# LifeChips-
# Putting Your Body on the Internet

**Invited Speaker**

**2012 Marconi Society Symposium Honoring Dr. Henry Samueli**

**"Technologies and Applications Driving the Future of Communications"**

**Beckman Center, UC Irvine**

**September 6, 2012**


**Dr. Larry Smarr**

**Director, California Institute for Telecommunications and Information Technology**

**Harry E. Gruber Professor,**

**Dept. of Computer Science and Engineering**

**Jacobs School of Engineering, UCSD**


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# Abstract

**The global market for cell phones is driving down the cost of components needed for sensing many aspects of our body. Combined with advances in nanotechnology and MEMS, a new generation of body sensors is rapidly developing. Using the cell phone as the server for a Body Area Network, this enables the real time sensing of many of the body's functions. As these real-time data streams are stored in the cloud, cross population comparisons becomes routine. The availability of biofeedback leads to behavior change toward wellness.**

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# Calit2 Has Been Had a Vision of "the Digital Transformation of Health" for a Decade

www.bodymedia.com



- **Next Step—Putting You On-Line!**
  - Wireless Internet Transmission
  - Key Metabolic and Physical Variables
  - Model -- Dozens of Processors and 60 Sensors / Actuators Inside of our Cars
- **Post-Genomic Individualized Medicine**
  - Combine
    - Genetic Code
    - Body Data Flow
  - Use Powerful AI Data Mining Techniques

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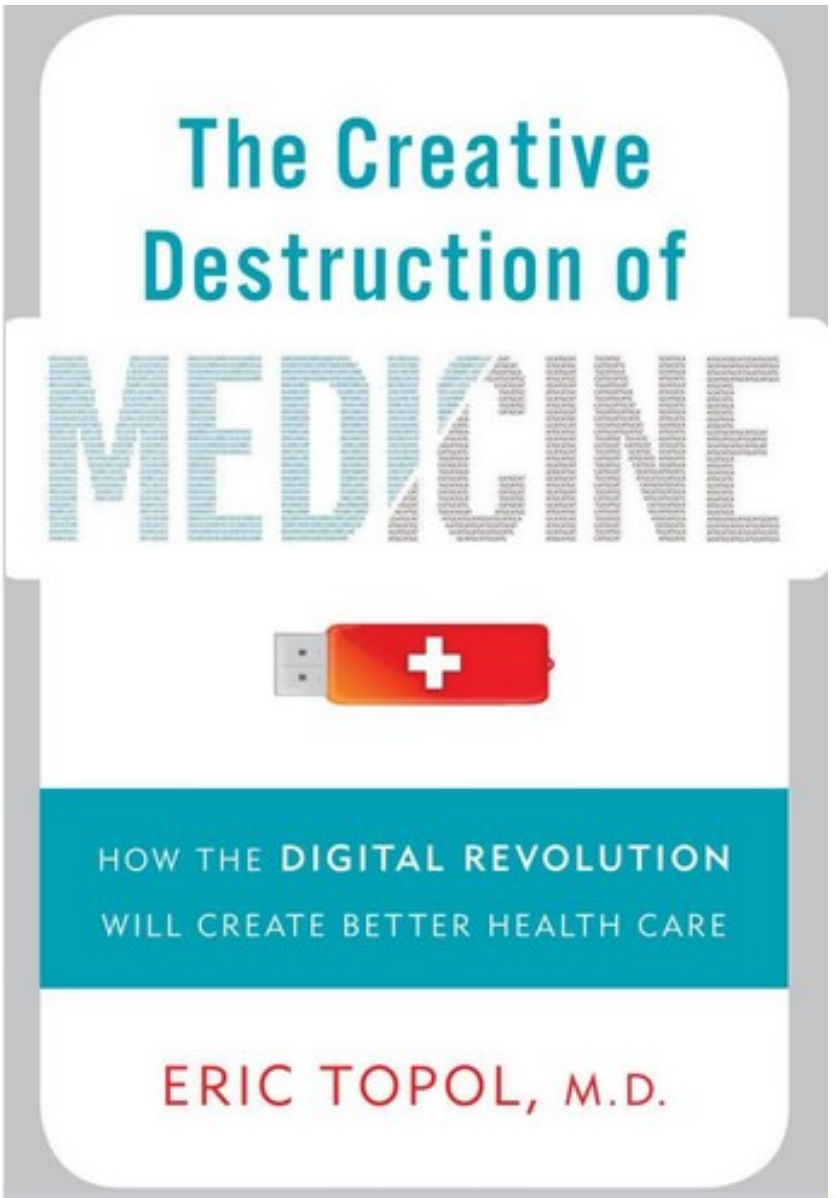
The Content of This Slide from 2001 Larry Smarr Calit2 Talk on Digitally Enabled Genomic Medicine

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# The Calit2 Vision of Digitally Enabled Genomic Medicine is an Emerging Reality




