INSIGHT

TAPPING INNOVATIVE SOLUTIONS & TECHNOLOGY AT JOHNS HOPKINS MEDICINE

OCTOBER 2016 PUBLISHED BY JOHNS HOPKINS MEDICINE MARKETING AND COMMUNICATIONS

Web Application Predicts Status of Low-Risk Prostate Cancer

Forty percent of prostate cancers remain idle and never affect a person's health. For this reason, physicians often choose to monitor rather than treat the cancer. To help physicians and patients decide on the best approach for low-risk prostate cancer, a Johns Hopkins team developed an application that predicts the likely risks of the cancer.

"It's one of the coolest models I have seen in the 30 years I have been at Johns Hopkins," says urologist Ballentine Carter. "I was surprised by what it could forecast."

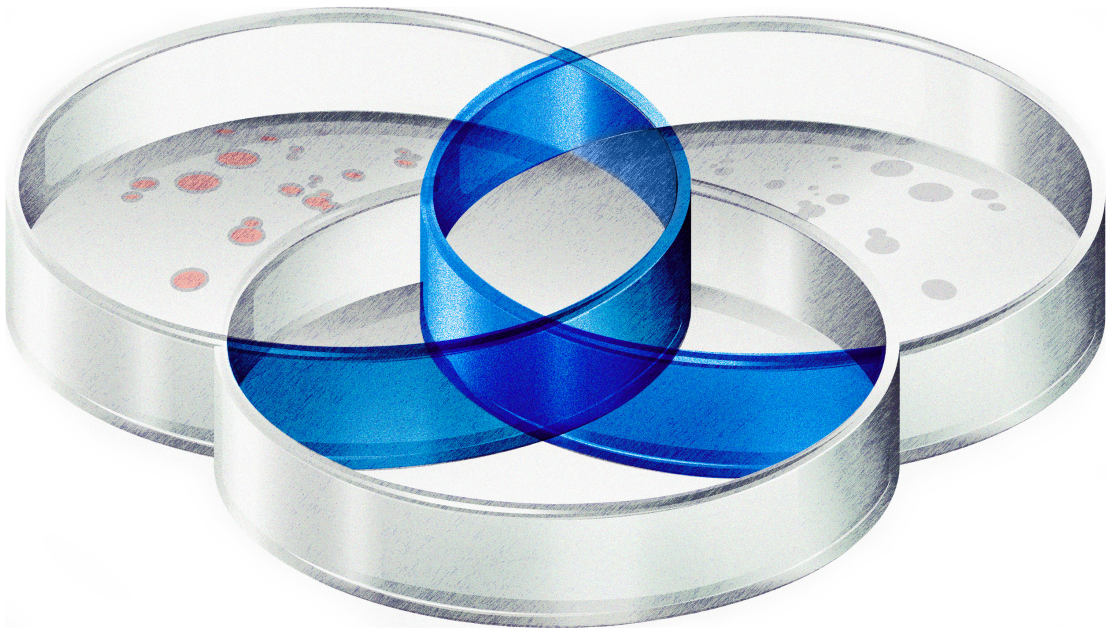
As one of the first projects out of the Johns Hopkins Individualized Health Initiative (Hopkins *in*Health), the application synthesizes an individual's demographic, clinical, biomarker and biopsy data into graphs that quantify the person's disease risks.

Biostaticians Yates Coley, Mufaddal Mamawala and Scott Zeger devised the algorithms that produce the predictions using 20 years of data collected from nearly 1,300 patients with low-risk prostate cancer.

The color-coded graphs show three things: the probability that the cancer will become severe, the likely results of future diagnostic blood tests and the likelihood that the next biopsy will find evidence of a more dangerous tumor. Such information is valuable when making decisions about medical treatment.

For example, if it is unlikely that someone's low-risk cancer will be reclassified as more severe, then the physician and patient may delay future biopsies. Alternatively, if the model predicts that the marker in future blood tests will increase, the clinician may recommend a biopsy.

The team is now conducting a study on patients' experience with the tool, and the Technology Innovation Center is incorporating the application into Epic. The goal is to bring data from Epic into the application and provide results to any clinician seeing a patient with prostate cancer.



Medical Student Recommends 4 Digital Study Tools

It's convenient to go online and look up a fact when you forget it, but medical students taking a board exam don't have that option. Prior to the exam, however, students are going online to master the material. Benjamin Ostrander, a third-year medical student, recommends four digital study tools to prepare for the board exams.

1. Picmonic. Animated interactive videos at picmonic.com bring anatomy, biochemistry, pharmacology and more to life. "Silly images take you through a humorous story," says Ostrander. "Research shows people remember visual information better than written information, and Picmonic takes advantage of this." It also lets users review material and answer questions to test their knowledge.

Cost: Memberships including an app start at $25 per month.

2. SketchyMedical. At sketchymedical.com, a narrator speaks while an invisible hand draws a sketch. Users watch while the setting and characters take shape, and they hear explanations to make connections between the sketches and the material. Topics include microbes and drugs.

Cost: Subscriptions start at $169 for a six-month plan. No app is available.

