

# Study Tour to Cleveland, OH

EY-Nottingham Spirk Innovation Hub  
and Cleveland Clinic

April 27–28<sup>th</sup>, 2023

# Participants

**Jerry Anunrojwong**

PhD Candidate, Decision, Risk, and  
Operations (DRO) Division,  
Columbia Business School (CBS)

**Richard Aviles**

President, Kingbridge Cleaners & Tailors

**Alexandria Darin**

Executive MBA Global '23 Graduate, CBS

**Jing Dong**

Regina Pitaro Associate Professor of  
Business, DRO Division, CBS

**Phyllis Dyson**

Vice President, Global Product  
Supply, Duracell

**Nelson Fraiman**

Professor of Professional Practice,  
DRO Division, CBS; Faculty Director,  
W. Edwards Deming Center, CBS

**Hongyao Ma**

Assistant Professor of Business,  
DRO Division, CBS

**Molly Muench**

Associate Director,  
W. Edwards Deming Center, CBS

**Jimmy Qin**

PhD Candidate, DRO Division, CBS

**Angela Quintero**

Adjunct Assistant Professor,  
DRO Division, CBS; Managing Director,  
W. Edwards Deming Center, CBS

**Nachum Sicherman**

Carson Family Professor of Business,  
Economics Division, CBS

**Jenny Tromski**

Assistant Vice President, Business  
Development, Brooklyn Navy Yard

**Liad Yamin**

Director of Engineering, 10XBeta

DEMING CENTER STUDY TOUR TO CLEVELAND, OH

# Visit to EY-Nottingham Spirk Innovation Hub

April 27<sup>th</sup>, 2023





Panaromic view of the  
EY-Nottingham Spirk  
Innovation Hub in  
Cleveland, OH



CBS faculty, staff,  
students, and other  
invited guests outside  
the EY-Nottingham  
Spirk Innovation Hub on  
April 27<sup>th</sup>. **From left to  
right:** Jenny Tromski,  
Nelson Fraiman, Nachum  
Sicherman, Angela  
Quintero, Alexandria  
Darin, Hongyao Ma,  
Richard Aviles, Jerry  
Anunrojwong, Phyllis  
Dyson, Jimmy Qin, Jing  
Dong, and Molly Muench



# Hosts and Speakers

**Paul Barsch**

Assistant Director of Demand  
Generation, Supply Chain, EY

**Ross Brubaker**

Global Advisory Account Leader,  
Consumer Packaged Goods, EY

**Tyler Campbell**

Manager, Supply Chain Consulting, EY

**Scott Dixon**

Digital Manufacturing Leader, North America, EY

**Brent Duersch**

Managing Director, EY-Nottingham Spirk  
Innovation Hub

**Sumit Katyal**

Senior Manager, Supply Chain  
Strategy & Transformation, EY

**John Nottingham**

Co-president and Co-founder,  
EY-Nottingham Spirk Innovation Hub

**Bob Schug**

Vice President, Digital Services and  
Supply Chain, Mondelez International

**Glenn Steinberg**

Global Supply Chain and Operations Leader, EY



# Summary



Nottingham Spirk is an open innovation and product development firm established in 1972 by John Nottingham and John Spirk, now run in collaboration with EY. The firm currently has over 70 employees focused on product invention, design and engineering, user research, rapid prototyping, structural packaging, market strategy, branding, interactive design, quality control, and global sourcing. Partnering with companies in the consumer, medical, retail, and business-to-business industries, the EY-Nottingham Spirk Innovation Hub houses the development cycle from focus group facilitation to product design and mechanical engineering.

Hosted in collaboration with CBS, the W. Edwards Deming Center's Supply Chain Innovation Network (SCIN), and EY, the visit to the EY-Nottingham Spirk Innovation Hub on April 27<sup>th</sup>, 2023 brought together senior business leaders with Columbia faculty, staff, and students for a first-hand look behind the hub's success in innovation, commercialization, and digitization within manufacturing and supply chain.