July/August 2011



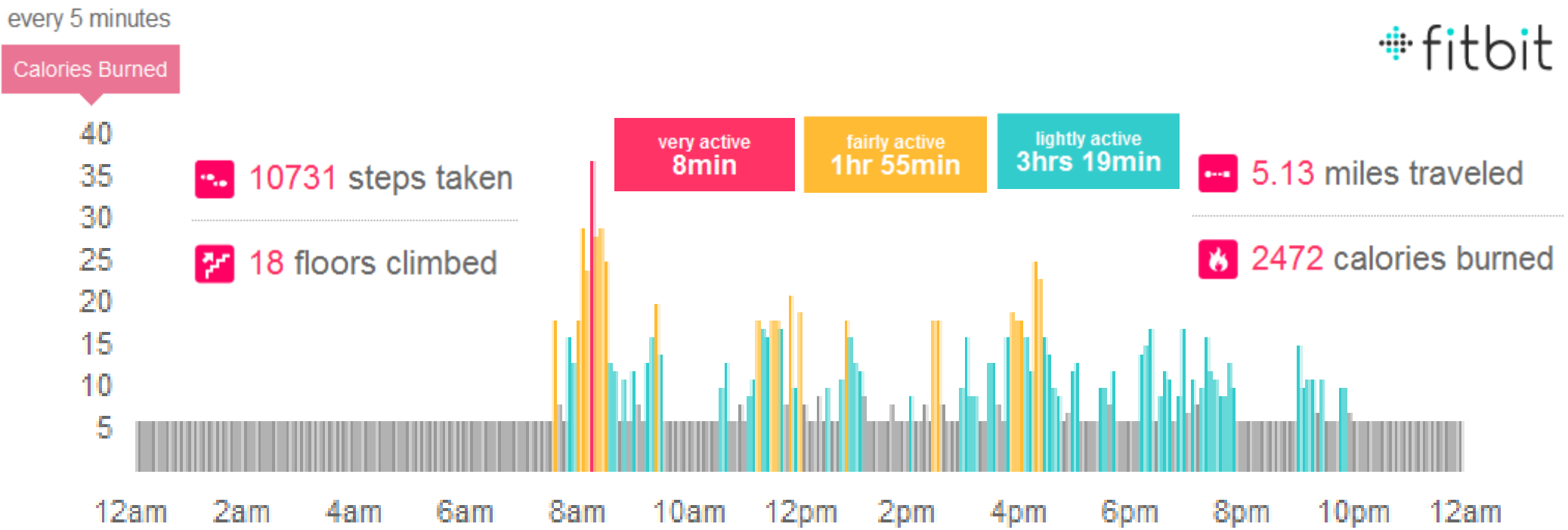

February 2012

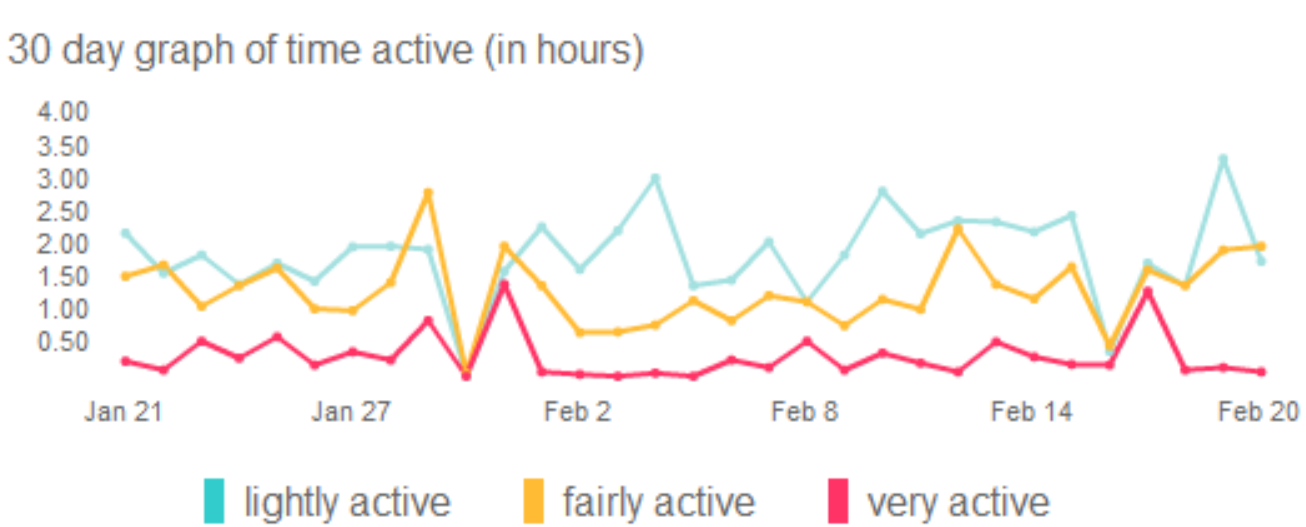


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# Wireless Monitoring Helps Drive Exercise Goals



