# Harnessing the Power of Data From Our Bodies – Toward Personalized Preventive Medicine

**Invited Remote Talk**
**Mini Diamond Meeting**
**Westfield Center, OH**
**October 27, 2010**

Dr. Larry Smarr
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Follow me on Twitter: lsmarr

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

- **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

www.bodymedia.com



- **Post-Genomic Individualized Medicine**
  - Combine
    - Genetic Code
    - Body Data Flow
  - Use Powerful AI Data Mining Techniques

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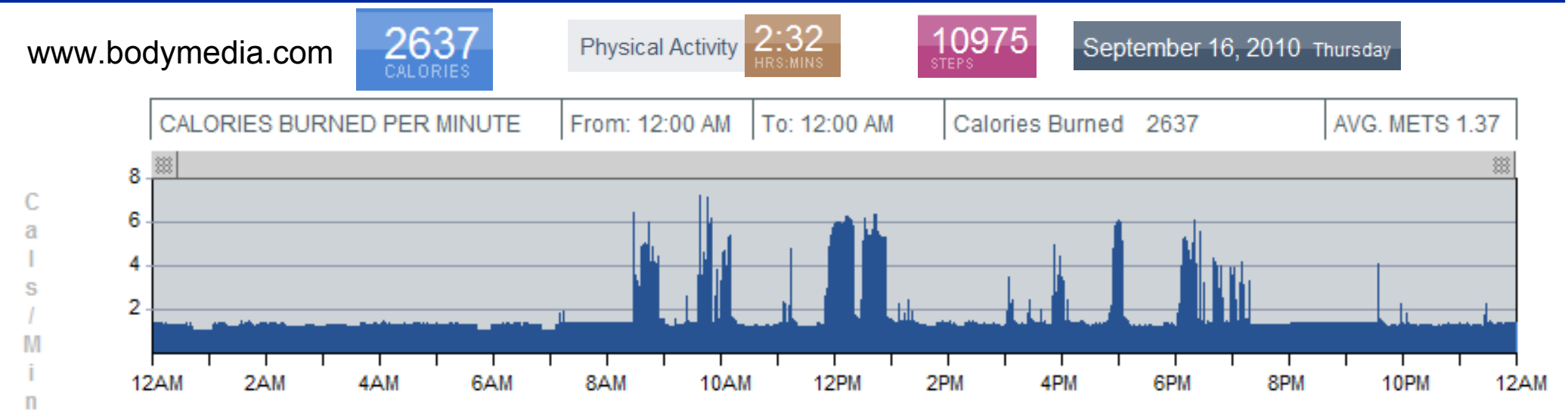
The Content of This Slide from 2001 Larry Smarr
Calit2 Talk on Digitally Enabled Genomic Medicine

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# Nine Years Later I Am Recording My Metabolic Self

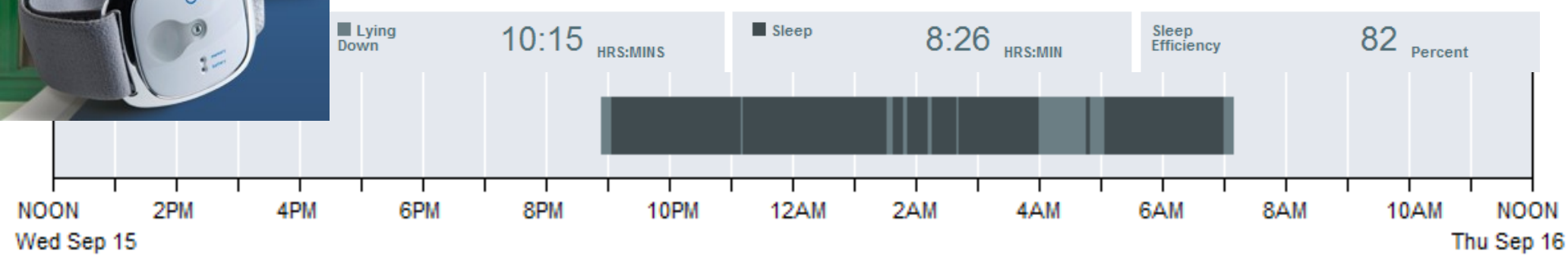
BODYMEDIA® Know your Body. Change your life

www.bodymedia.com






7 Week Ave:
2550 Calories Burned/Day
1:31 hr Physical Activity/Day (>3 METs)
7755 Steps/Day (~3.9 Miles)




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Measure Quantity and Quality of Sleep--
7 Week Ave: 6:55 hrs with 81% Efficiency

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# Leading Causes of Preventable Deaths in the United States in the Year 2000




| Cause | Number of deaths resulting |
|---|---|
| Tobacco Smoking | 435,000 deaths or 18.1% of the total deaths |
| Overweight and Obesity | 365,000 deaths or 15.2% of the total deaths. |
| Alcohol consumption | 85,000 deaths or 3.5% of the total deaths. |
| Infectious diseases | 75,000 deaths or 3.1% of the total deaths. |
| Toxicants | 55,000 deaths or 2.3% of the total deaths. |
| Traffic collisions | 43,000 deaths or 1.8% of the total deaths. |
| Incidents involving firearms | 29,000 deaths or 1.2% of the total deaths. |
| Sexually transmitted diseases | 20,000 deaths or 0.8% of the total deaths. |
| Drug abuse | 17,000 deaths or 0.7% of the total deaths. |

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Mokdad AH, Marks JS, Stroup DF, Gerberding JL (March 2004). "Actual causes of death in the United States, 2000". JAMA 291 (10): 1238–45. doi:10.1001/jama.291.10.1238. PMID 15010446. www.csdp.org/research/1238.pdf.

