AI IN PRECISION ONCOLOGY

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COMMENTARY

"We're Doing it Wrong!" Phenomics and Hyperscale AI for Health Care

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Abstract

Dr. Leroy "Lee" Hood, MD, PhD, is an American physician-scientist who has served on the faculties at the California Institute of Technology and the University of Washington. Lee has developed groundbreaking automated scientific instruments for DNA and protein sequencing and synthesis that transformed biomedical research. He is the founding director of the Institute for Systems Biology, the founding CEO of Phenome Health, a faculty member of the Buck Institute for Aging and one of the earliest advocates for personalized and precision medicine. Lee also works regularly with Dr. Scott Penberthy, an AI CTO at Google Cloud, on applying hyperscale artificial intelligence (AI) to the field of phenomics. In this regular forum, we'll hear from Lee and Scott and their unique vantage points.

Dear Colleagues,

Let's just put it out there: we're doing it wrong! Oh, don't get us wrong, we've done some incredible work in oncology. But let's face it, much of our health care system is actually more of a "sick care" system. We wait for diseases like cancer to show up uninvited, like that cousin who crashes family parties, and then we roll out the red carpet of treatments. It's reactive, not proactive.

So, what's the game changer? It's called phenomics. This isn't some buzzword cooked up in a lab; we believe it's the future of health care. Phenomics takes everything we know about your body—your genes, quantification of the proteins and metabolites in your blood, the tiny microbes living in your gut, even the heart rate and distance data from your smartwatch—and blends its data together to create a predictive picture of you. With all this information, we can start to see health problems before they get serious. It's like having a weather forecast for your body, telling you when you need to take action to avoid the storm of a severe disease.

Now, you might be wondering how we sift through all this health data. It's not like looking through a couple of old family photo albums; it's more like sorting through every photo ever posted on Instagram. That's where hyperscale AI steps in. This isn't just your standard-issue computer program; it's a combination of the most advanced technology we have—deep learning to sift through the data, knowledge graphs to connect the dots, digital twins to make predictive models of you, multiple language models to summarize knowledge, and something called latent space representations, which help us understand patterns and trends that would otherwise be like a puzzle with missing pieces.

This isn't just about collecting data for the sake of having lots of numbers and charts. These are actionable insights telling you how to be more well or to avoid disease. Imagine knowing years ahead that you're at risk for a serious disease—then getting advice on small lifestyle changes that could prevent it. It's like your future self, sending you life-saving tips. We all deserve to feel like we're in our 30s, while jogging or walking

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Fig 1. A supercentenarian out for a fast walk in Central Park in 2030. (Image was generated using stable diffusion open source software, prompted by the author.)

around Central Park in our 100s (Fig. 1). And if a health problem is unavoidable, we've got more tools than ever before to deal with it. Techniques such as CRISPR, mRNA therapeutics, combinatorial drug therapies and other advanced therapies can be used to ''patch'' the system. It's a bit like updating the software on your phone, but in this case, the software is you. Systems biology— a global and holistic approach to systems—gives one the means to take this enormous amount of individual information and integrate it into the dynamical biological networks that unpin normal and diseased physiology.

Building the Future

But this future isn't going to just build itself. We've got to get in there and make it happen. There are already tools out there that can help us get up to speed. One example, of course, are the recent large language models, tools that can provide just-in-time education while we're in the middle of our work. No need to halt everything and hit the books; you get the info you need about a patient's condition when you need it.

Patients can contribute too, by becoming data donors through adding their own unique data to make these systems smarter and more accurate. And this isn't some far-off dream. Companies like Tempus Labs, focused on cancer precision medicine, are already making huge strides in this direction. The data-driven health will employ three powerful strategies and approaches: big data (especially phenomics), systems biology, and hyperscale AI to move us increasingly away from disease care towards a health care of wellness and prevention.

So let's not stick to our old ways and miss out on a future that could revolutionize health care. Phenomics and hyperscale AI aren't just fancy new terms; they're the tools we need to shift from reactive to proactive, from ''sick care'' to a true health care of wellness and prevention. As professionals, it's time for us to lead that charge. Let's be the ones to say we got it right by first admitting that we've been doing it wrong.

Here's to a future where we're all a lot healthier and our health care system is smarter. Let's get this right, together.

Yours in the quest for a better way,

Leroy Hood & Scott Penberthy