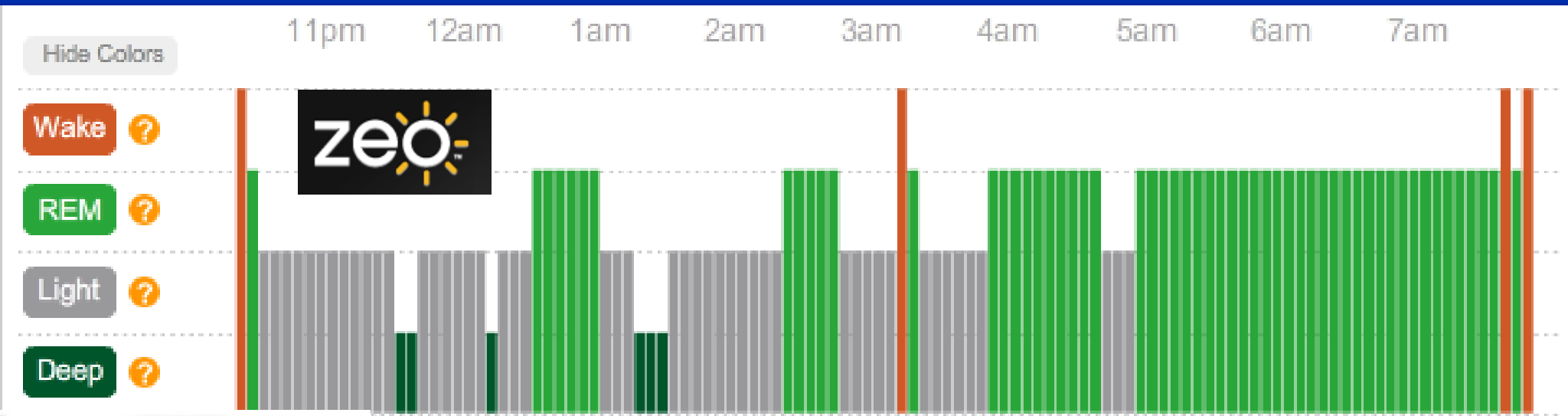






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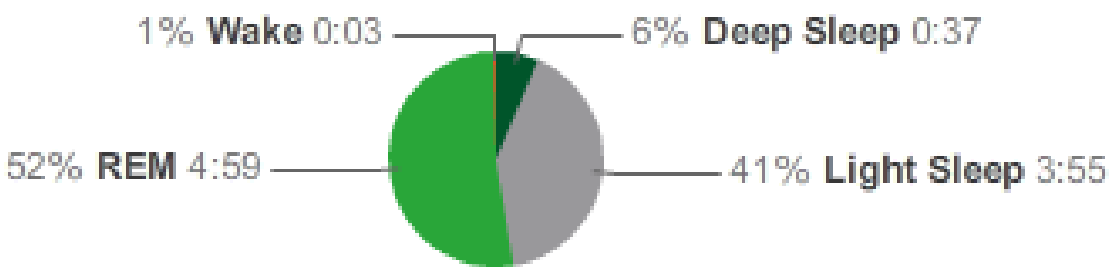
# Quantifying My Sleep Pattern Using a Zeo "LifeChip" - Surprisingly About Half My Sleep is REM!






**Total Z:** 9 hr 31 min

**Time to Z:** 0 hr 2 min




Why are these numbers different from the sleep graph above?

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**REM is Normally 20% of Sleep**
**Mine is Between 45-65% of Sleep**

**An Infant Typically Has 50% REM**

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# Combining the Wireless Internet, Body Sensors, Smart Phones, and Social Networks to Drive Healthier Lifestyles




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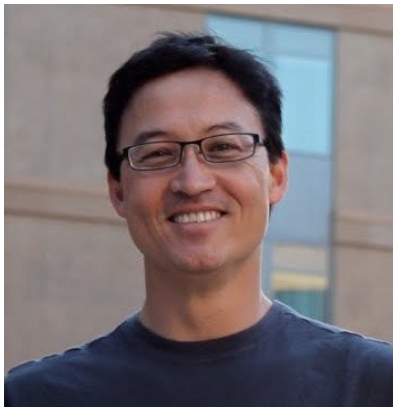
# UC Irvine Collaborative Efforts in eHealth and LifeChips



**G.-P. Li**

**Director of LifeChips program at UC Irvine**

**Calit2-Irvine Director**



**Mark Bachman**

**Director of eHealth collaboratory at UC Irvine**

# Example project: Personal Health Monitoring




"Stability sole" integrates miniaturized flexible sensors and electronics into standard athletic insoles.

Devices are easy to use, invisible, and socially acceptable.

Body worn sensors and electronics are an important technology area for TLC technology.

*Collaborators: Hamid Djalilian and Mark Bachman*

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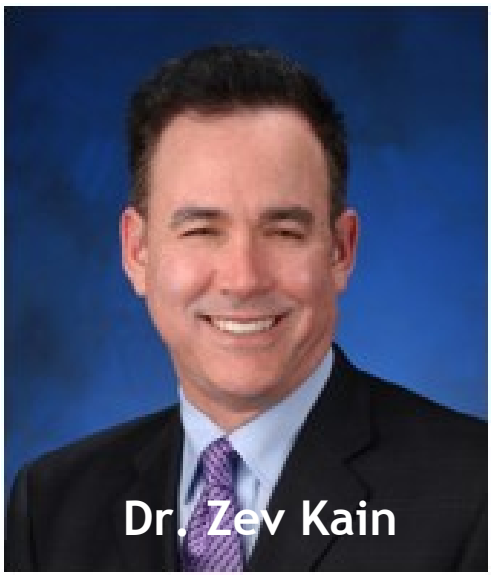
Source: Mark Bachman and G.-P. Li, eHealth and LifeChips at UC Irvine