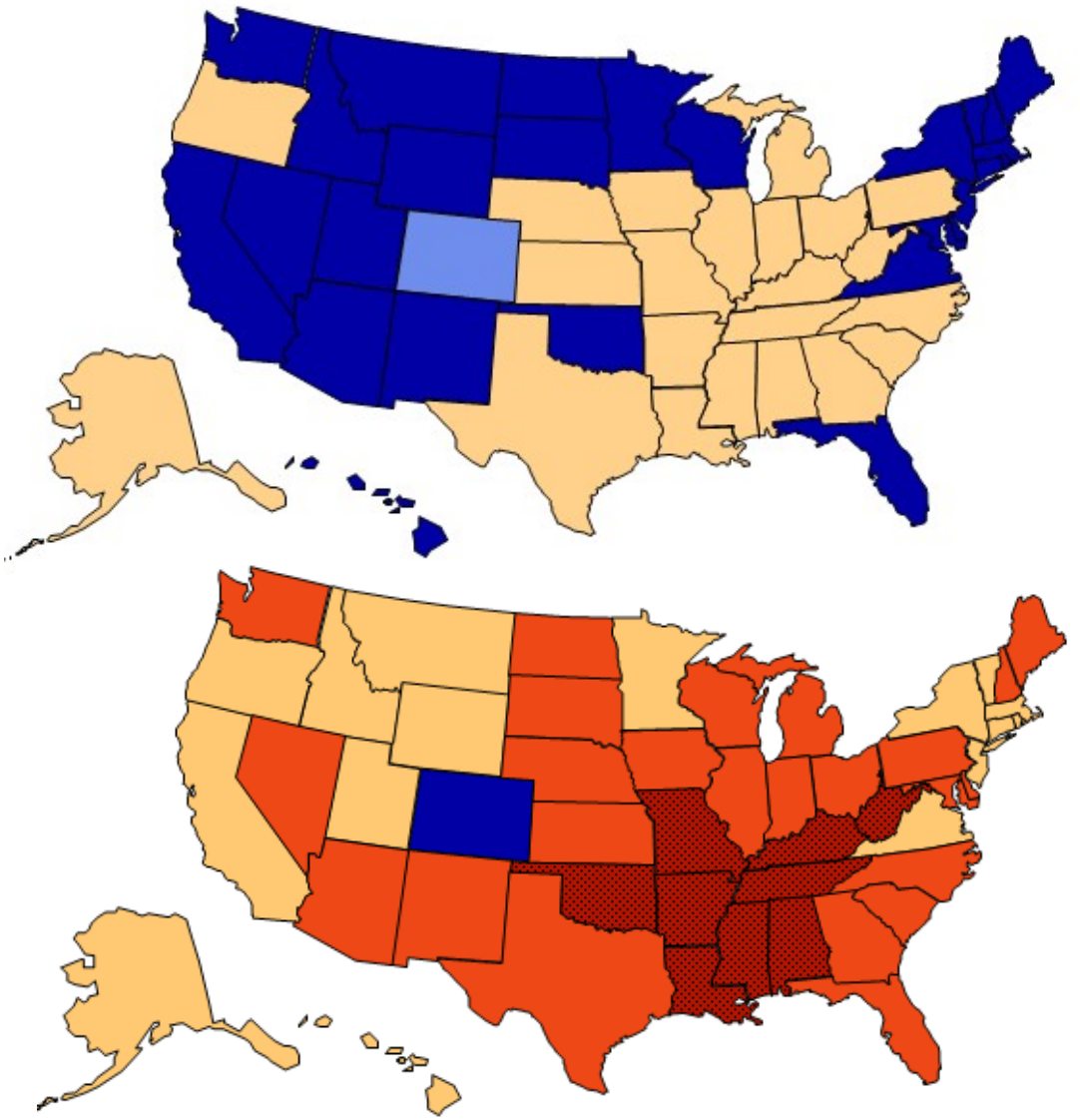
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# During the 2000s, The Fraction of the Population That is Overweight or Obese Has Greatly Increased

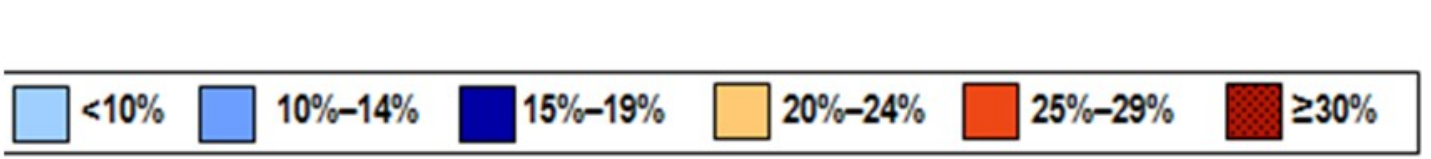
Source: Behavioral Risk Factor Surveillance System, CDC

2000

2009



(*BMI ≥30, or ~ 30 lbs. overweight for 5' 4" person)