John Nottingham, co-president and co-founder of Nottingham Spirk, kicked the day off with an infectious enthusiasm for innovation within the space of consumer-packaged goods (CPGs). "Can you believe that the industry standard for commercialization is only 5 percent?" asked Nottingham. "Is that number acceptable to you?" While "design thinking" may be a popular trend, Nottingham noted that, oftentimes, it only leads to brainstorming and post-it notes, with the end result being patents and reports that collect dust on a shelf. In contrast, the EY-Nottingham Spirk Innovation Hub boasts an impressive commercialization rate of 95 percent, and Nottingham was keen to share what he referred to as the "secret sauce" behind the firm's success in designing innovative products that meet consumer needs.

First, he noted the hub's rigorous vetting process that approaches ideas holistically and with an eye for commercialization, rejecting any projects that fail to meet their standards. Second, once a decision is made to produce and soft launch a product, the entire team works relentlessly towards its commercial success. Nottingham used the metaphor of an SUV, where the starting point and the point of commercial success represent two patches of solid





Opening slide for the April 27<sup>th</sup> visit to the EY-Nottingham Spirk Innovation Hub



Brent Duersch, Managing Director of the EY-Nottingham Spirk Innovation Hub, opens the day in the conference space of the EY-Nottingham Spirk Innovation Hub



CBS faculty, staff, and students and members of the SCIN listen to the opening presentations



John Nottingham, co-founder and co-president of Nottingham Spirk, speaks to the group on his process behind product design, prototyping, and commercialization



ground, and the space in between represents quicksand. The multi-disciplinary team at the EY-Nottingham Spirk Innovation Hub, involving industrial design, value engineering, supply chain, insights, branding, and more, piles into the SUV together, driving until it reaches its final destination. Cross-functional collaboration, in other words, is essential to the hub's success, and trademarked through Nottingham's own term, "vertical innovation."

Unique to the EY-Nottingham Spirk Innovation Hub as a product development and innovation firm are its in-house prototyping capabilities, allowing for rapid feedback and shorter time-to-market. Attendees were able to visit the hub's three-floor basement and state-of-the-art machinery dedicated solely to prototyping, alongside its most notable finished projects showcased on the ground floor, including the first affordable electric toothbrush, user-friendly multi-functional lawn-care tools, self-stacking milk packaging, and Internet of Things (IoT)-enabled ice cream. The majority of these projects have arisen from the hub's own initiatives, and the firm raises money from investors to develop prototypes before partnering with or selling to consumer-goods conglomerates, such as Procter & Gamble (P&G).

During the rest of the day, the group learned about the different facets of digital transformation within manufacturing and supply chain from both EY leaders and the SCIN members in attendance, with insight into the creation of digital twins for manufacturing, as well as how to plan for supply chain disruptions, mitigate risks, and extend visibility beyond the first tier. Particularly noted was the importance of a solid foundation in driving value versus just investing in technology for the sake of it. In other words, while artificial intelligence sounds impressive, a foundation of consistent and trustworthy data is crucial to effectively implement AI-powered technology. Furthermore, EY raised the issue of non-communication between enterprise resources planning (ERP) systems, a problem its Supply Chain Intelligence Platform (SCIP) aims to solve by breaking down data silos to enable effective supply chain orchestration.

Invited as a featured guest speaker, Bob Schug, Vice President of Digital Services and Supply Chain at Mondelez International, delivered a presentation on Mondelez's journey into digital manufacturing and the digitization of its own operations, looking at the challenges of implementing a digital road map for each of its sites. Schug provided an overview of the