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# Example project: Media feedback for pain

## Biofeedback with media

**Use of physiological monitoring combined with computer generated imagery to produce relaxation states for improved pain and stress management.**









*Collaborators: Zev Kain, Michelle Fortier, and Mark Bachman*



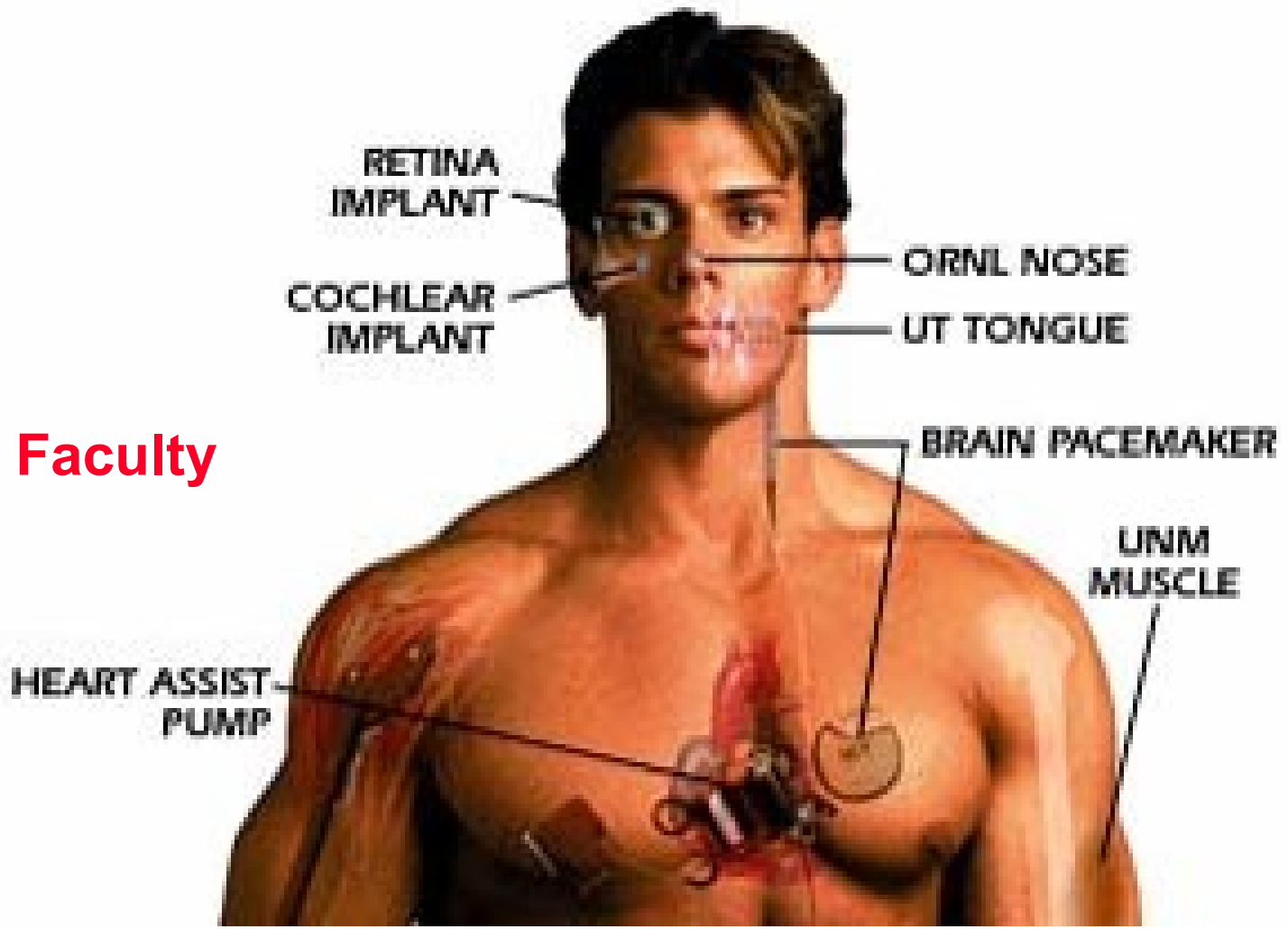

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**Source: Mark Bachman and G.-P. Li, eHealth and LifeChips at UC Irvine**

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# Lifechips--Merging Two Major Industries: Microelectronic Chips & Life Sciences

**65 UCI Faculty**




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lifechips
university of california, irvine
www.lifechips.org

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# Center for Wireless & Population Health Systems: Cross-Disciplinary Collaborating Investigators

