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## The Science of Wellness

By Leroy Hood

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**Editor's Note** This article was originally published in the *LA Times* on Sunday, March 21, 2021, in the *Second Opinion* column. Leroy Hood, a contributor to 4sight Health, is SVP and Chief Science Officer, Providence St. Joseph Health; Chief Strategy Officer, Co-founder and Professor at the [Institute for Systems Biology](#).

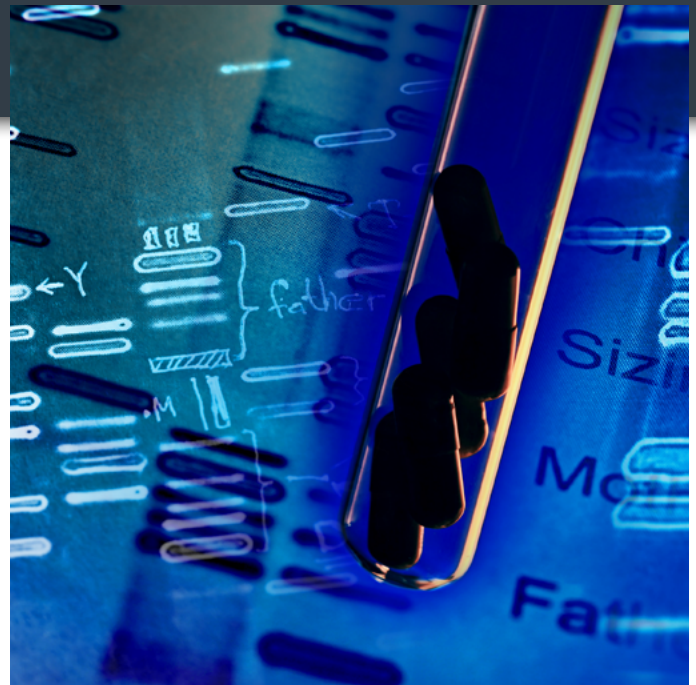
America was sick before COVID-19 struck. The pandemic has made our national sickness more acute and illustrated the critical importance of “wellness” in preventing disease and optimizing health. We know this because COVID disproportionately impacted people with chronic illness and unhealthy lifestyles.

As a scientist who has worked at the leading edge of medicine, engineering and genetics for decades, I'm on a quest to give mind and body wellness the scientific rigor and urgency it deserves. No doctor, policy or breakthrough drug is as effective as “wellness” at minimizing disease and enhancing the length and quality of life.

From 1959 to 2014, America experienced a dramatic rise in life expectancy due to advances in medicine, nutrition, lifestyle, the environment, safety and economic well-being. Since then, life expectancy has declined four of the past five years, something we haven't seen in a century.

While COVID-19 was a major factor in 2020's life expectancy decline, it is only part of a bigger national health catastrophe. Some 45% of Americans suffer from at least one chronic condition and 70% of all deaths in America are attributable to chronic disease.