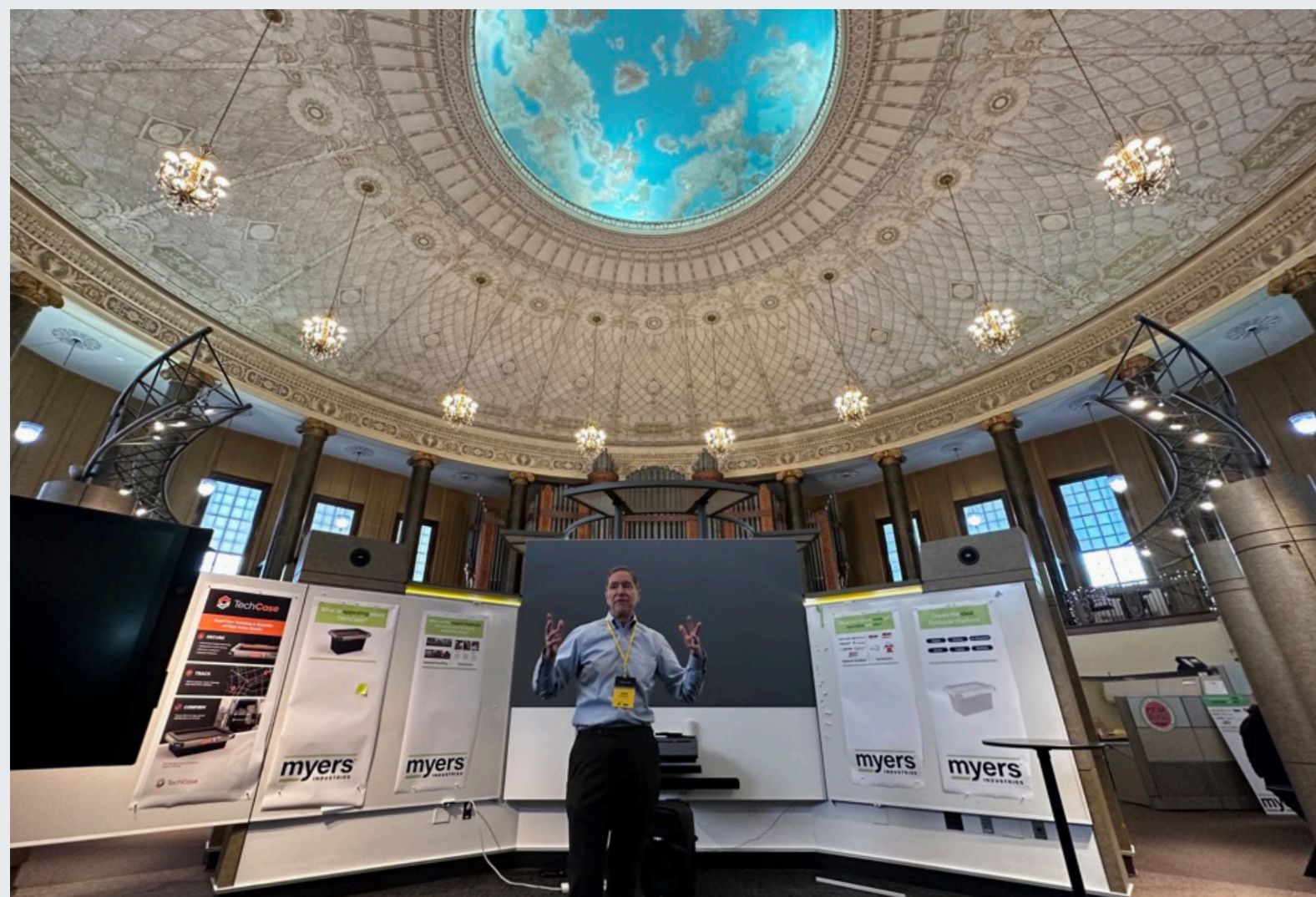




A few of the many patents held by Nottingham Spirk and the EY-Nottingham Spirk Innovation Hub



Notable prototype highlights from Nottingham Spirk, such as Arm & Hammer Spinbrush, the Swiffer Sweep + Vac, and the Sherwin-Williams Twist & Pour paint container



John Nottingham takes the group through the Innovation Hub's spaces, with a visit inside the building's distinctive center dome



Additional prototypes on display in the halls of the EY-Nottingham Spirk Innovation Hub



Mondelez Supply Chain (MSC), comprised of more than 110 manufacturing facilities, 130 warehouses, \$17.5 billion in cost of goods sold, and 55,000 MSC associates worldwide.

