

# Smarter Technologies, Healthier Bodies

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I think in the future in health and medicine there are so many new technologies that are getting faster, cheaper, more powerful, they're converging to a point where we can mash them together in really powerful ways. It's a really exciting era. There's lots of opportunities for innovation and improvement.

I am Daniel Kraft. I'm a physician, scientist, entrepreneur. Looking into the future I thought, you know, what better way to do that than to think about the world that my son and my daughter are going to grow into, which is, you know, changing really, really fast. You know, our traditional model, I think our mean for the way we've practiced health care is actually not health care, it's been sick care. We wait until often we get sick. We have the heart attack, the stroke, the cancer that pops up. Where things are sort of heading, I believe is from waiting for disease to happen to wellness and prevention.

In 50 years from now we'll have the equivalent of almost an OnStar for the body that's going to be taking information from our environment, from our diet, from our social networks, from our genomics. Health will become something that's truly infused and integrated into our life. It's not for their doctor to be in charge of their health. It's you own your own health information.

Many of the technologies, which used to be super expensive are writing sort of Moore's Law, that the



poorest on the planet will have access to low-cost tablet technology, phone technology that can enable them to be connected with a physician in their local village, access to the best medical minds, the best medical data bases, using artificial intelligence to understand the whole spectrum of publications, and guidelines, and Omix. It's not just about the data that's important. It's how it becomes actionable information, to help guide you, just like a GPS would be, proactively.

What's particularly exciting now and going into the next 50 years is we're starting to unlock and understand the brain. The world of tele-presence, which is just on the cusp of exploding with technologies like Oculus Rift, where you can feel like you're in a virtual environment and not be able to tell the difference between that and reality. That can be hugely powerful for modulating behavior change. For example, if you can look in the virtual mirror and see future you, if you're not maintaining your exercise and your diet regimen and see yourself 50 pounds later or 10 years later, if you keep smoking, that can change your mind and sensibility.

We're seeing now new ways to train the brain to interact with it directly with technology, the world of brain-computer interface. We're on the cusp now of building optical prosthetics, basically a bionic eye. As the sensors get smaller and better, they're going to reach the point where we have almost normal vision.

Let's take a woman, who is completely quadriplegic, can't move from the neck down from a stroke or a motorcycle accident, for example, put a chip on the motor cortex, which can read their thoughts, essentially, I want to move my arm to the right or to the left, and she can now control a three-dimensional robotic limb to give her her first drink of coffee, for example, in 16 years. We'll have those who have major disabilities connected back to not only prosthetic arms, but maybe rewired and connected to their own.

Alzheimer's today is a devastating diagnosis, which I think by 2064 will lead to a world where we won't wait for someone to get Alzheimer's. We're on the cusp of having imaging modalities that can pick up the plaques in a patient's brain 10 or 20 years before they're showing any clinical signs of Alzheimer's. We'll be able to give them interventions, whether that's mind games, or exercise, or other therapeutics that fits under not just personalized medicine, but this idea of precision medicine, to participatory medicine. It's not just enough to treat a whole set of Alzheimer's patients. We want to learn from every single one of those, and contribute to the whole medical establishment.

Imagine elements like our human genome, which cost millions of dollars 10 years ago, is down to about \$1,000 price point, and in 50 years maybe the equivalent of \$5, or a dollar, or almost free. And I see the future being one where 3D will print a pill with your name on it, with your combination of drugs that help prevent the diseases you're at genetic and other risks for.

Fifty years from now I would hope that many cancers are essentially cured, because we're going to find them early, we're going to prevent them from

happening in the first place for those who have the predispositions, we'll be taking every single tumor, and we're going to sequence every tumor, we're going to understand the expression profiles. We're going to be able to model which drugs work for that individual patient in (Inaudible) models and in simulations that are run in the Cloud, and when you do need therapy, it's not going to be the one-size-fits-all pill that's off the shelf. We'll be personalizing that therapy using other agents that can scan the literature and know it's worked for other patients with similar subtypes and molecular pathways. Many cancers will become chronic diseases or be cured, because we're going to apply very specific combinations of cocktails that really match that individual's cancer.

I think the future of health and medicine will not be just going to the high-tech drugs, and interventions, and devices, but be more attune to our own rhythms, and diets, and exercise, and behavioral elements. You can have a truly integrated care that's smart. It knows you. It knows your physiology. It can manage the drugs and interventions in a much more personalized way than we have today, much more a partnership between the doctor, and the patient, and the healthcare team, and so it's smart and infused in everything that we do. The future's coming faster than we think. We won't wait for disease to happen. We'll start to cure the well before they even get sick.

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