# Measuring the State of Your Body So You Can "Tune" Your Body to Have a Healthier Longer Life

## I Arrived from 20 Years in the Midwest in 2000 and Decided to Move Against the Trend

Age 52







Age 62

HEALTH IT, PEOPLE, WIRELESS

## How Internet Pioneer Larry Smarr Lost 20 Pounds by Becoming a "Quantified Self"

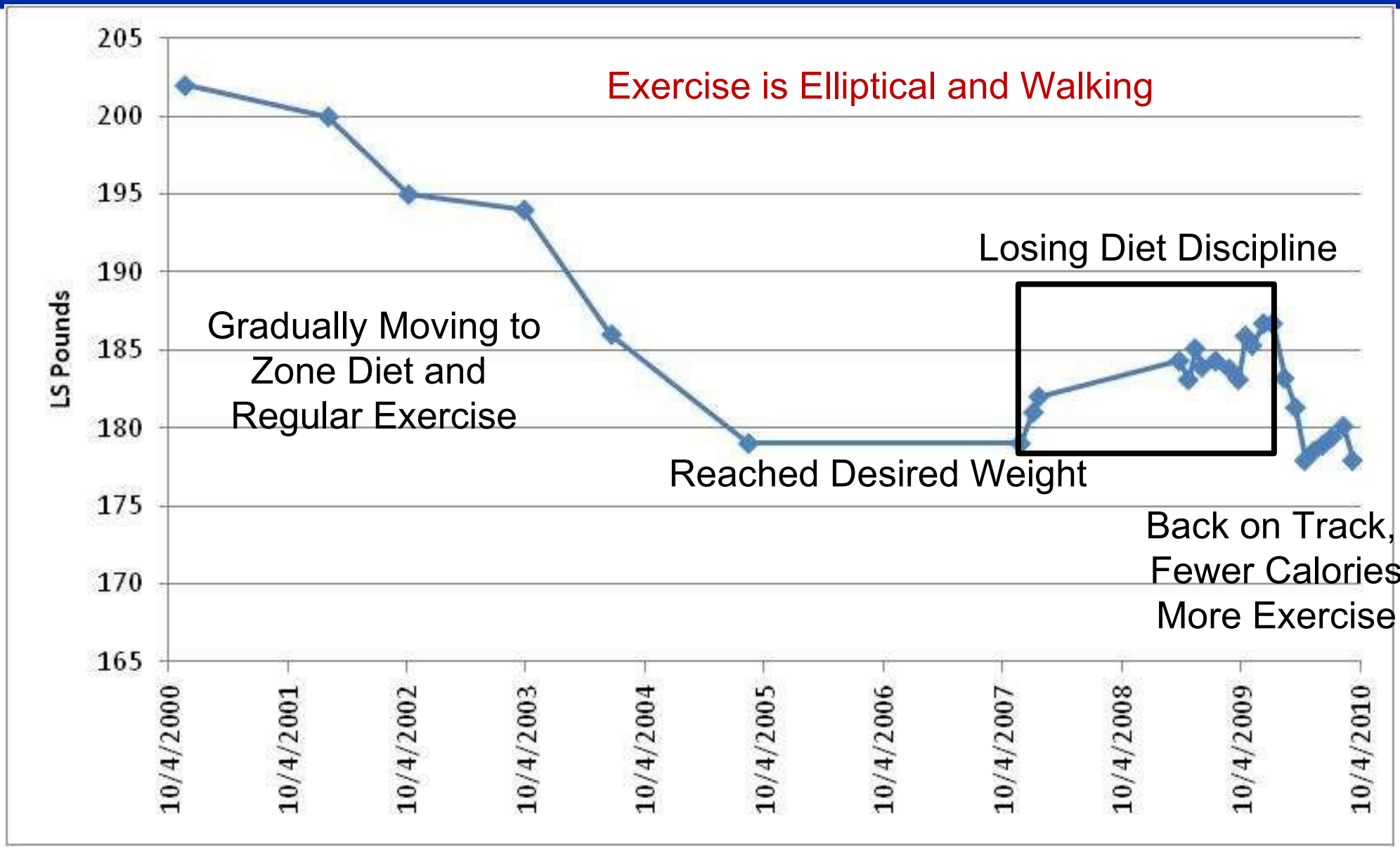
Luke Timmerman 5/12/10

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www.xconomy.com/san-diego/2010/05/12/how-internet-pioneer-larry-smarr-lost-20-pounds-by-becoming-a-quantified-self/

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# Goal: Lose Weight by Changing What &How Much I Ate, While Increasing Aerobic Exercise

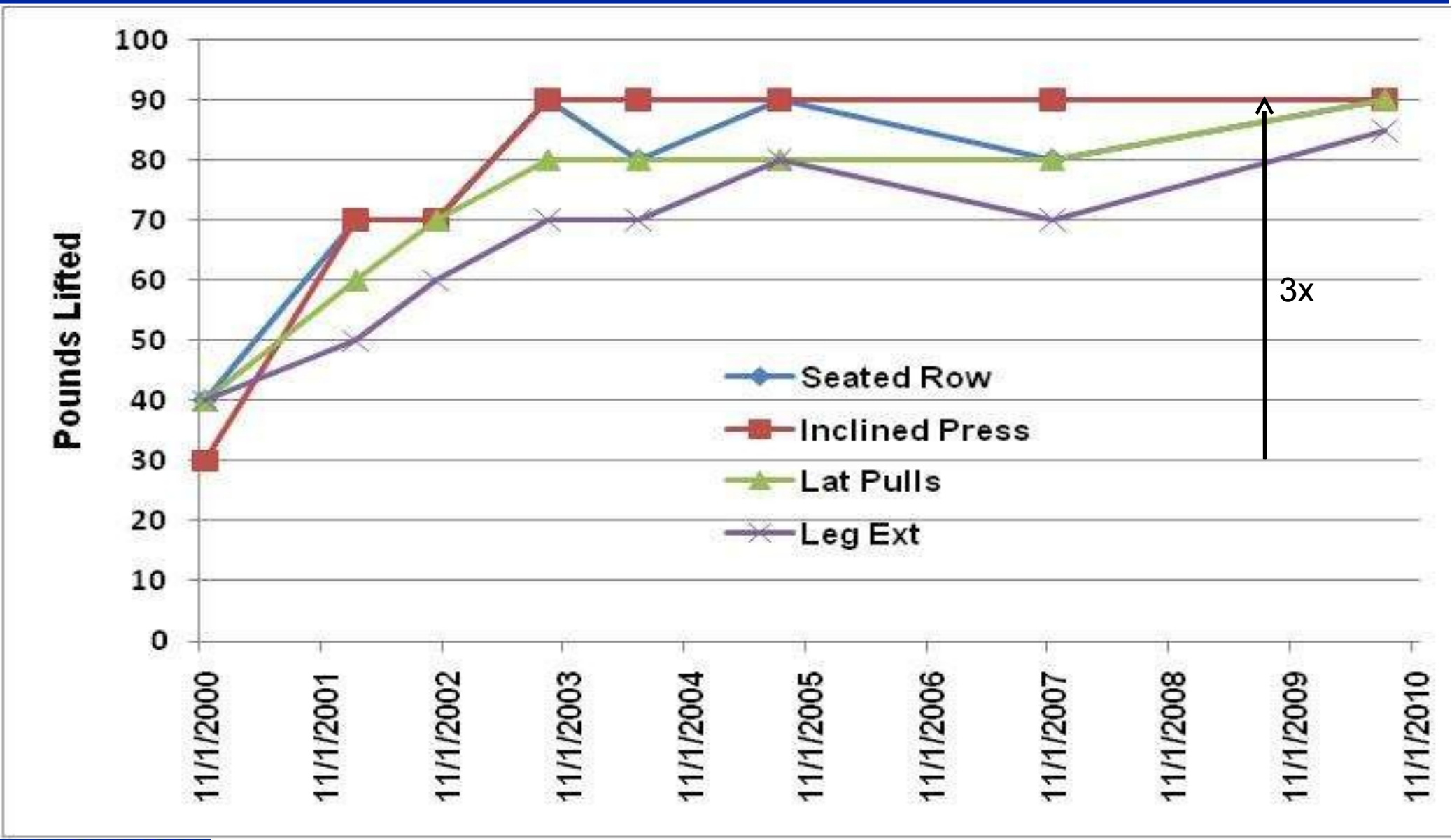



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Blood Pressure 134/73 Pulse 55
Resting Pulse Lowered to 45