While Mondelez has always invested in technology and digitization, Schug noted that a pivotal point in their journey was the 2017 malware incident, which significantly impacted their operations. Since then, the company has undergone a comprehensive transformation of its digital manufacturing infrastructure as a response. Between 2019 and 2021, Mondelez implemented the plant remediation and security program, as well as the foundational line event visibility program. They also developed a plan segmentation strategy program that encompasses four global archetypes: business critical, accelerated visibility and value, developing scalability and value, and emerging priority. These archetypes assist the company in prioritizing growth and execution.

Mondelez has also made significant strides in enhancing its factory cyber posture and augmenting cyber security, recognizing that the factories of tomorrow, equipped with electronic sensors and IoT devices, are particularly vulnerable. Additionally, they have made progress in integrating the lean six sigma program and established the Supply Chain Central Analytics Team. From 2022 onwards, Mondelez has also been actively developing proofs of concept for Azure Internet of Things and Metaverse immersive training, as well as exploring computer vision, artificial intelligence, and machine learning.

According to Schug, the key for the future is to adopt an agile mindset, rather than thinking transactionally. All teams, including manufacturing, engineering, IT, and external partners, need to operate as a unified multi-functional ecosystem in order to unlock exponential value. While manufacturing differs from software development – where the “agile” concept originated – the high-level principles still apply. A key takeaway from the group discussion following was that, at the end of the day, digitization is about the operators, and “buy-in” from plant managers is crucial for project success – if they don’t see the value, the project is likely to fail.

The final presentation of the day was delivered by Scott Dixon, EY’s Digital Manufacturing Leader for North America, who highlighted three major trends impacting the manufacturing industry: globalization, demographics, and digital technologies. He specifically emphasized





Scott Dixon, Digital Manufacturing Leader for EY Americas, explains the concept of a “digital twin” and its use in manufacturing



Bob Schug presents Mondelez' journey into digital manufacturing, emphasizing the importance of having a people-centered approach to digitization



Professor Nelson Fraiman takes a look at one of the hub's robot as it tests for quality assurance for an IoT product currently in development



Bob Schug in conversation with Professor Nachum Sicherman



the role of demographics and the challenges posed by an aging population. According to the National Association of Manufacturers (NAM)'s outlook survey, the primary business challenge in manufacturing has been the workforce, although other factors, such as raw materials, were comparable from 2020 to mid-2022. According to Dixon, the industry as a whole needs to improve its efforts in introducing manufacturing careers to younger generations and adapt its culture and working conditions to attract and retain talent. Another significant trend presented by Dixon is "Industry 4.0," which refers to digital manufacturing and the journey towards digital transformation, which he noted is complex and often slow. At each step, key questions arise: (i) how do we initiate the process, (ii) how do we scale it, and (iii) how do we accelerate it? Ultimately, data-driven manufacturing necessitates commitment across all levels and requires effective integration of people, data, processes, and technology.



DEMING CENTER STUDY TOUR TO CLEVELAND, OH

# Visit to Cleveland Clinic

April 28<sup>th</sup>, 2023





View of the Cleveland Clinic's immaculately maintained main campus in Cleveland, OH



CBS faculty, staff, students, and other invited guests in front of the Cleveland Clinic's quantum computer on April 28<sup>th</sup>.  
**From left to right:** Phyllis Dyson, Angela Quintero, Liad Yamin, Nachum Sicherman, Richard Aviles, Molly Muench, Alexandria Darin, Jenny Tromski, Jing Dong, Hongyao Ma, and Jimmy Qin



# Hosts and Speakers

**Jay Ball**

Imaging Manager, Clinical Engineering,  
Cleveland Clinic (CC)