- **UCSD School of Medicine**
  - Kevin Patrick, MD, MS, Greg Norman, PhD, Fred Raab, Jacqueline Kerr, PhD
  - Jeannie Huang, MD, MPH
- **UCSD Jacobs School of Engineering**
  - Bill Griswold, PhD, Ingolf Krueger, PhD, Tajana Simunic Rosing, PhD
- **San Diego Supercomputer Center**
  - Chaitan Baru, PhD
- **UCSD Department of Political Science**
  - James Fowler, PhD
- **SDSU Departments of Psychology & Exercise/Nutrition Science**
  - James Sallis, PhD, Simon Marshall, PhD
- **Santech, Inc.**
  - Jennifer Shapiro, PhD, Ram Seshan, MS, MBA
- **PhD students and Post-doctoral Fellows (current)**
  - Jordan Carlson, Barry Demchak, Laura Pina, Ernesto Ramirez, Celal Zifti

http://cwphs.ucsd.edu

CW PHS Center For Wireless & Population Health Systems

UCSD

San Diego State University

SANTECH

SDSC San Diego Supercomputer Center

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# SMART:
# Social Mobile Approach to Reduce Weight

- **Leveraging social networks, social media, mobile phones, and the web for weight loss among 18-35 year old young adults**
  - **Funded with a 5-year grant from NHLBI/NIH**





CW PHS
CENTER FOR WIRELESS & POPULATION HEALTH SYSTEMS

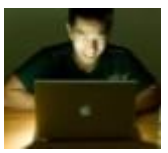
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**Source: Kevin Patrick, UCSD SOM & Calit2**

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# CitiSense –UCSD NSF Grant for Fine-Grained Environmental Sensing Using Cell Phones



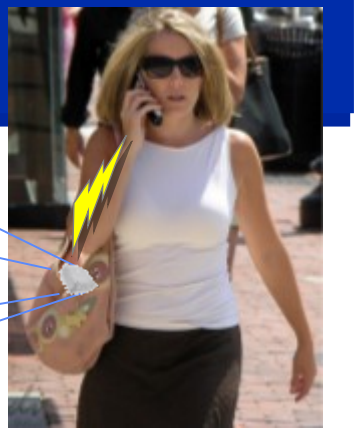
4oz
30 compounds



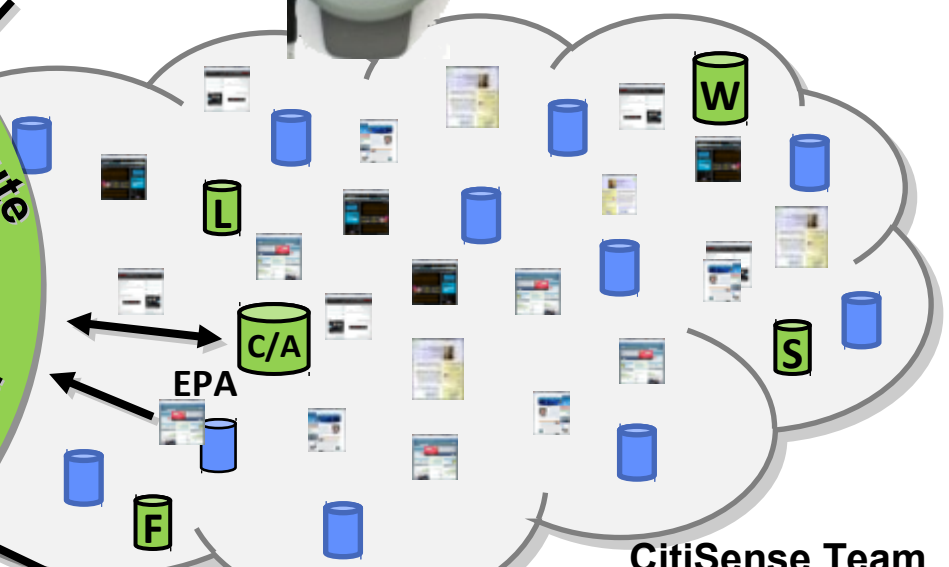
Seacoast Sci.

Intel MS

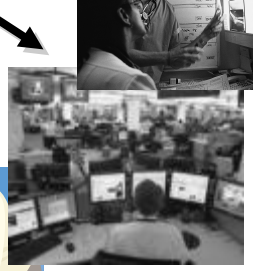










**CitiSense Team**
**PI: Bill Griswold**
**Ingolf Krueger**
**Tajana Simunic Rosing**
**Sanjoy Dasgupta**
**Hovav Shacham**
**Kevin Patrick**

