NEWSLETTER

ITECH COMMITTEE

DNA APP STORE

An online store for information about your genes will make it cheap and easy to learn more about your health risks and predispositions.

Our genomes hold information about our health risks, our physical traits, and whom we're related to. Yet aside from ancestry tests that provide a limited genetic snapshot, there's not a mass market for DNA data. Helix is a bet by Kao's former employer, the buyout firm Warburg Pincus, and Illumina, the leading manufacturer of ultrafast DNA sequencing machines, that what's been missing is the right business model.Helix's idea is to collect a spit sample from anyone who buys a DNA app, sequence and analyze the customers' genes, and then digitize the findings so they can be accessed by software developers who want to sell other apps. Helix calls the idea "sequence once, query often." (The company says customers will find these apps on websites and possibly in the Android and Apple app stores.)

The engine to power the app store is being assembled a mile from Illumina's San Diego headquarters, in a building where workmen were still bending sheet metal and laying floor tiles in January. Several miles of data cables strung through the ceiling will be connected to a large farm of sequencing machines, able to process the DNA from a million samples a year. Illumina's CEO, Jay Flatley, also chairman of Helix, has said it could be the largest sequencing center anywhere.One company working with Helix is Good Start Genetics, a startup in Cambridge, Massachusetts, that offers pre-conception testing. These DNA tests tell parents-to-be if they share a risk for passing on a serious genetic condition, such as cystic fibrosis. Jeffrey Luber, Good Start's head of business development, says it hopes to reach a larger audience with an app that can report a few important risks. As with browsing on Amazon, he thinks, people will discover things they "didn't know they needed but that [are] targeted to them, and that they want."question mark is the U.S. Food and Drug Administration, which has kept close tabs on gene tests and will decide how much information Helix apps can reveal. Right now, says Keith Stewart,director of the Center for Individualized Medicine at the Mayo Clinic, most apps that return real medical information—your chance of cancer, say, not just how much Neanderthal is in your DNA—would need agency approval, or at least a doctor in the loop.

Power from the Air

Internet devices powered by Wi-Fi and other telecommunications signals will make small computers and sensors more pervasive.

Even the smallest internet-connected devices typically needs battery or power cord. Not for much longer. Technology that lets gadgets work and communicate using only energy harvested from nearby TV, radio, cell-phone, or Wi-Fi signals is headed toward commercialization. The University of Washington researchers who developed the technique have demonstrated Internet-connected temperature and motion sensors, and even a camera, powered that way.Transferring power wirelessly is not a new trick. But getting a device without a conventional power source to communicate is harder, because generating radio signals is very power-intensive and the airwaves harvested from radio, TV, and other telecommunication technologies hold little energy Shyamnath Gollakota and his colleague Joshua Smith have proved that weak radio signals can indeed provide all an Internet gadget needs, using a principle called backscattering. Instead of generating original signals, one of their devices selectively reflects incoming radio waves to construct a new signal—a bit like an injured hiker sending an SOS message using the sun and a mirror. A gadget using the technique absorbs some energy from the signal it is modifying to power its own circuits."We can get communication for free," says Gollakota. RFID chips for the contactless smart cards used in mass transit also rely on backscattering, but they require specialized reader devices and can communicate only within a few inches because the reflected signals are weak and the reader itself presents interference.

Smith says that passive Wi-Fi consumes just 1/10,000th as much power as existing Wi-Fi chipsets. It uses a thousandth as much power as the Bluetooth LE and ZigBee communications standards used by some small connected devices and has a longer range. A device using passive Wi-Fi to communicate—for example, a security camera—could power its other circuits using energy harvested from the Wi-Fi signals it is backscattering, or by feeding on other signals such as TV and radio broadcasts.The researchers believe that tiny passive Wi-Fi devices could be extremely cheap to make, perhaps less than a dollar. In tomorrow's smart home, security cameras, temperature sensors, and smoke alarms should never need to have their batteries changed.