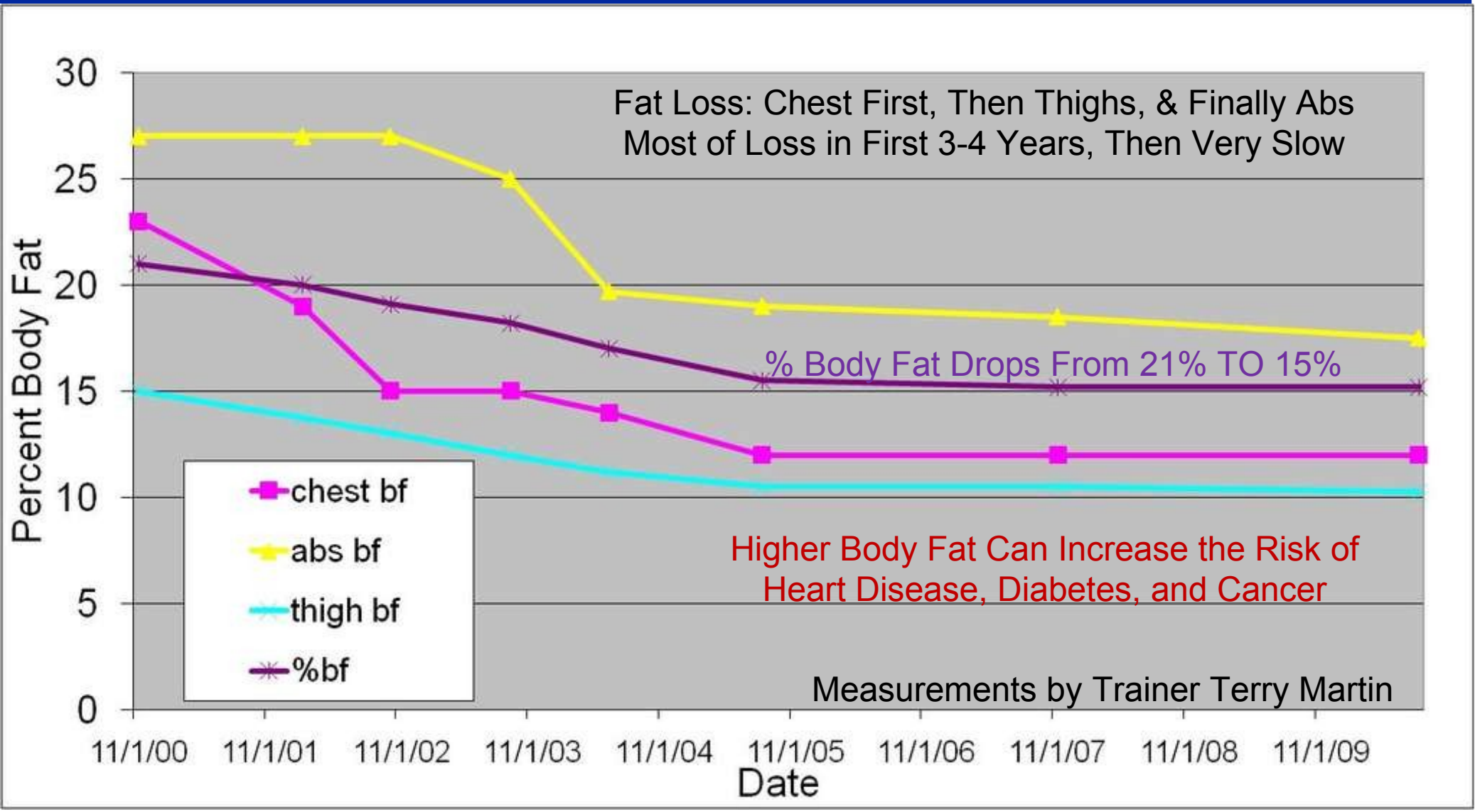
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# Goal: Use Strength Training to Raise My Rest Metabolic Rate




Source: Terry Martin, LS Trainer

# Goal: Reduce My Body Fat Through Nutrition and Exercise



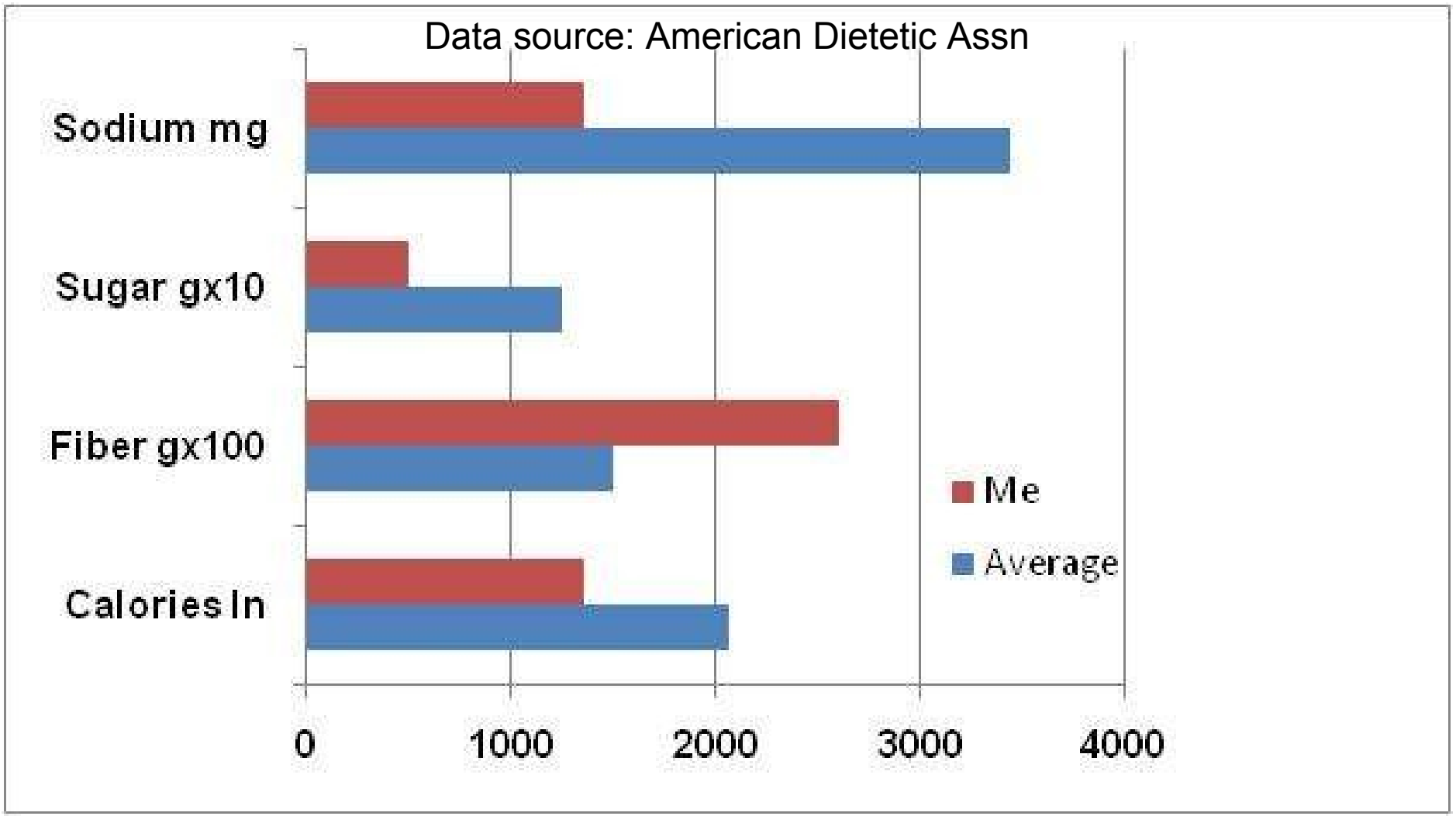

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I Lost More Than 1/3 of My Original Body Fat

