Johns Hopkins Technology Ventures' FastForward program brings together resources—including work space—to help healthcare startups move from prototype to market.

Startups, Stat!

HOW JOHNS HOPKINS IS TURNING DOCTORS INTO ENTREPRENEURS BY **KELSEY ALPAIO**

You

see a flashing light or hear a soft hum. ■ Suddenly, you're filled with joy, anger, or fear. ■ You're light-headed and confused. ■ Those are just a few of the "aura" symptoms that people with epilepsy can experience before having a seizure. Auras can help individuals by giving them time to find a safe place, contact a loved one, or—in the case of EpiWatch—log an oncoming seizure on their Apple Watch. ■ EpiWatch, a research project that helps track seizures, possible triggers, medications, and side effects using an Apple Watch app, is just one of the digital healthcare concepts that the Technology Innovation Center at Johns Hopkins helped develop in 2016. ■ The TIC is a design and software engineering team within the IT organization at Johns Hopkins Medicine, the Baltimore-based, $8 billion healthcare system. Johns Hopkins Medicine combines the expertise of the students, physicians, and scientists at Johns Hopkins University with the professionals and facilities of Johns Hopkins Hospital, which dates back to 1889, and is regularly ranked as one of the world's best. Within Johns Hopkins Medicine, the Technology Innovation Center serves as a hub for budding innovators, helping them build, deploy, and test clinical solutions for JHM. ■ The TIC's goal is connectedness—the team of around 27 is located just a block away from the main hospital. And just a few floors below the TIC is Johns Hopkins Technology Venture's FastForward startup incubator. ■ "I always found that there were too many degrees of separation between the people that create solutions and the people who then have to use them," says Paul Nagy, TIC's deputy director. "The role of an innovation center is trying to reduce all those degrees of separation, so that we can have a quick way of evaluating a new technology and then really seeing if it actually improves clinical value... The people who are building the solutions are sitting right next to the physicians who are trying to deliver care to their patients."

Photograph by **Jimell Greene**

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> **PAUL NAGY, DEPUTY DIRECTOR, JOHNS HOPKINS MEDICINE TECHNOLOGY INNOVATION CENTER**

FastForward, a startup incubator located on the Johns Hopkins campus, offers shared and private lab space in one their Baltimore-based "innovation hubs."

GIVING PHYSICIAN-FOUNDERS A 'DECENT CHANCE OF SUCCESS'

Nagy earned his PhD in Diagnostic Medical Physics from the Medical College of Wisconsin, working alongside medical students in radiology and oncology.

"I was trained to be a partner with physicians to help them use technology," says Nagy. "I grew up trying to understand how they can use technology to improve patient care... I found that the ingredients for change are a combination of getting clinical leaders trained in leadership, and then pulling in technology and partnering with technology [experts] to evaluate it."

These were the principles that guided Nagy as he helped to build the innovation center in 2014, along with Executive Director Dwight Raum. His goal was to create a function that would give physicians the opportunity to grow as leaders, work with engineering teams to find solutions, and ultimately test solutions in a clinical setting.

"I train physicians in systems thinking, design thinking, and how to be part of a team, so that I can give them an engineering team, and [they've] got a decent chance of success at developing a solution that can actually improve patient care," says Nagy. "[The innovation center] is an extension of the IT organization. Most hospitals have very large IT organizations. I think they're seen as infrastructure support, whether it's desktop or networking or clinical information systems like the [electronic medical record.] We wanted to be an actual engineering arm alongside our IT group, to build new solutions. We often find that commercially, we only can get a certain percentage of the way to the solutions we're looking for clinically. We built a team that can actually help us build custom solutions once we've already explored commercial opportunities, and we've explored the market, and we need to build things that we couldn't find," says Nagy.

Nagy says it took a couple of years for the center to get formally organized; his team was scattered across three different locations until mid-2017. But that doesn't mean they weren't delivering impact for the hospital and its

patients. In 2016, the software developed by the TIC was used by Johns Hopkins providers to improve patient care in more than 2,598,401 different situations.

FINDING THE RIGHT IDEAS TO DEVELOP

Solutions designed in the TIC typically address problems brought to the center by Johns Hopkins clinicians. That happens in two ways.

The first way is fairly traditional. A clinician with a problem submits their proposal to the TIC, similar to how they might interact with an IT group or an outside software development company. But the TIC has a leg up on those alternatives. The innovation center keeps project costs low by offering a subsidized rate for the work it does for colleagues within Johns Hopkins Medicine, and their familiarity with the institution aids in the implementation of the solution once it's ready.