**Anthony Blamer**

Senior Director, Continuous Improvement, CC

**Chris Cruickshank**

Director, Materials Management, CC

**Jonathan Derby**

Manager, Facilities Engineering, CC

**John Dockins**

Executive Director, Sourcing, CC

**Ken Dyer**

Director of Operations, Clinical Engineering, CC

**Geoff Gates**

Senior Director, Supply Chain,  
Peer-to-Peer and Technology, CC

**Kelly Hancock**

Chief Caregiver Officer

**Andi Jacobs**

Executive Director, Operations, CC

**Leslie Jurecko, MD, MBA**

Chief Safety, Quality and Patient Experience  
Officer, CC

**Doug Lippus**

Project Director, Construction and Planning, CC

**Joelle Lofaso, RN, MBA**

Senior Director, Medical Operations, CC

**Julie Marth**

Administrative Director, Protective Services, CC

**Kosta Mathiellis**

Executive Director, Strategic Operations, Chief  
Research and Academic Office

**Bob Mehosky**

Director, Engineering, CC

**Jim Meola**

Senior Director, Emergency Management, CC

**Brandon Musarra**

Program Manager, Innovations and Education,  
Lerner Research Institute (LRI)



**Dave Orr**

Senior Director, Enterprise Safety and  
Quality, CC

**Rita Pappas, MD, FAAP, FHM**

Medical Director, Hospital Operations, CC

**Marcy Pardee**

Director, Cleveland Clinic Lerner College of  
Medicine (CCLCM)

**Bill Peacock**

Chief of Operations, CC

**Pat Rios**

Executive Director, Buildings + Design, CC

**Jeff Rosner, RPh**

Executive Director, Pharmacy Sourcing and  
Analytics, CC

**Gordon Snow**

Chief Security Officer, Protective Services, CC

**Travis Tyson**

Director, Planning, CC

**Geoffrey Vince, PhD**

Executive Director, Innovations, CC

**Lisa Yerian, MD**

Chief Improvement Officer, CC



# Summary



The Cleveland Clinic is a non-profit, multi-specialty international medical center that integrates clinical and hospital care with academic research and education. From a small outpatient clinic founded in 1921, it has grown to become a world-renowned institution at the forefront of modern medicine, with facilities extending beyond its main campus in Cleveland to include hospitals, family health centers, and outpatient centers across the northeast of Ohio, Florida, Nevada, Toronto, Abu Dhabi, and London. With more than 65,000 caregivers worldwide, the Cleveland Clinic has almost 6 million patient visits per year at more than 200 locations. A physician-led group practice with a vigorous annual review process for all leaders, the clinic's mission is three-fold around education, research, and patient care – the latter being the most central focus of all its activities and initiatives.

On April 28<sup>th</sup>, 2023, the Deming Center conducted a study tour to the Cleveland Clinic, during which CBS faculty, staff and students were given an inside look at the intersection of healthcare and business. The visit began with an overview from planning and design leadership on the clinic's main campus and its upcoming projects around re-development and expansion to increase patient capacity. Decorated with acclaimed artwork from around the world, the clinic's commitment to the patient experience was evident in its master planning, which ensures that everyone can move smoothly, conveniently, and safely throughout the facilities. This people-centric approach also extends to its healthcare providers and other staff, evident in its efforts to become not only a place of work, but a destination for both living and working. As part of their investment initiatives, the clinic plans to build a comprehensive community of housing, police stations, grocery stores, and other basic services in support of its workforce. To this end, competitive compensation and benefits, including a four-month maternity leave, help to attract top talent and retain employees amidst the current nationwide shortage of healthcare workers.