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# Goals: Reduce Calories, Sugar, and Sodium Intake, While Increasing Fiber

Also, Average American Drinks 526 12-oz Sodas per Year--Me Zero




Me Compared to Average American Male Over 60

# Goal: Quantify Your Food Intake So You Can "Tune" Your Glucose/Insulin System and Lower Inflammation

Computed Average Over 12 Days When at Home for Maximum Accuracy
Measure All Food and Drink Components,
Then Use USDA Lookup to Compute Each Item

| calories | fat | carb | protein | | fiber | sugar | sodium |
|---|---|---|---|---|---|---|---|
| kcal | g | g | g | | g | g | mg |
| 1441 | 46 | 122 | 80 | 0 | 26 | 53 | 1358 |

Still Need to Lower Sugar &
Increase Protein and Decrease Fat by 15%

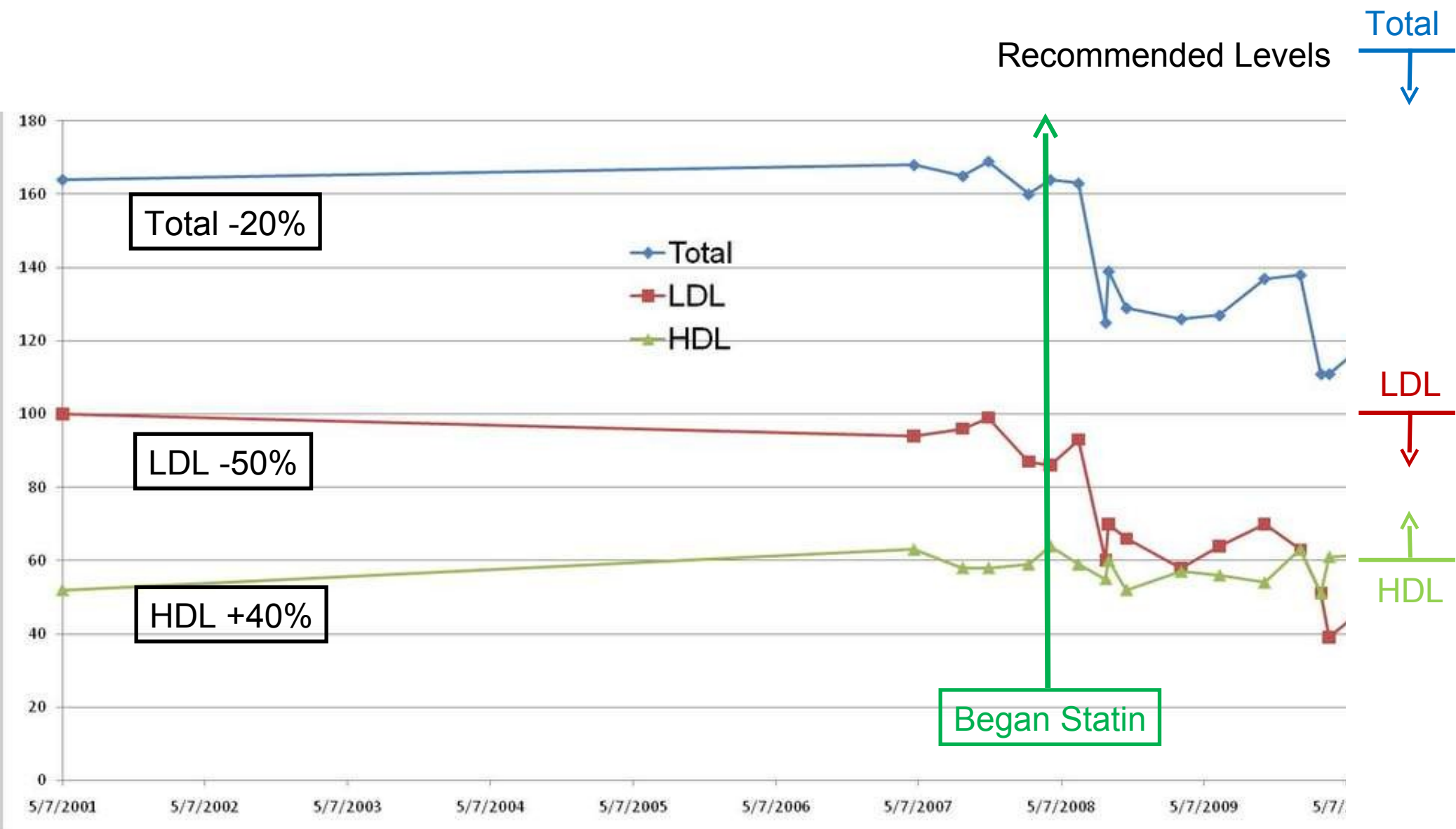
- **Quality of Food**
  - **All Organic and Mostly Locally Grown**
  - **Carbs are Low Glycemic Index**
    - **No Added Sugar or Refined Flour – Mostly Fruits and Vegetables**
  - **Proteins are Lean**
    - **Meat is Grass Fed – No Corn or Antibiotics**
    - **Fish is Wild, Often Locally Caught**
  - **Fats are Omega-3 Rich**
    - **Supplemented by 7g Daily Pharmaceutically Purified Fish Oil Pills**



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# Goal: Change Your Cholesterol Levels to Lower LDL, Raise HDL, While Lowering Total




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Raising “Good” HDL Seems Most Difficult

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# Goal: Lower Triglycerides and Cholesterol Ratios to Reduce Future Risk of Diabetes and Heart Disease

- **TG**
  - **High Risk 200-500**
  - **Best <150**
  - **My TG ~35**
- **TG/HDL**
  - **Ratio>4 Are Pre-Diabetic or Have Type 2 Diabetes**
  - **Average American Has a Ratio of ~3.3**
  - **My Ratio 0.5**