The second method is a bit more involved: a clinician with a problem or idea submits an application to "Hexcite," a four-month pre-accelerator program run by TIC. Through workshops, leadership training, and team building, Hexcite's goal is to provide clinicians with the resources they need to not only create a solution to their clinical problem, but potentially create a startup that will take it to market.

"We are clinician-led," says Nagy. "One of the key tenets here is that we're pulling solutions into the clinical space, not trying to push technology. It's not technology looking for a problem. We start with a physician with a problem...and try to see how technology can help them."

Applicants to Hexcite pitch their ideas during a "Shark Tank"-style event, and the ideas with the most merit, potential impact, and feasibility are accepted into the program. Five clinical leaders participate in Hexcite each year. Once accepted, these clinicians must commit 20 percent of their time to the program, and pay a tuition of $5,000, which is often covered by their department.

Successful startups share a few key factors, Nagy says. "One of them is the idea. One of them is the team. The other is the timing of the idea. We put a lot of energy into the team," he says. In helping to build Hexcite teams, Nagy explains that the TIC also recruits business school, engineering, biomedical, computer science, and design students from the university to help the clinicians create their solutions and companies. "We focus on team performance, strengths, and integration... The physician is not going to become the CEO of the company. We want them to keep practicing medicine, but we want to build them a team and a company around their idea that could take their idea to the marketplace."

Through Hexcite, clinicians are trained in "evidence-based entrepreneurship," an approach developed by the author and professor Steve Blank. Teams conducts more than 40 customer interviews during their time in the program, and the clinicians are developed as "leaders" ready to implement their solution when the 16-week program is over.

"We don't believe there are any technical solutions," says Nagy. "We believe they're all social-technical solutions, which means that that requires adaptive leadership. Whenever we deploy a tool, generally that tool requires people to change their roles, or change their behaviors, or it requires a change in the clinical workflow, which can be very difficult... We also spend time training the clinical providers not just in how to build an engineering team, but in design and systems thinking and in how to have the adaptive leadership skills to be able to help influence their peers, and looking at this from a systems perspective... Part of this is really the physician leaders themselves working with their clinical and organizational leads as they deploy a solution to make sure that it has got good ownership within the clinical staff."

But before TIC or Hexcite-made solutions can be implemented by the Johns Hopkins system, the question of funding must be answered. Funding for projects at the TIC tends to come from three places: operations, the capital budget, and external grants.

"We're trying to partner with physicians," says Nagy. "We want to train them in leadership and entrepreneurship. If you can't get a $100,000 grant from the state, the odds are good that you're probably not going to be very successful with venture capital. There's a way of beginning to learn how to pitch and learn how to raise funds [that are] part of the steps you need to do in company formation."

FASTFORWARD

Nagy says the best next step for individuals who've been through Hexcite is to use FastForward, a collection of resources created by Johns Hopkins Technology Ventures to help companies move from prototype to marketplace. (The Technology Ventures group is the licensing and commercialization arm of Johns Hopkins University.) One of FastForward's "Innovation Hubs" is just an elevator

Pitch Day at Hexcite

Just outside the glass doors, doctors hustled by, the tails of their white lab coats fanning out. Nurses in colorful scrubs clung to their clipboards, making beelines from one patient room to the next. But inside the Chevy Chase Auditorium at Johns Hopkins Hospital, there's a different sort of charge. Nervous energy was in the air on December 8, as the five teams from The Technology Innovation Center's 2017 Hexcite program prepared to give their final pitches. Each team delivered a 10-minute pitch to a panel of judges, including David Greenwald, Director of Business Development and Corporate Partnerships at Johns Hopkins Technology Ventures; Brett Jackson, Head of Strategy for Radiology at Philips; and Elizabeth Harber, Senior Program Officer at Abell Foundation, a Baltimore nonprofit focused on healthcare and community development. Here's a look at the five companies that presented:

▸ **DaiWare** DaiWare is a mobile health application with the goal of helping physicians "forecast" a patient's health based on diet, exercise, circadian rhythms, and biometric information. The team is currently beta testing DaiWare, and creating a physician portal for the application, called "CompassRX." Targeted at hypertension patients, the application will collect patient-generated data and present it to the physician via an online portal.

▸ **Welby** Welby is an educational tool for patients, aimed at solving the problem of interpreting health information they may not understand. The tool includes a "decision support portal," electronic medical record data, patient stories, checklists, and more. This data is also laid out along a timeline, to help patients understand their path from diagnosis to recovery.

▸ **Project Commune** Project Commune aids in communication between physicians by creating a "snapshot" of patient information based on the electronic medical record. This solution targets coordination around "episodes of care," or all of the services provided to a patient in a single visit. The platform brings this data together in real-time, providing all involved physicians with useful insights.