The 360-Degree Selfie

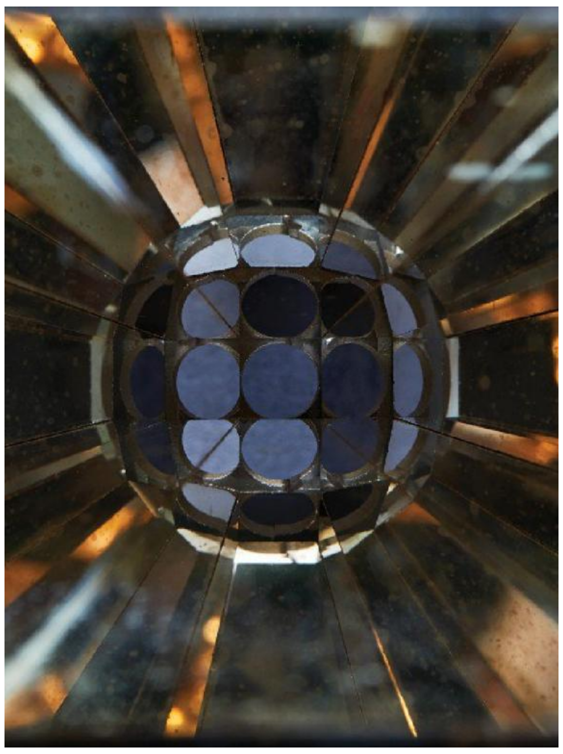
Inexpensive cameras that make spherical images are opening a new era in photography and changing the way people share stories.

Seasonal changes to vegetation fascinate Koen Hufkens. So Hufkens, an ecological researcher at Harvard, devised a system to continuously broadcast images from a Massachusetts forest to a website called VirtualForest.io. And because he used a camera that creates 360° pictures, visitors can do more than just watch the feed; they can use their mouse cursor (on a computer) or finger (on a smartphone or tablet) to pan around the image in a circle or scroll up to view the forest canopy and down to see the ground. If they look at the image through a virtual-reality headset they can rotate the photo by moving their head, intensifying the illusion that they are in the woods.Today we experience the world in 360 degrees, surrounded by sights and sounds. Until recently, there were two main options for shooting photos and video that captured that context: use a rig to position multiple cameras at different angles with overlapping fields of view or pay at least $10,000 for a special camera. The production process was just as cumbersome and generally took multiple days to complete. Once you shot your footage, you had to transfer the images to a computer; wrestle with complex, pricey software to fuse them into a seamless picture; and then convert the file into a format that other people could view easily. These applications are feasible because of the smartphone boom and innovations in several technologies that combine images from multiple lenses and sensors. For instance, 360° cameras require more horsepower than regular cameras and generate more heat, but that is handled by the energy-efficient chips that power smartphones.

Both the 360fly and the $499 ALLie camera use Qualcomm Snapdragon processors similar to those that run Samsung's high-end handsets.Most 360° cameras lack displays and viewfinders. To compensate, camera makers developed apps that you can download to your phone to compose shots and review the resulting images. The cameras connect to the apps wirelessly, and many of them allow you to upload photos and video directly from your phone to Facebook and YouTube. In turn, those sites have made it possible over the past year for people not just to post recorded 360° content but to live-stream 360° videos as well.Because creating 360° content requires stitching together multiple images, doing it on the fly for live streaming represents an impressive technical achievement. Computer-vision algorithms have simplified the process so that it can be done on the camera itself, which in turn allows people to live-stream video with minimal delays.

Hot Solar Cells

By converting heat to focused beams of light, a new solar device could create cheap and continuous power.



Solar panels cover a growing number of rooftop,but even decades after they were first developed, the slabs of silicon remain bulky, expensive, and inefficient. Fundamental limitations prevent these conventional photovoltaics from absorbing more than a fraction of the energy in sunlight.But a team of MIT scientists has built a different sort of solar energy device that uses inventive engineering and advances in materials science to capture far more of the sun's energy. The trick is to first turn sunlight into heat and then convert it back into light, but now focused within the spectrum that solar cells can use. While various researchers have been working for years on so-called solar thermophotovoltaics, the MIT device is the first one to absorb more energy than its photovoltaic cell alone, demonstrating that the approach could dramatically increase efficiency.Standard silicon solar cells mainly capture the visual light from violet to red. That and other factors mean that they can never turn more than around 32 percent of the energy in sunlight into electricity. The MIT device is still a crude prototype, operating at just 6.8 percent efficiency—but with various enhancements it could be roughly twice as efficient as conventional photovoltaics.The key step in creating the device was the development of something called an absorber-emitter. It essentially acts as a light funnel above the solar cells. The absorbing layer is built from solid black carbon nanotubes that capture all the energy in sunlight and convert most of it into heat. As temperatures reach around 1,000°C, the adjacent emitting layer radiates that energy back out as light, now mostly narrowed to bands that the photovoltaic cells can absorb.