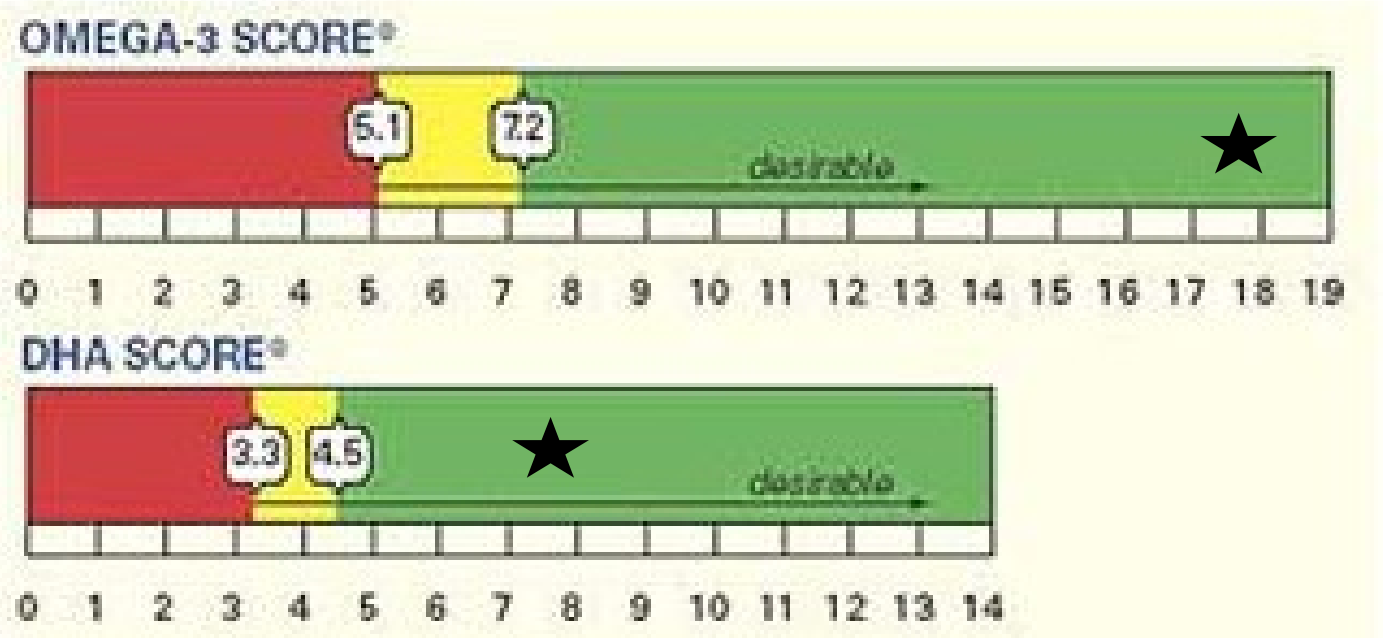
"The Ratio of Triglycerides to HDL Cholesterol (TG/HDL-C) is the Single Most Powerful Lipid Predictor of Extensive Coronary Disease."
[Clinics 2008; v.64: 427-432]

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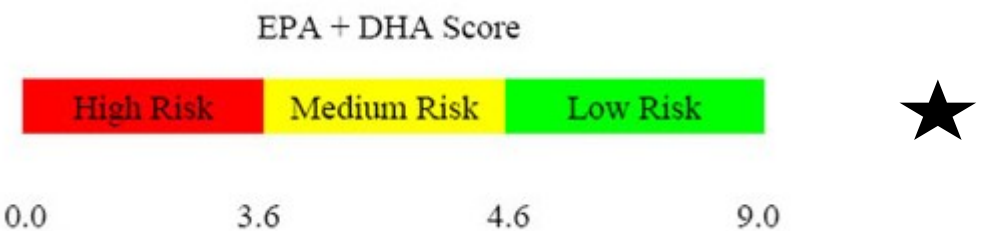
# Goal: Improve My Omega-3 Scores To Protect Against Future Heart Disease

Graphics from www.anne-marie.ca/ratiokits/

If your Omega-3 Score is at least 7.2 and your DHA Score is at least 4.5, you are 32% less likely to develop heart disease



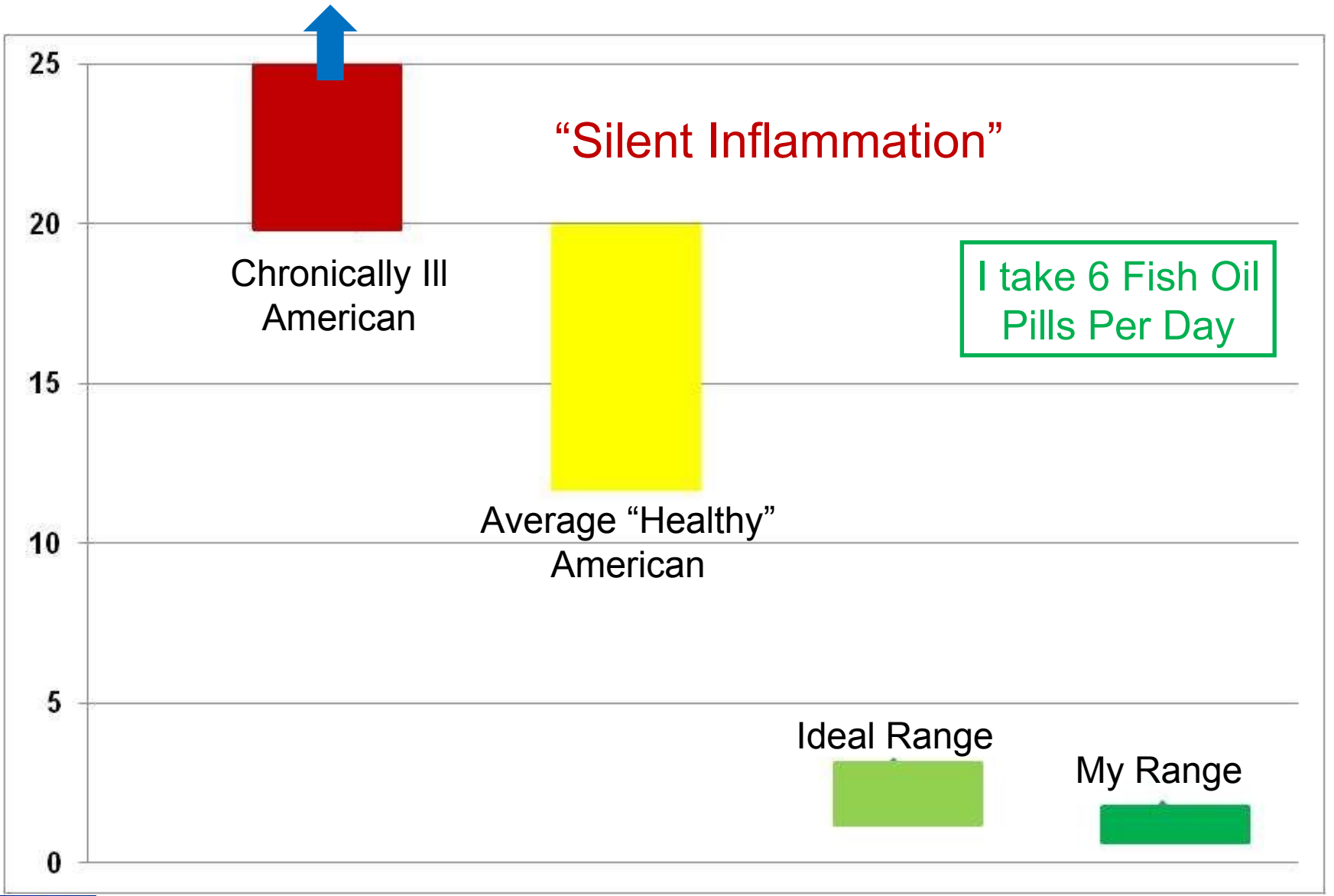

If your EPA+DHA Score is at least 4.6, you are 70% less likely of dying from a heart attack.




