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Vivek Wadhwa: How Technology Will Eat Medicine

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INVESTOR STARTUP TRENDS FOR 2015 VIVEK WADHWA










VIVEK WADHWA: The most significant announcement that Apple made in 2014 wasn't a larger-sized iPhone. It was that Apple is entering the health-care industry. With [HealthKit](#), it is building an iTunes-like platform for health; Apple Watch is its first medical device. Apple is, however, two steps behind Google, IBM and hundreds of startups. They realized much earlier that medicine is becoming an

information technology and that the trillion-dollar health-care market is ripe for disruption.

My prediction is that 2015 will be the year in which tech takes baby steps in transforming medicine. The technologies that make this possible are advancing at exponential rates; their power and performance are increasing dramatically, even as their prices fall and footprints shrink. The big leaps will start to happen at around the end of this decade.

The health devices that companies such as Apple, Microsoft and Samsung are developing are based on MEMS sensors, which are one of the exponential technologies. These enable the measurement of things such as heart rate, temperature, blood pressure and activity levels and can feed data into cloud-based platforms such as HealthKit. They will be packaged in watches, Band-Aids, clothing — and contact lenses. Yes, Google announced in January that it is developing a contact lens that can measure glucose levels in a person's tears and transmit these data via an antenna thinner than a human hair. In July, the company [said](#) it was licensing the technology to Novartis, enabling it to market it to people with diabetes.

We will soon have sensors that monitor almost every aspect of our body's functioning, inside and out.

Advances in microfluidics are [making possible](#) the types of comprehensive, inexpensive diagnostics that Theranos is developing. In a single drop of blood, it can test for things [such as](#) cancer, cholesterol and cocaine. Newer technologies coming from nanobiophysics will soon make Theranos obsolete by providing immediate analysis at the point of care, rather than in a laboratory as Theranos does. One of the most promising of these, from [Nanobiosym](#), is Gene-Radar, a portable nanotechnology platform that uses biological nanomachines to rapidly and accurately detect the genetic fingerprints of organisms. It will enable the detection of diseases such as HIV and Ebola and deliver the results to a mobile device within minutes — for a hundredth of the cost of conventional tests.

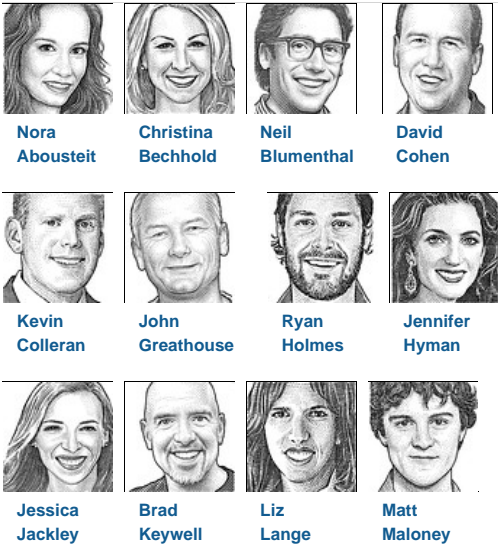
By combining these data with our electronic medical records and the activity and lifestyle information that our smartphones observe, artificial intelligence-based systems will monitor us on a 24/7 basis. They will warn us when we are about to get sick and advise us on what medications we should take and how we should improve our lifestyle and habits. Watson, the technology that IBM developed to defeat human players on the TV show

About The Accelerators

For aspiring or actual entrepreneurs, The Accelerators forum is a lively discussion among startup mentors— entrepreneurs, angel investors and venture capitalists. To reach us: [@wsjstartup](#) or theaccelerators@wsj.com.

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Jeopardy, has already become capable of diagnosing cancer **more accurately** than human physicians can. Soon it will be better than humans are in making every diagnosis.

With the added sensors and the apps that tech companies will build, our smartphone will become a medical device akin to the *Star Trek* tricorder. Indeed, there are already **ten finalists** for the \$10 million Qualcomm XPRIZE to build a device that can “diagnose patients better than or equal to a panel of board certified physicians.” Watching one of these, **Scanadu**, in action, I have little doubt that we will see many revolutionary technologies by the time XPRIZE winners are selected in early 2016.

With health data from millions of patients, technology companies will be able to take on and transform the pharmaceutical industry — which works on limited clinical-trial data and sometimes chooses to ignore information that does not suit it. These data can be used to accurately analyze what medications patients have taken, to determine which of them truly had a positive effect; which simply created adverse reactions and new ailments; and which did both.