▸ **Theramate** Theramate is a mobile health application design to monitor the mood, medication adherence, and treatment delivery for patients with both addiction and a mood disorder. This app aims to tackle the problem of disengaged patients who are at high risk for relapse and hospital admissions.

▸ **Bartleby** Bartleby is an analytical tool used to improve clinical documentation, especially in regards to giving the correct "code assignments" for care provided to patients. Code assignments are used to identify diseases and care provided, which impacts reimbursement and supports physician decision-making. The tool uses machine learning to accurately document care, ensuring patient safety and cost-effective care.

ride away from the TIC, and a second is across the street. These spaces, which have a bustling, high-energy vibe, serve as coworking space and lab space for companies participating in FastForward.

FastForward also hosts educational programming and workshops, such as an "Entrepreneurship Bootcamp" and "Startup Creation Series." Megan Wahler, FastForward Program Manager, says FastForward startups can also access mentorship offerings, legal and accounting services, and assistance with investors.

Wahler says the relationship between TIC and FastForward has existed ever since the former got started.

"We have had startups come through [FastForward] that have been developed from ideas that went to the TIC," says Wahler. "We've had some of our teams referred back to the TIC to do some development. [Our partnership] really came to fruition when we opened our second space and the TIC was temporarily displaced... They rented space [from us], and all of a sudden we became very close with a lot people on the team, learning about what they did, and they learned what some of our startups were doing. It created this symbiotic, collaborative relationship."

One startup that has used the resources of both TIC and FastForward was EDuMD, which created a web-based training platform called MileMarker. Wahler says the MileMarker project went through a development process with the TIC, which led to the formation of EDuMD as a company. After completing their time with TIC, FastForward helped EDuMD receive funding via the Maryland Innovation Initiative, and helped the company find their CEO.

EDuMD also participated in the first cohort of FastForward's M1 Accelerator, a 16-week program for connected health and fitness companies. Hosted in one of FastForward's hubs, M1 companies receive $25,000 in equity funding and support from Plank Industries, the University of Maryland, Brown Advisory, and the Abell Foundation.

"Johns Hopkins is a huge institution, and when Johns Hopkins Tech Ventures was reorganized three years ago, it used to be just a tech transfer office," says Wahler. "We're now focused more on commercialization and creating viable ventures. We made it one of our goals to work collaboratively with all departments and all of the different institutions within Johns Hopkins. We are sort of in the middle, and we're constantly working to find how we can help our many constituents and clients across each department, school, and institution. Part of our mission is also to promote the economic development of Baltimore and Maryland, so we

Participants in the 16-week Hexcite pre-accelerator take part in a design thinking exercise.

realized that if we're working with each of the departments in our institutions, we also need to be working more collaboratively across the city and the state."

COMMUNICATION AND INTEGRATION

With resources like the TIC and FastForward, physicians at JHM have a multitude of ways to cultivate solutions to problems they encounter in the clinical setting.

Nagy says that one rich problem set surrounds communication and collaboration.

"The ability for healthcare providers to collaborate with each other is a real challenge," Nagy explains. "Right now, the electronic medical record [involves] big documentation systems, and so they're not like Slack or instant messaging... If you're inside the hospital, there's many different care providers. There's lots of different hand-offs. There's a really strong need for collaboration."

He continues, "We don't typically use Skype inside healthcare. There's an enormous value for that, but that requires a lot of clinical workflow [changes.]"

Nagy adds another major theme he's seeing in healthcare is patient engagement. He says physicians are often frustrated with the minimal interactions they have with their patients. There's a push for extending the relationship between office visits with wearable technology, telemedicine, or digital advising. This challenge is especially prevalent for patients with chronic illness.

But Nagy cities adoption of digital health solutions by both physicians and patients as one of the major challenges the TIC still needs to work on.

"You shouldn't even start a project in digital health unless you have a strategy for clinical integration," says Nagy. "If you're not going to be integrated into the electronic medical record, no matter how good your tool is, there's no way physicians are going to be able to use it, because they're just way too busy. The same thing should be thought of for patients as well. Right now, patient portals are their doorway into the medical records... We've actually built tools right off of our patient portal, and built apps that can integrate with it, so patients don't have to use a new password or have a separate account or have to manually enter in fields about what medications they're taking... People don't appreciate the value of integration. They think of a great idea, and they think people are going to jump through all these hoops to do it. People are incredibly busy, whether they're patients or providers."

That grounding in reality is essential, Nagy says, to getting innovation in healthcare to take hold. ⬢