★ = My Values Tested by yourfuturehealth.com

Ref: Based on Lemaitre et al., n-3 Polyunsaturated fatty acids, fatal ischemic heart disease, and nonfatal myocardial infarction in older adults: the Cardiovascular Health Study. Am. J. Clin. Nutr. 77:319-325 (2003).

# Goal: Lower Ratio of Arachidonic Acid to EPA to Reduce Pro-Inflammatory Potential of Your Cells

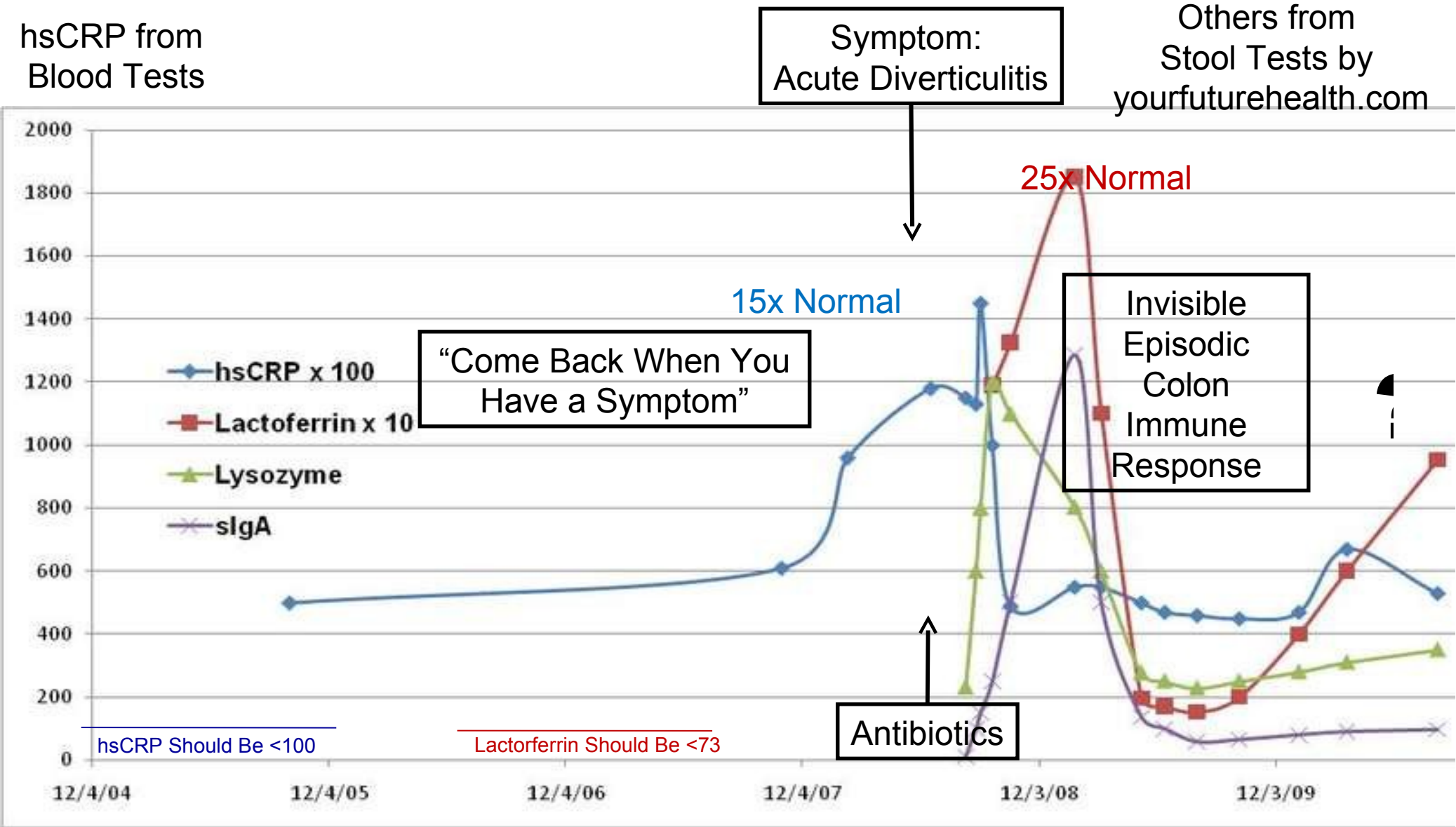



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Range Source: Barry Sears
My Tests by www.yourfuturehealth.com

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# Goal: Quantitatively Monitor the State of Your Inflammation and Immune System




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Future Challenge: Danger of Persistent hsCRP Inflammation and Destabilized Microbiome

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# Blood Tests I Do Quarterly to Annually In Addition to hsCRP, Lipids, Minerals, & Omegas

- **Electrolytes**
  - Sodium, Potassium, Chlorine, $CO_2$
- **Blood Sugar Cycle**
  - Glucose, Insulin, A1C Hemoglobin
- **Bones**
  - Alkaline Phosphatase
- **Kidneys**
  - Bun, Creatinine, Uric Acid
- **Protein**
  - Total Protein, Albumin, Globulin
- **Liver**
  - GGTP, SGOT, SGPT, LDH, Total and Direct Bilirubin
- **Thyroid**
  - T3 Uptake, T4, Free Thyroxine Index, FT4, 2nd Gen TSH
- **Heart**
  - Homocysteine
- **Blood Cells**
  - Complete Blood Cell Count
  - Red Blood Cell Subtypes
  - White Blood Cell Subtypes
- **Cancer Screen**
  - CEA, Total PSA, % Free PSA
  - CA-19-9
- **Vitamins & Antioxidant Screen**
  - Vit D, E; Selenium, ALA, coQ10, Glutathione, Total Antioxidant Fn.
- **Others**
  - Ferritin
  - Progesterone
  - Testosterone, Total and Free
  - FSH
  - Estradiol