Innovation proved to be a significant pillar of the Cleveland Clinic's strategy and key to shaping its culture of operational excellence and continuous improvement. This was demonstrated by the visit's next stop, the Cleveland Clinic Lerner College of Medicine (CCLCM)'s HoloLens





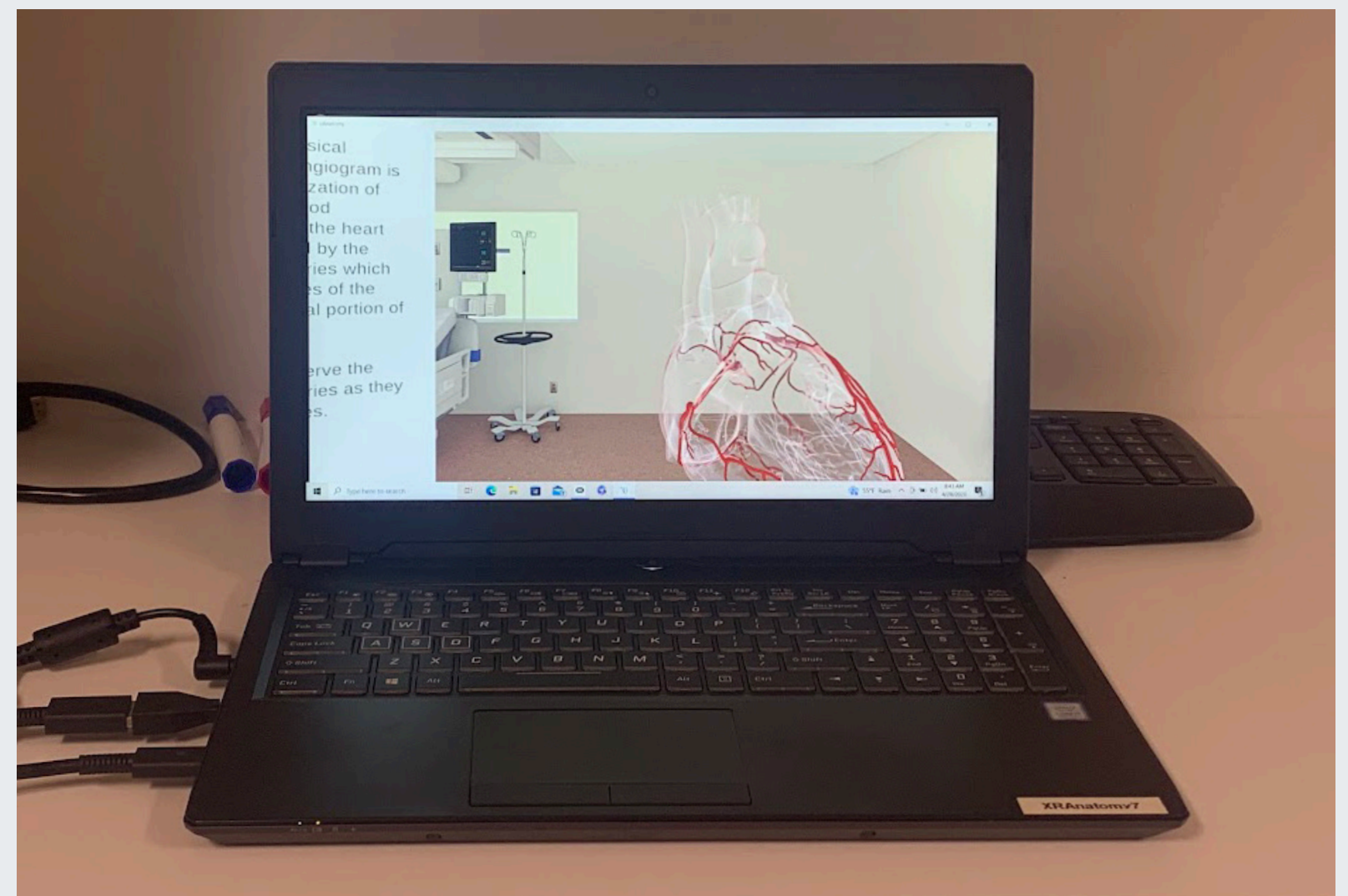
Pat Rios, Travis Tyson, and Bob Mehosky of the campus design and building maintenance team give the group an overview of the Cleveland Clinic's master planning