**Integrate Into a "LifeChip"**

# From Measuring Macro-Variables to Measuring Your Internal Variables

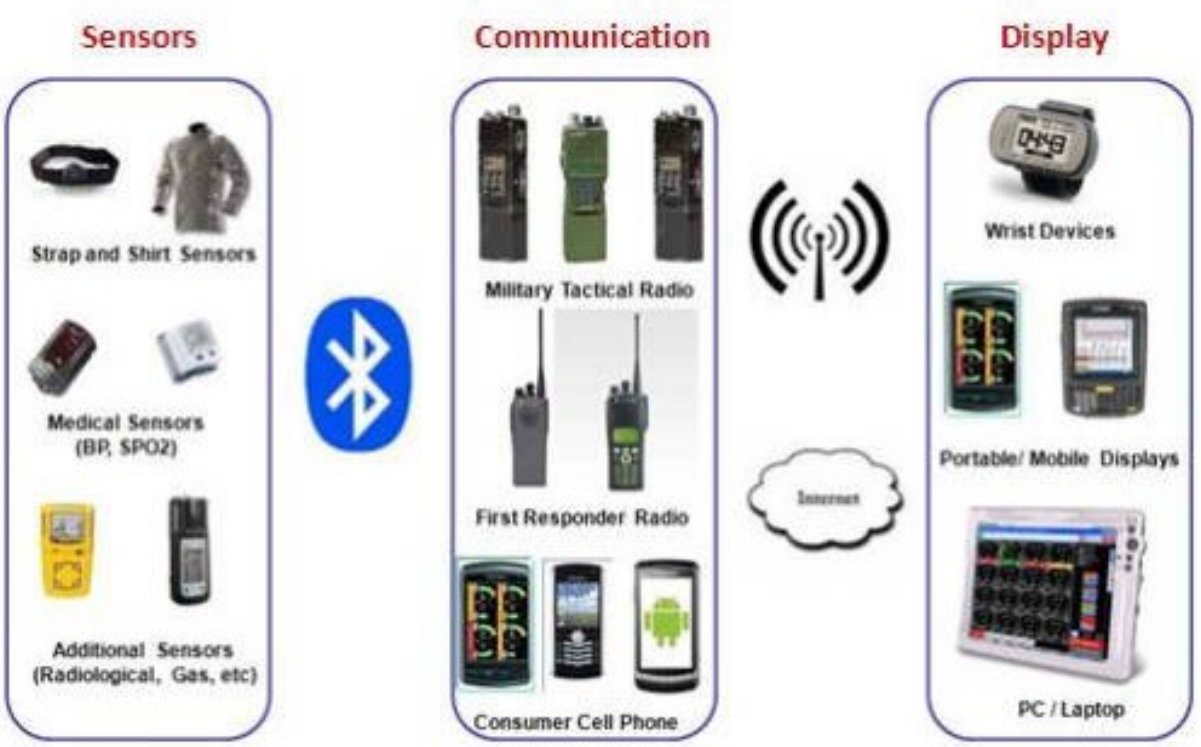


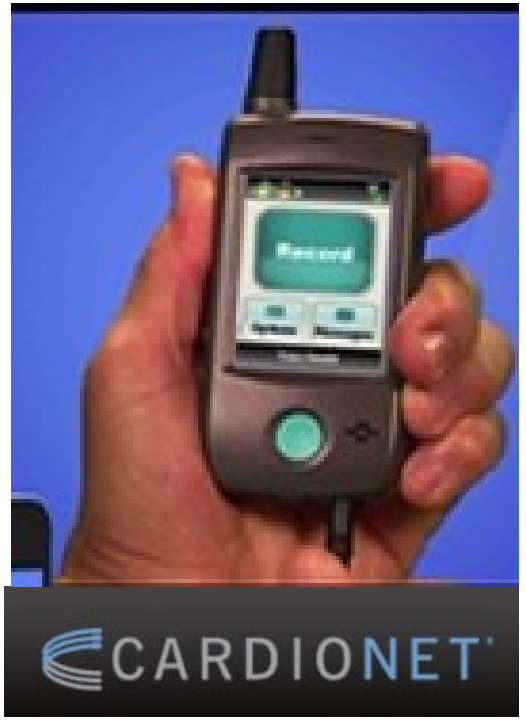

**www.technologyreview.com/biomedicine/39636**

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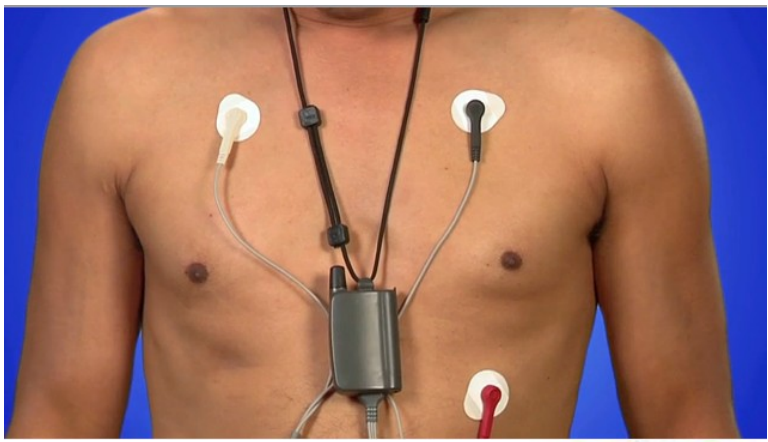
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# Putting Your Heart On-line




