Hopkins Hospital

KEYNOTE SPEAKER: TODD J. BRINTON, M.D., F.A.C.C.
 VICE PRESIDENT, CSO, EDWARDS LIFESCIENCES
 CO-FOUNDER OF STANFORD BIODESIGN

| | | |
|--|-----------------|------------------------|
| Join us to hear business pitches from startup teams working in obstructive sleep apnea, ovarian cancer, pediatric health monitoring, fecal incontinence. Food & refreshments will be provided! | 3:00PM - 3:15PM | Welcome & Introduction |
| | 3:15PM - 5:15PM | Startup Presentations |
| | 5:15PM - 5:30PM | Break |
| | 5:30PM - 6:15PM | Keynote - Todd Brinton |
| | 6:15PM - 7:00PM | Awards & Reception |

cbid.bme.jhu.edu | cbid@jhu.edu



Dolphin Tank Innovation Showcase at School of Medicine 3.15.23

Hogan Lovells

CBID places great emphasis on fostering strong industry connections and providing students with valuable insights from leading experts. One notable highlight from the past year was our visit to Hogan Lovells, a renowned global law firm specializing in healthcare and life sciences. During this visit, a team of experts generously dedicated their time to provide critical feedback on the FDA pre-submissions written by our students. The expert team at Hogan Lovells conducted a thorough review of the pre-submissions and offered insightful advice to the students. Their expertise in navigating the complex regulatory landscape proved invaluable as they outlined the necessary next steps for each team to undertake. The students greatly benefited from this feedback, gaining a deeper understanding of the FDA approval process and the regulatory requirements specific to their projects.



Our teams had the privilege of meeting with representatives from the Centers for Medicare & Medicaid Services (CMS) to discuss reimbursement strategies. During these meetings, the CMS team provided valuable feedback to each CBID team, offering insights into the reimbursement process and highlighting key considerations for success. The students appreciated the opportunity to engage directly with CMS experts, gaining a broader perspective on the economic aspects of their projects. The feedback received from CMS played a crucial role in shaping the students' understanding of the reimbursement landscape and equipped them with the knowledge needed to navigate the complex intersection of healthcare innovation and financial sustainability.



A critical component of the biomedical device design pathway is developing regulatory strategies that enable the optimal path to market. Teams have done risk assessments and competitive market research on their device to develop an FDA strategy for their innovations. They have had the opportunity to work with internal mentors and experts, as well as have received a full review of their work from Hogan Lovells. The teams refined their strategy and developed a full FDA pre-submission and received guidance for best practices in a pre-sub meeting. Each team got the opportunity to present their work to the FDA in an informational pre-sub meeting. For each of the four meetings, the FDA brought in a panel of 5+ specific experts for each device area of the teams to review the submitted documentation and address the questions of the teams. The teams were able to ask clarification questions of the FDA to refine their evidence-generation plans and their selections of predicate devices. The teams were able to ask critical questions to determine the risk analysis of the reviewers and had the opportunity to follow up with experts after the call. Each team was able to debrief after the call to update their strategy and evaluate the regulatory risk for their projects based on the feedback of the FDA reviewers.



Youseph Yazdi, PhD

22-23 Publications

- Nanofiber-coated, tacrolimus-eluting sutures inhibit post-operative neointimal hyperplasia in rats
- DescePrep Significantly Increases Descemet Membrane Endothelial Keratoplasty Processing Efficiency and Success Rate in Diabetic Human Donor Corneas in Comparison With Manual Dissection

22-23 Grants

- Partnership for Pediatric Health Innovation
Orthopediatrics Corp - \$750,000
- NeuroTech Harbor: Our nation's first equitech ecosystem for neuromedical technologies
NIH - \$117,103,018
- Highly efficient and effective tools for corneal tissue separation to improve access and outcomes of vision-restoring corneal transplant procedures
Eyedea Medical Inc. - \$103,491
- Enhancing Slow-Wave Sleep in Older Adults Using Acoustic Stimulation
Johns Hopkins Bayview Medical Center - \$245,240
- CurveAssure
NSF I-Corps - \$50,000



Clifford Weiss, MD

22-23 Publications

- Genetic testing in the evaluation of individuals with clinical diagnosis of atypical Sturge-Weber syndrome
- Venous malformation may be a feature of EXT1-related hereditary multiple exostoses: A report of two unrelated probands
- Intraoperative Neuromonitoring During Peripheral Arteriovenous Malformation Embolization

22-23 Grants

- Prospective, Multicentric Registry of Pulmonary AVM Embolization
SIR Foundation - \$249,998
- Multi-Site Automated Segmentation and Multi-Parametric MRI Quantification to Assess the Effect of Treatment of Venous Malformations
DoD - \$200,000
- Image-Guided Bariatric Arterial Embolization (BAE) for the Treatment of Obesity
\$4,016,955
- Randomized Trial for Pazopanib in HHT-Related Bleeding
DoD Clinical Trial Award - \$5,240,964.00
- FRONTIER Study (Safety and Feasibility of using TheraSphere™ GBM Y-90 Glass Microspheres in patients with recurrent GBM)
Boston Scientific - \$1,000,000



Ashish Nimgaonkar, MD

22-23 Highlights

- Co-founder/CEO of Glyscend Therapeutics; Glyscend is developed oral gut restricted therapies replicating the physiological effects of bariatric surgery for T2D and Obesity indications
- Inventor on 4 granted patents issued by USPTO in 2022-2023 (includes the original patent licensed from Johns Hopkins to Glyscend)
- Glyscend achieved an important milestone in May 2023 when it announced positive topline results from its Phase 2a clinical trial in patients with T2D

22-23 Publications

- First-in-human study of a pharmacological duodenal exclusion therapy shows reduced postprandial glucose and insulin and increased bile acid and gut hormone concentrations



Kunal Parikh, PhD

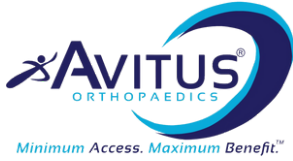
22-23 Publications

- DescePrep significantly increases DMEK processing efficiency and success rate in diabetic human donor corneas in comparison to manual dissection
- Nanofiber-coated, tacrolimus-eluting sutures inhibit post-operative neointimal hyperplasia in rats
- Nanofiber-based glaucoma drainage implant improves surgical outcomes by modulating fibroblast behavior

22-23 Grants

- Smartphone-based community screening of anterior eye diseases in rural India
National Eye Institute - \$390,808
- Ultra-thin, high strength, drug-eluting sutures for prevention of thrombosis in microvascular surgery
NIH - 1,970,756
- Highly efficient and effective tools for corneal tissue separation to improve access and outcomes of vision-restoring corneal transplant procedures
NSF - \$1,000,000
- Development and Evaluation of a Non-rodable, Replaceable Suprachoroidal Drug Implant
Celanese - \$614,902
- Visilant: equitable access to eye care through telemedicine and artificial intelligence
NIH AITC - 163,750
- Dendrimer nanotherapeutics for treatment of mental health and pain disorders
\$2,455,046

CBID STARTUPS SINCE 2009



\$50+ MILLION

IN FUNDING RAISED AFTER CBID

SPECIAL THANKS TO OUR
CURRENT AND PAST PARTNERS



Medtronic



BILL & MELINDA
GATES *foundation*



BTG



Laerdal
helping save lives



Saving lives. Improving health.
Transforming futures.

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