Jimmy Qin and the group test out the virtual reality goggles of the HoloLens with guidance from Marcy Pardee



Professor Jing Dong uses the HoloLens virtual augmentation device, used by the CCLCM to provide hands-on medical training to students



A look at the medical anatomy software that accompanies use of the HoloLens



training hub, which offers medical students an immersive and standardized learning experience through virtual reality equipment. Guided by Marcy Pardee, Director of the CCLCM, the group had the opportunity to explore this unique technology first-hand, gaining a unique perspective into the anatomy of the heart and blood vessels through the practical application of cutting-edge teaching methods.

Among the Cleveland Clinic's pioneering work in technology, the group was given a first-hand look at the Innovation District's IBM Quantum System One, the world's first quantum computer dedicated solely to healthcare and life sciences research. A cube of Venetian glass maintained at a temperature colder than outer space, the computer embodies the concept of "science on display." Currently, it is being used to develop 25 ground-breaking medical research projects – a few of which aim to reduce the time span of drug development – and the clinic has been approached by external organizations for its application towards other areas, like supply chain optimization. Additionally, the clinic is actively involved in educating the next generation on quantum computing and its potential applications, further demonstrating the clinic's commitment to education and cross-disciplinary collaboration among scientists, engineers, and students.

Shifting to its radiology and cardiovascular care facilities, the group was able to visit one of the clinic's 30 cardiac catheterization laboratories, which feature state-of-the-art electrocardiography (EKG) equipment from manufacturers like Siemens, Philips, and GE. The clinic employs dedicated clinical engineers trained to provide on-site support and troubleshooting, and the importance of predictive maintenance and adherence to manufacturer recommendations to ensure minimal machine downtime was also emphasized. Additionally, the clinic showcased its focus on sterilization, with efficient protocols for cleaning and maintaining a sterile environment to maximize the capacity of its labs. Embodying an all-hands-on-deck approach, the on-the-ground team has been able to standardize cleaning and sterilization processes to a mere 16 minutes between each imaging session, further exemplifying the clinic's commitment to operational efficiency.

Other highlights of the study tour included a look at the underground control room, where factors like operating room temperature are carefully managed across all facilities and





Gordon Snow and Jim Meola brief the group on the safety and security protocols of the clinic's Incident Command Center (ICC)



The group learns about the clinic's cardiac catheterization laboratories, which provide around-the-clock service through staff scheduling and predictive machine maintenance



The ICC's monitoring and control room, which allow for international surveillance and enable coordinated emergency response



Professor Sicherman takes a look at the on-screen coordination and status of the Cleveland Clinic's 30 cardiac catheterization laboratories



locations, and a stop at the clinic's Incident Command Center (ICC), where the group had the opportunity to learn about the clinic's protocol around safety and due diligence. There, the ICC's Chief Security Officer of Protective Services, Gordon Snow, and Senior Director of Emergency Management, Jim Meola, outlined the clinic's extensive emergency operations plan for large-scale events and daily disruptors, as well as its robust exercise program, which holds around 150 exercises per year to build preparedness for a wide variety of threats and hazards. In collaboration with the ICC, the clinic boasts its own private police department – the second largest in northeast Ohio – which, in turn, collaborates with local police to address work-force violence and ensure a safe environment for both patients and care providers alike. Additionally, the group learned about the clinic's approach to research and development (R&D) with a walk-through of its computerized numerical control (CNC) machine shop, where 800 active projects – consisting of medical devices, pharmaceuticals, and digital health products – are designed and fabricated.

To close the visit, the group was able to hear from senior leaders, including Leslie Jurecko, Chief Safety & Quality and Patient Experience Officer, and Lisa Yerian, Chief Improvement Officer, on areas such as continuous improvement, quality of care, and patient safety. In addition to its efforts towards cost-effectiveness and accessibility for patients, the clinic's culture of continuous improvement encourages employees to identify and eliminate waste, supplemented with a walk-through of the clinic's basement level, home to its materials-handling robots, which carry out 2,500 trips per day eliminating waste products and transporting necessities like linens and food. One essential takeaway to the clinic's approach to process improvement, particularly in terms of patient care, was to standardize where possible and personalize when necessary.