3. Khan Academy. Online videos present lectures on numerous topics, including science, at khanacademy.org. Instead of a chalkboard or PowerPoint, instructors use electronic boards to write notes or draw diagrams while speaking. Practice exercises are also available.

Cost: Website and app are free.

4. Anki. At ankisrs.net, users make custom digital flashcards featuring words or images. Ostrander first used Anki to tackle microbiology. "It's better than paper cards because you can tell Anki to show you difficult cards more frequently and easy cards less often," he says. Flashcard decks created and shared by other users are also available through an online search.

Cost: Website is free. App costs $24.99.

TECH/ENVY

A look at innovative developments outside the halls of Johns Hopkins Medicine

To Help the Heart

From smart heart scaffolding to apps that track every heartbeat, researchers are developing new ways to monitor, understand and heal our tickers.

Capable of recording electrocardiogram signals and lactate levels, the Chem-Phys wireless device could help athletes to train better and doctors to monitor patients with heart problems. Worn on the chest, its sensors track the heart's electrical activity and the body's lactic acid, an indicator of physical exertion. Created by University of California, San Diego nanoengineers and electrical engineers, it's one of the first devices to monitor the body's electrical and biochemical signals in real time.

Scaffolding used to grow cardiac tissue could eventually act like a pacemaker to help damaged hearts. Harvard University researchers have developed nanoelectronic-enabled scaffolding that grows heart tissue, to which it can then monitor and respond. Ultimately, this implanted bionic patch could replace tissue damaged by a heart attack. It could also detect abnormal heart rhythms earlier and respond to them more precisely with the appropriate voltage.

Cardiogram, a heart rate-tracking app that relies on smartwatch heart sensors, is being taught to detect atrial fibrillation, a common type of irregular heartbeat. The app's developers and University of California, San Francisco researchers have launched a study to collect heart data from roughly 10,000 participants to help train the software. Left untreated, atrial fibrillation can double a person's risk of dying from a heart-related cause.

'Lab on a Chip' Blood Test Aims to Deliver Quick Results

Barriers to getting a blood test can be numerable, but infectious disease specialist Robert Bollinger is hoping to overcome those obstacles with a "lab on a chip."

Through a project called miLab, Bollinger, an international team of Johns Hopkins scientists and silicon chip engineers in Belgium are aiming to create a device that will test blood quickly and inexpensively, at home or in a clinic, for a variety of conditions.

So far, they've designed a 1.5-cubic-inch mechanism that detects hepatitis C, provides a complete blood count and performs other common blood tests. Their goal is to develop an even smaller single-use device that can send results—wirelessly or via a cable—to a smartphone, tablet, computer or similar device in 10 minutes, for $10 or less, using a small amount of blood.

"We're not there yet, but that's where we're heading," says Bollinger, who's working with Johns Hopkins doctors to identify the conditions most in need of rapid testing.

Bollinger has long dreamed of crafting an affordable device for quick front-line testing. It began to seem like a possibility three years ago, when he was invited by Belgium-based IMEC—a global leader in silicon chip engineering research—to discuss how to collaborate with Johns Hopkins.

As a result of the meeting, Bollinger assembled a research team at Johns Hopkins and, with IMEC, helped start miDiagnostics to support the miLab project and commercialize prototype devices.

Bollinger estimates that it could take three years or more to develop the miLab diagnostics platform—which will require approval from the FDA and other international regulatory agencies—into marketable products. Until then, Bollinger looks forward to when low-cost, simple, reliable and disposable blood tests are only a few steps away, anywhere in the world.

Bandages with Pressure Sensors Could Prevent Bedsores

Plastic and reconstructive surgeon Justin Sacks treats pressure sores that refuse to heal. Now he thinks he's found a way to prevent the wounds from forming in the first place.

Sacks teamed with students in the Center for Bioengineering Innovation and Design (CBID) to create the Mercury Patch, a wound dressing equipped with pressure sensors.

Patients can develop bedsores in as little as two hours as pressure builds on vulnerable areas, like heels or buttocks. Clinicians try to prevent the injuries by moving patients and by protecting skin with breathable foam and gauze bandages.

The Mercury Patch adds pressure-detecting sensors to those bandages without changing the feel. Bluetooth technology transmits pressure information wirelessly to nursing stations, phones or other destinations, helping clinicians decide when to move patients and showing whether the repositioning relieves pressure.

In May, the innovation placed second out of about 25 biomedical projects in CBID's annual Design Day. CBID is part of the Department of Biomedical Engineering, which is shared between the schools of engineering and medicine.

Biomedical engineering students Kelly Lacob, Sean Mattson, Matthew Nojoomi, Madeline Wilson, Alison Wong and Sam Zschack worked with Sacks and other advisers to create the device. In June, the team won a $100,000 Johns Hopkins-Coulter Translational Partnership grant to continue development.

Sacks, a CBID faculty member, expects to conduct clinical trials at The Johns Hopkins Hospital within a year and says the patches could be on the market by 2018. "It's a simple tool to monitor pressure, so health care providers in the inpatient setting react accordingly," he says.