Zephyr technology





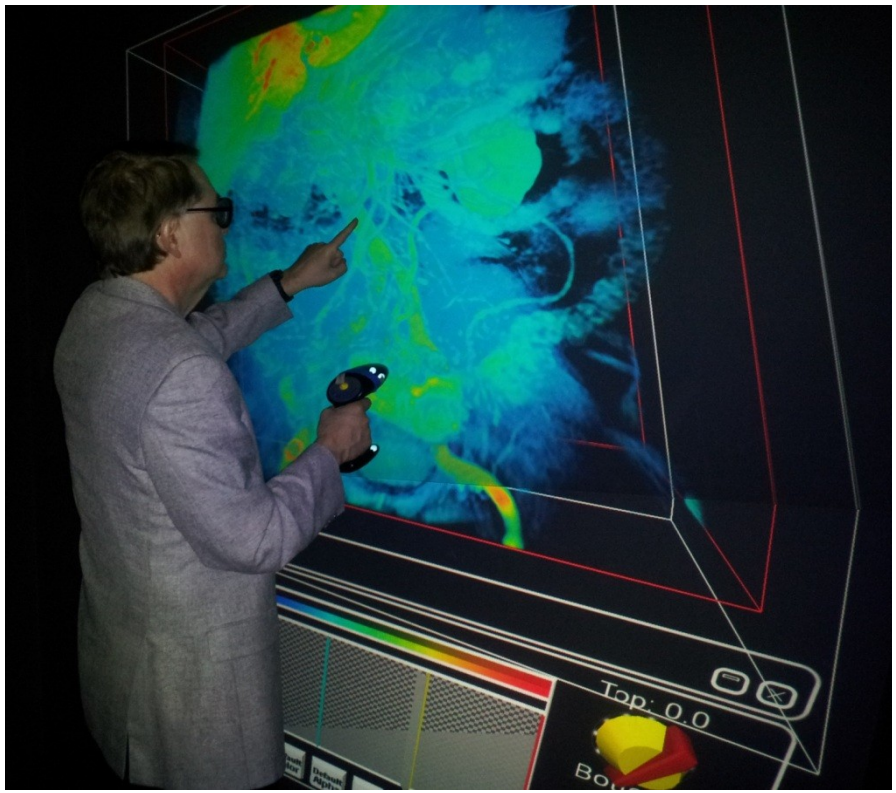

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# Putting Your Organs On-line

- **Videos of Me Giving Tours of My Insides:**
  - **http://www.youtube.com/watch?v=9c4DtJ_L_Ps**
  - **www.theatlantic.com/magazine/archive/2012/07/the-measured-man/309018/**




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**Photo & DeskVOX Software Courtesy of Jurgen Schulze, Calit2**

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# Determining My Gut Microbes and Their Time Variation




**Shipped Stool Sample**
**December 28, 2011**

**I Received**
**a Disk Drive April 3, 2012**
**With 35 GB FASTQ Files**

**Weizhong Li, UCSD**
**NGS Pipeline:**
**230M Reads**
**Only 0.2% Human**

**Required 1/2 cpu-yr**
**Per Person Analyzed!**

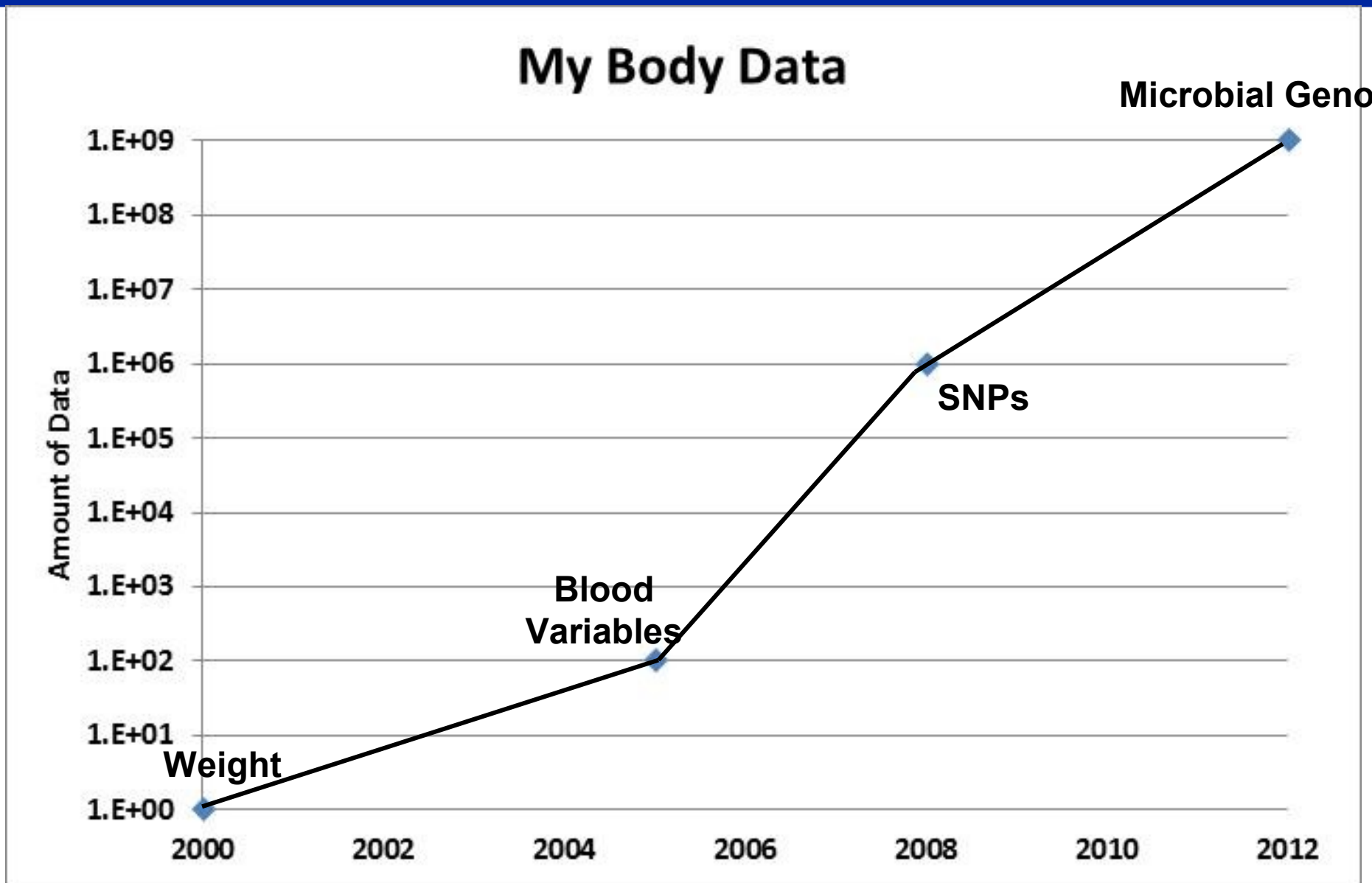
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HEALTH SCIENCES