In conclusion, the Deming Center's study tour to the Cleveland Clinic provided attendees with a comprehensive understanding of its initiatives within technological innovation and operational excellence, as well as its unwavering commitment to providing exceptional patient care, driving research advancements, and creating a thriving work environment for its employees was particularly evident throughout.





Housed at the Cleveland Clinic, the IBM Quantum System One is the first quantum computer dedicated to healthcare and life sciences research



Doug Lippus, Project Director for Construction and Planning, shows the group the clinic's ongoing construction as part of its plans for expansion and re-development



An informational blurb of the IBM Quantum System One on the nearest wall with an interior sketch inside the chrome cylinder



**From left to right:** Nachum Sicherman, Jenny Tromski, Jimmy Qin, Phyllis Dyson, Hongyao Ma, Richard Aviles, Alexandria Darin, Liad Yamin, Jing Dong, Molly Muench, Angela Quintero





The group visits the basement level of the clinic, home to its materials-handling robots, which carry out 2,500 trips per day transporting necessities like linens and food



Geoffrey Vince, Executive Director of Innovations, showcases the clinic's CNC machine shop, where medical devices, pharmaceuticals, and digital health products are fabricated



Charging stations for the Cleveland Clinic's self-charging, materials-handling autonomous robots



In discussion with Leslie Jurecko on the clinic's approach to continuous improvement, quality assurance, and patient safety



# Feedback

“The Cleveland Clinic stands as a testament to technological advancement in healthcare, consistently pushing boundaries and employing cutting-edge innovations to enhance patient care and outcomes. Beyond their technological prowess, the Clinic’s remarkable organizational culture fosters collaboration, excellence, and patient-centeredness, setting a benchmark for the industry.”

**Richard Aviles**, President, Kingbridge Cleaners & Tailors

“It was impressive to see how Cleveland Clinic implements its mission of caring for life, researching for health, and educating those who serve. A few things we saw on our visit included the control room that ensures the rooms with pediatric patients is warmer, the latest VR software modules they use to train medical professionals, and the ways their own Police Department serves all staff and patients by keeping the campus safe.”

**Alexandria Darin**, Executive MBA  
Global ‘23 Graduate, CBS

“As a participant in this study tour, I gained valuable insights that will undoubtedly contribute to my research and teaching endeavors. The tour provided a comprehensive view of the clinic’s operations, and it’s certain that these insights will transform into practically important research ideas and engaging teaching materials in the future.”

**Jimmy Qin**, PhD Candidate, DRO  
Division, CBS

“I enjoyed the whole visit tremendously, but the Cleveland Clinic was really amazing. It was probably the most efficiently organized visit that I have seen. In a very short time, we were exposed to various units of the hospital, mixing physical visits to various operations and locations, with interesting meetings with the people that run these operations.”

**Nachum Sicherman**, Carson Family  
Professor of Business, Economics  
Division, CBS



“Our Cleveland Clinic trip was especially impressive, with visits to over 10 departments, and generous insights from senior leadership in each. The insider’s view across an impressive range of operations activity within a global hub of innovation, and exemplar of partnerships across public, private, and non-profit sectors, was incredibly impactful. I was immediately able to take learnings from the trip and feed it back into my own professional practice, updating my approach to continuous improvement and taking new steps to driving growth and partnerships. Moreover, the relationships formed within our travel cohort were both meaningful and productive. In the several weeks since, I have already had two follow-up conversations that will yield new initiatives within the Brooklyn Navy Yard, and laid the groundwork for future collaborations. Thank you again Deming Center for curating this environment of learning, professional growth, and networking in just a few short days.”

**Jenny Tromski**, Assistant Vice  
President, Business Development,  
Brooklyn Navy Yard