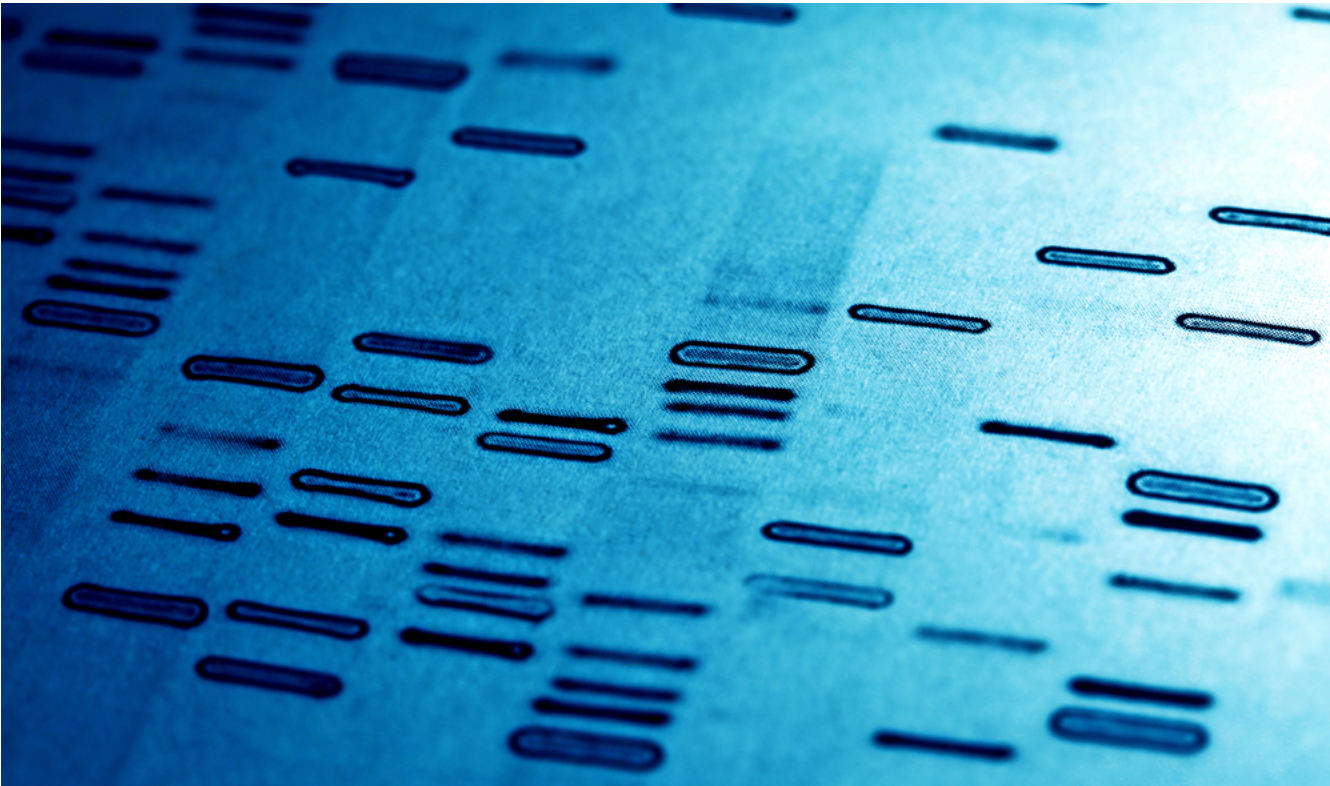
Consistent with these grim statistics, the U.S. devotes 90% of its healthcare spending to treat patients with chronic physical and mental health conditions. Devastating chronic disease will be with us long after this pandemic recedes unless we make major changes in how we promote health and treat illness.



Our healthcare system is great at fighting disease retroactively, but it's dismal at keeping people healthy proactively. Waiting to treat disease after it emerges is not the answer. Once heart disease sets in, cancer spreads, or Alzheimer's takes root, it's too late. Shorter lifespans and diminished quality of life are the result.

In contrast, wellness is the absence of disease in the body, and the most powerful force in human health. While “preventative medicine” seeks earlier detection of already established disease, scientific wellness gives medical providers a new way of treating patients based on a data-informed understanding of their personal health.

Each person's genome, or genetic makeup, is unique. Other factors, including our epigenomes, blood analytes, microbiomes, environmental toxins, diet and lifestyle, contribute in complex but inter-related ways to disease susceptibility and overall health.



As an example, consider the gut microbiome, which consists of trillions of bacteria of multiple species that live in the gut. When functioning well, these bacteria regulate metabolism, bolster immune responsiveness and even promote cognitive health. Their diversity is essential to human health.

My research organization, the [Institute for Systems Biology](#), did a fascinating experiment recently where we studied the gut microbiomes of 9,000 individuals across the entire adult human lifespan. We demonstrated that gut microbiomes in healthy people change markedly as they age. These healthy gut biomes individualize in unique ways, maintaining species diversity while deleting major bacterial species common in the young. These were surprising results.

From our four-year observational studies, we found that people in their 80s with less microbiome change were four times more likely to die than those with markedly changed microbiomes. Four times!

Why healthy microbiomes for the elderly differ from healthy microbiomes for the young is a fascinating research question. Answering it will increase our understanding of the aging process and lead to powerful new strategies for promoting life-long health.

This is how we need Big Data and scientific wellness to work together. Starting in 2014, my organization has sequenced genomes and catalogued health measures of 5,000 patients over five years.