J. Craig Venter
INSTITUTE

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# From One to Billions of Data Points Defining Me: The Exponential Rise in Body Data in Just One Decade!




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# Publically Sharing Your Genome and Medical Records: Is it Crazy or the Future?

World DNA Day: April 25, 2012

GET Genomes Environments Traits CONFERENCE

**I Have Been Accepted by PGP and Spoke at GET 2012**

## Personal Genome Project

Posted 06.01.08 | NOVA scienceNOW

The Personal Genome Project, spearheaded by George Church of Harvard's Center for Computational Genetics, aims to recruit 100,000 people willing to offer up their DNA and personal life histories. It's all in an effort to further knowledge of human genetics and why we get—or don't get—diseases.

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# Crowd-Sourcing Health Studies Is Rapidly Growing With More Open Health Data




patientslikeme®

transparency life sciences

clinical studies YOU design

research surveys

23andWe begins with you. Learn about yourself while contributing to research.



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*Open health studies on the web. Breaking open bottlenecks in health research and discovery with collective data sharing and analysis. The next wave in health.*

Mountain View, CA · http://genomera.com

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# Where I Believe We are Headed: Predictive, Personalized, Preventive, & Participatory Medicine

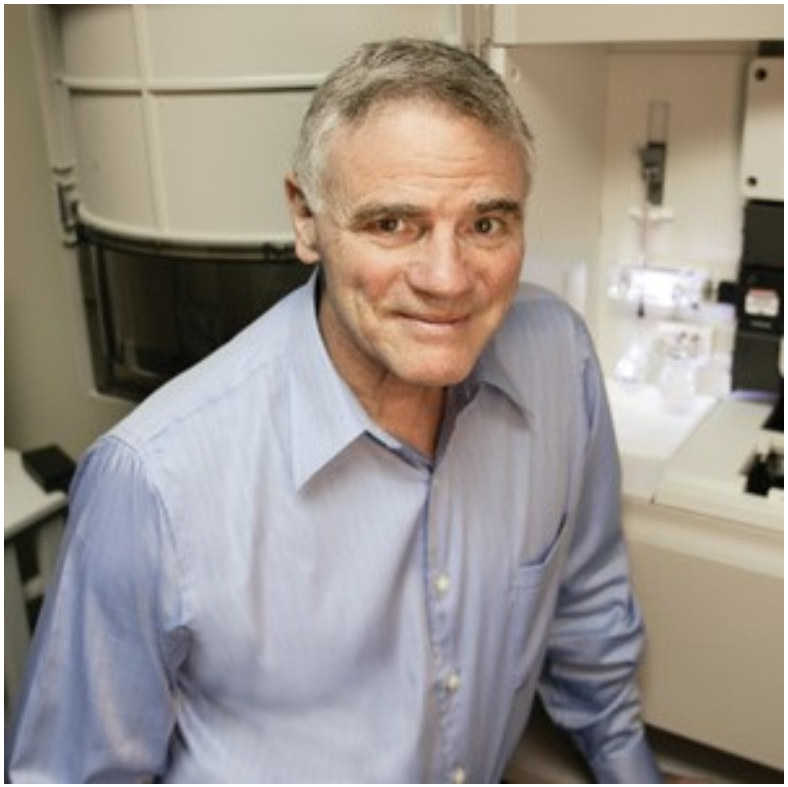
Newsweek

**I am Leroy Hood's Lab Rat!**

## A Doctor's Vision of the Future of Medicine

Leroy Hood
NEWSWEEK

From the magazine issue dated Jul 13, 2009



**Using a "LifeChip"**
**Quantify ~2500 Blood Proteins,**
**50 Each from 50 Organs or Cell Types**
**from a Single Drop of Blood**
**To Create a Time Series**

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www.newsweek.com/2009/06/26/a-doctor-s-vision-of-the-future-of-medicine.html

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