And then there is the genomics revolution. The cost of sequencing a human genome has fallen from \$100 million in 2001 to about \$1,000 today and will likely cost as much as a blood test by the end of this decade. What this means is that the bits and bytes that make up a human being have been deciphered; for all intents and purposes, we have become software.

Genome analysis is already being used to guide the treatment of cancers of the brain and the breast. Eric Green, director of the National Human Genome Research Institute, explained to me that a decade ago, scientists focused on using DNA-sequencing and computational technologies to interpret the genome and understand its biology. Now they are using them to improve diagnostics, medicines and clinical practice. Green predicts that, before long, doctors will tailor treatment for diseases on the basis of an individual's genomic information. This is what becomes possible by understanding the correlation between genome, habits and disease.

That is why **Google** and **Amazon** are competing to offer a repository for genomics. They are charging practically nothing (\$25) to store your genome — so that they can peek at the data just as they peek at your emails and web searches.

Google is, as well, developing nanoparticles that combine a magnetic material with antibodies or proteins that can attach to and detect cancers and other molecules inside the body and notify a wearable computer on the wrist.

Entrepreneurs have far greater ambition than just diagnosing and curing disease, however.

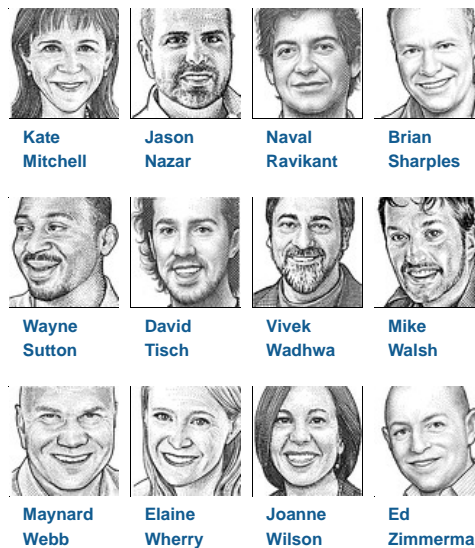
Craig Venter, who was a pioneer of genomic sequencing, **announced**, in March, that he was starting a company, Human Longevity, to develop cell therapies using genomics to extend the healthy lifespan of humans. Google made a significant investment in a company called Calico to research diseases that afflict the elderly, such as neurodegeneration and cancer. It wants to understand ageing and, ultimately, extend life.

In an emerging field of synthetic biology, which allows the “writing” of DNA, researchers are creating new organisms and synthetic life forms. Entrepreneurs have developed software tools to “design” new organisms. As scary and risky as this may be, they are “designing” new drugs, therapeutic vaccines and microorganisms. They hope to completely eradicate deadly diseases.

Tissue-engineering and 3D-printing technologies are beginning to merge and make possible the “printing” of personalized organs and enhance the human body. Imagine exoskeletons and bionic enhancements of strength, vision and hearing as we saw in the '70s TV series *The Six Million Dollar Man*. This too is becoming possible.

Perhaps the greatest leap of all is being attempted by Google. It is learning how the human brain works. One of its chief scientists, Ray Kurzweil, is **bringing to life** the theory of intelligence expounded in his book *How to Create a Mind*. He believes that we will be able to enhance our intelligence with technology and back up our brains on the cloud.

2014 marked an inflection point in the technology curve for medicine. It isn't yet clear which technology advances will indeed impact humanity and which will be nothing more than cool science experiments. What is clear is that we have entered an era of acceleration and there is much promise — and risk of peril — ahead.



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4:17 pm January 10, 2015

Ihfkzfkhljblklh wrote:

Reading the New Yorker article only further cements that perception that Theranos is hiding behind the smoke and mirrors of the founder's intellect. Are we supposed to be so impressed that she speaks Mandarin that we forget the science is unknown, and the correlation data undisclosed? "Trust me, I am smart" doesn't work in the medical field. Why the attack on the lab industry with bold falsehoods (days to run routine tests, everything requires several vials of blood)? If the science behind the hype is real, the smear campaign is not required and only works against Theranos as they try to establish themselves as a force of change in the industry. As every true scientist knows, the truth is in the data and until it is disclosed, Theranos will remain on the sidelines.

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