We were able to elevate individual wellness and extend its duration by data-driven individual analyses from the genome, blood and individual lifestyle reports, which led to actionable possibilities.

For example, 91% of a population we studied had very low vitamin D levels (low levels probably increase susceptibility to cancer, Alzheimer's, COVID-19 and other diseases). We found that some individuals were brought back to normal by a daily dose of just 1,000 international units of vitamin D, but many others were not. Many of those who were unresponsive had one to several gene variants that blocked the uptake of vitamin D. They often required mega doses, up to 15,000 units per day, to return to normal. This integration of two data types (genome variants and blood vitamin D level) was necessary for this actionable possibility. This is the essence of personalized medicine — treating each individual according to that person's unique traits.

We found striking blood signals long before disease symptoms can traditionally be diagnosed. That transformational research offers exciting opportunities to pursue interventions that delay or prevent the onset of disease.

Imagine the data-based insights gained by studying the genomes and health measures of a million people. That is our goal. With that depth and breadth of understanding, we can significantly extend the lifespan and enhance the quality of life of every person living today.

In a healthcare system focused on wellness, physicians would spend as much or more time helping patients achieve healthy lifestyles as they currently spend treating patients for preventable or manageable diseases. Using a scientific or quantitative approach to wellness, medical providers will be able to develop tailored interventions based on each patient's unique genome, blood, gut microbe, diet and digital physiology.

By identifying transitional states best described as "pre-pre-disease," wellness-oriented physicians could prescribe treatments that reverse and heal adverse health conditions before they become pathologic. Through wellness-focused medicine, individual health spans could extend well into the 90s and beyond.

COVID-19 has wrought a year of sickness and death. We cannot change what has already happened, but we can commit our energy and resources to combatting the ongoing pandemic of chronic illness and diminished health.

In a world in which predictive, preventative and personalized care is standard practice, people would not only live longer, but be able to lead more satisfying, productive and active lives. No breakthrough drug or treatment could compete with that. And that's a world within reach today.

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## AUTHOR



**Leroy Hood**, a world-renowned scientist and recipient of the National Medal of Science in 2011, Dr. Leroy Hood co-founded the Institute for Systems Biology (ISB) in 2000 and served as its first President from 2000-2017. In 2016, ISB affiliated with Providence St. Joseph Health (PSJH) and Dr. Hood became PSJH's Senior Vice President and Chief Science Officer. He is also Chief Strategy Officer and Professor at ISB.

He is a member of the National Academy of Sciences, the National Academy of Engineering, and the National Academy of Medicine. Of the more than 6,000 scientists worldwide who belong to one or more of these academies, Dr. Hood is one of only 20 people elected to all three.

He received his MD from Johns Hopkins University School of Medicine and his PhD in biochemistry from Caltech. Dr. Hood was a faculty member at Caltech from 1967-1992, serving for 10 years as the Chair of Biology. During this period, he and his colleagues developed four sequencer and synthesizer instruments that paved the way for the Human Genome Project's successful mapping and understanding of the human genome. He and his students also deciphered many of the complex mechanisms of antibody diversification. In 1992, Dr. Hood founded and chaired the Department of Molecular Biotechnology at the University of Washington, the first academic department devoted to cross-disciplinary biology.

Dr. Hood is currently carrying out studies in Alzheimer's Disease, cancer, and wellness. He is pioneering a 1 million patient genome/phenome project for Providence St. Joseph Health and is bringing scientific (quantitative) wellness to the contemporary U.S. health care system.

Dr. Hood has played a role in founding 15 biotechnology companies including Amgen, Applied Biosystems, Arivale, and Nanostring. He has co-authored textbooks in biochemistry, immunology, molecular biology, genetics, and systems biology.

In addition to having received 18 honorary degrees from prestigious universities in the U.S. and abroad, Dr. Hood has published more than 850 peer-reviewed articles and currently holds 36 patents.

Dr. Hood is the recipient of numerous national and international awards, including the Lasker Award for Studies of Immune Diversity (1987), the Kyoto Prize in advanced technology (2002), the Heinz Award for pioneering work in Systems Biology (2006), the National Academy of Engineering Fritz J. and Delores H. Russ Prize for developing automated DNA sequencing (2011), and the National Academy of Science Award for Chemistry in Service to Society (2017).



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