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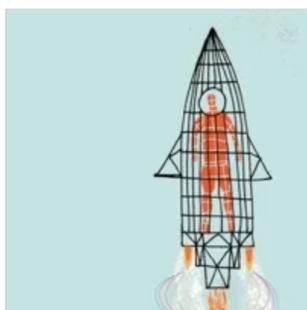
worldVIEW

A GLOBAL BIOTECHNOLOGY PERSPECTIVE



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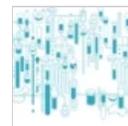
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WorldViewpoint: How Nanobiophysics Will Transform Global Healthcare

Mobilizing, personalizing and decentralizing the next generation of infrastructure

by Anita Goel



A Guided Tour

Enhanced with a new guidebook and region-specific ratings, the 2016 Scorecard ventures deeper than ever to track down the latest in biotech

innovation

The current global healthcare industry can trace its roots back to the Industrial Revolution. It was developed around the paradigm of centralized infrastructure that many British factories of the time used. In fact, Westminster Hospital—founded in London in 1719 as one of the first public hospitals in Britain—serves as a prototype for how medicine is still practiced today. Centralized hospitals and diagnostic labs have become the focal point around which our entire healthcare ecosystem and supply-chain alliances are organized. However, this model faces major limitations, as nearly 4 billion people worldwide lack access to basic healthcare. This includes both the developing world and rural, remote areas (even in industrialized nations) where people do not have access to these nodes of concentrated healthcare infrastructure. Furthermore, we face an impending multi-trillion-dollar crisis in the United States as our healthcare system grows more complex, with highly specialized and overpriced reductionist silos that seek to cut costs by adopting a “one size fits all” mentality. I believe that the solution to this problem will come from the new science of nanobiophysics.

At Nanobiosym, we have been developing next-generation technologies to disrupt the current centralized healthcare paradigm. We have harnessed over 20 years of our work in nanobiophysics to develop Gene-RADAR, a mobile diagnostic platform for providing anyone, anytime, anywhere with instant access to personalized information about their health. By decentralizing the infrastructure needed to diagnose and manage disease, we are democratizing access on a global scale, empowering individuals to take ownership of their health. What Google did for the information industry and what cell phones did for the telecommunications industry, Nanobiosym is doing for healthcare.

In the past two decades, we have experienced two profound technological revolutions. Previously, access to information was confined to certain centralized infrastructures like libraries, schools and centers of higher learning. With the Internet, Google disrupted the information industry by giving anyone, anytime, anywhere access to the world’s information. Likewise, wireless technology democratized access to telecommunications by leapfrogging traditional infrastructure requirements. As an example, India went from a few million landlines to over 800 million cell phones in about a decade. In both industries, the adoption of next-generation technology empowered individuals and even entire

nations and their economies to make a sudden quantum leap to the global stage. Healthcare, as an industry, is still very centralized and has yet to undergo this transformative level of disruption.

Tiny Tech, Huge Impact

Nanobiosym's portfolio of technologies is poised to mobilize, personalize and decentralize the diagnosis of disease, and will ultimately render superfluous much of the landline-era infrastructure of traditional diagnostic labs and disrupt established supply-chain alliances. At Nanobiosym, we are driven by the humanitarian mission to drastically reduce the cost of diagnosis with the aim of democratizing access to real time diagnostic information to people worldwide, including empowering those 4 billion people who currently lack access to even basic healthcare.

The gold standard in medical diagnosis today is based on a 20-year-old Nobel Prize-winning technology called the polymerase chain reaction (PCR), which forms the basis of the multi-billion-dollar molecular diagnostics industry and requires significant, costly infrastructure. Through the new science of nanobiophysics, we are creating next-generation technologies like Gene-RADAR that will fundamentally transform how diseases are diagnosed and treated. We harness tiny molecular machines that read and write DNA to detect genetic fingerprints of various diseases. We have embedded these nanomachines and nanosensors in microelectromechanical systems and nanofluidic engineering platforms to enable real-time, mobile diagnosis. We are at a point in history where these nanobiophysics innovations, along with several recent technological advances—smart phones, information and communications technology, human genome sequencing, bioinformatics and so on—are poised to completely transform the delivery of global healthcare.

The real-world consequences are profound. In the developed world, today's gold standard for testing HIV viral load costs US\$200–300 dollars and can take 2–3 weeks to deliver a result. In sub-Saharan Africa, these tests can take up to six months, given the cost, lack of infrastructure and difficulty in transporting specimens for testing. The Gene-RADAR platform reduces that time to under an hour, with a price point 10–100 times more affordable—all without the need for running water, constant electricity or highly trained personnel. But these are only the initial ways in which nanobiophysics will transform medical diagnosis. Earlier, faster, more accurate detection of other infectious diseases also provides new hope for containing the spread of global pandemics like Avian Flu and SARS, as well as for reducing multidrug-resistant strains of diseases such as HIV, tuberculosis and malaria. Technologies like Gene-RADAR will also enable the healthcare system to provide the right drug, for the right patient, at the right time, offering what we call “personalized nanomedicine.”

Engineering the Ecosystem

Disruptive technologies alone are not enough to drive the revolution in global healthcare. We need an entire ecosystem of early adopters and change agents to pilot and integrate these next-generation technologies. Engineering the ecosystem is just as important as physics and nanotechnology engineering. By replacing the hospital and centralized lab as the epicenter of healthcare delivery, nanobiophysics-enabled platforms like Gene-RADAR will put the patient and consumer at the center of the healthcare ecosystem.

Our nanobiophysics-based technologies facilitate a quantum leap for developing countries that would otherwise have to invest billions in providing roads, water, infrastructure, trained healthcare personnel, hospitals and labs just to be on par with developed nations. By becoming early adopters of mobile diagnostics platforms, these nations will transform healthcare delivery to their citizens. By empowering patients and consumers to take ownership of their health and wellness, we are making healthcare more integrated and holistically centered around the individual. Our disruptive nanobiophysics technologies, coupled with the right business models, will unleash a healthcare revolution—transforming not just the infrastructure needed to deliver basic healthcare, but ultimately transforming the entire experience.

Opinions expressed in worldVIEWpoint do not necessarily reflect those of the editors.

Anita Goel is founder, chairman and CEO of the Nanobiosym Research Institute and Nanobiosym Diagnostics in Cambridge, Massachusetts. A Harvard-MIT-trained physicist and physician, she was awarded the 2013 XPRIZE in recognition of her pioneering contributions to the new field of nanobiophysics and her Gene-RADAR technology.



Illustration by Veronica Lawlor

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