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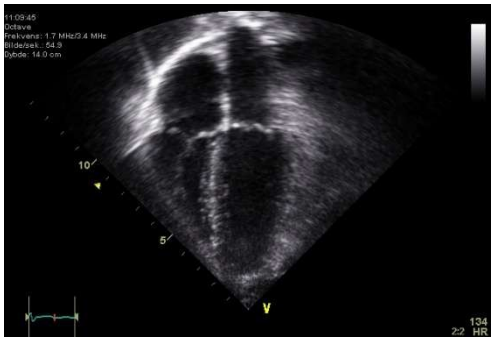


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# Goal: Determine the Structural State of Each Internal Organ and Major Body Subsystems




Carotid Ultrasound Imaging
Plaque Thickness



Stress Test with Echocariogram
Heart Fitness
Structural Weakness

Physical Colonoscopy
Detect Polyps
Colon Disease



64 Slice Heart CT Scan
Plaque Sites
Valve Anomalies





3D Full Body Scan
mm Accuracy
Small Tumors
Organ Damage
Plaque Sites
Virtual Colonoscopy



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# Goal: Measure Your Individual Genetic Predispositions to Future Health Risks

Navigenics®

| 0 - 1% | >1 - 10% | >10 - 25% | >25 - 50% | >50 - 100% |
|---|---|---|---|---|
| Graves' disease<br>You: 0.93%<br>Avg: 0.55% | Lung cancer<br>You: 8%<br>Avg: 8% | Prostate cancer<br>You: 17%<br>Avg: 17% | Osteoarthritis<br>You: 44%<br>Avg: 40% | You have no results in this range |
| Glaucoma<br>You: 0.78%<br>Avg: 1.1% | Colon cancer<br>You: 6%<br>Avg: 6% | Diabetes, type 2<br>You: 12%<br>Avg: 25% | Heart attack<br>You: 38%<br>Avg: 42% | |
| Macular degeneration<br>You: 0.74%<br>Avg: 3.1% | Psoriasis<br>You: 6%<br>Avg: 4.0% | | Obesity<br>You: 32%<br>Avg: 34% | |

You: 1.7%
Avg. 3.0%

You: 22.4%
Avg. 11.4%

You: 14.7%
Avg. 23.7%

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# However, SNP Indications of Adverse Drug Side Effects May Be Quite Useful

Navigenics

23andMe

Side Effects

| Drug | Your Risk | Side Effect | |
|---|---|---|---|
| Abacavir (Ziagen®)<br>Used to treat HIV infection | High Risk | Severe allergic reaction, including fever, rash, and nausea | Increased Risk |
| Floxacillin (Floxapen®)<br>Used to treat infections | High Risk | Severe liver toxicity, leading to liver damage | Greatly Increased Risk |

I Would Definitely Not Take Either!

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# The Cost for Full Human Genome Sequencing is Exponentially Decreasing

Forbes

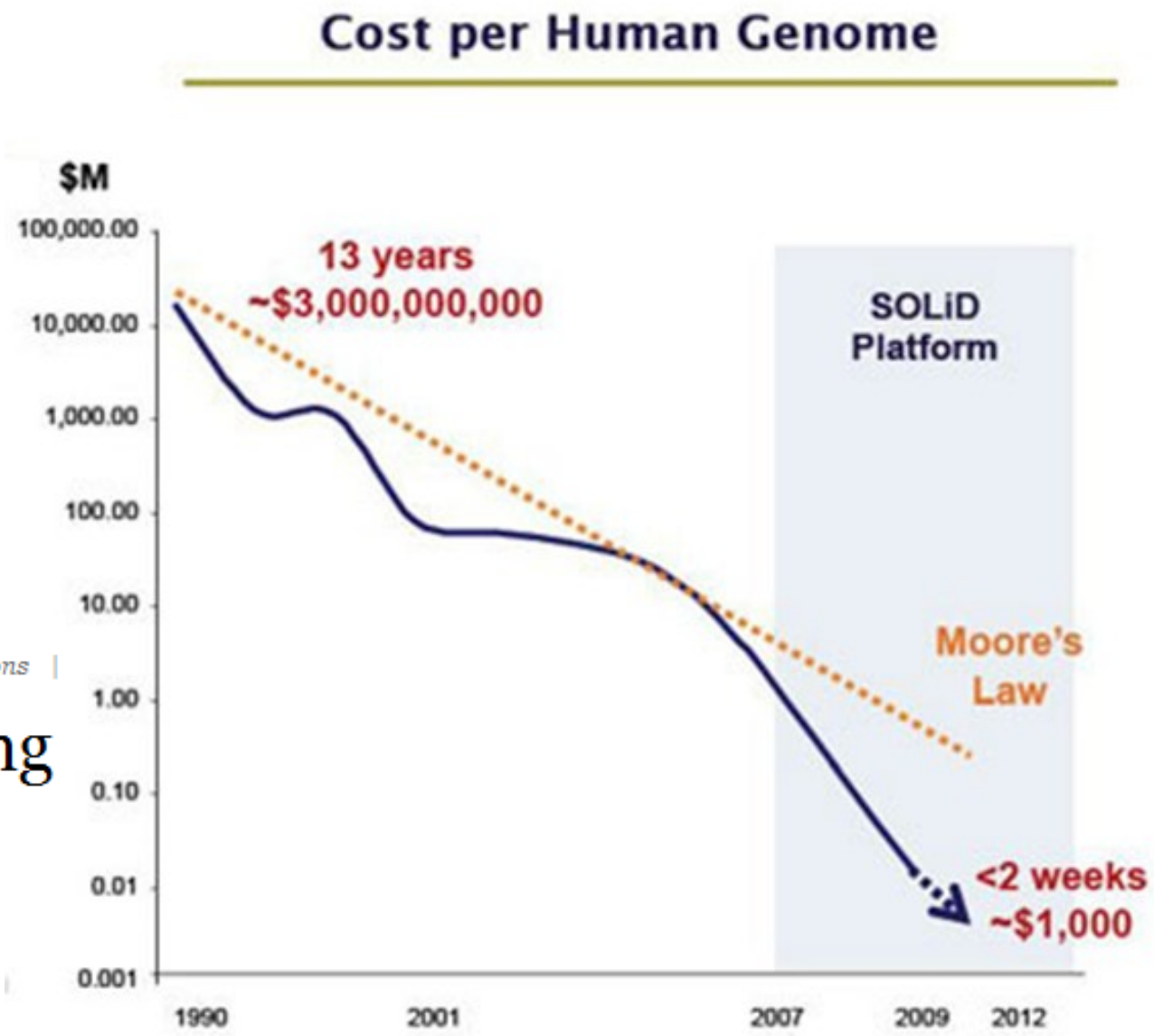



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## Your Genome Is Coming

*posted by* **MATTHEW HERPER**




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http://blogs.forbes.com/sciencebiz/2010/06/03/your-genome-is-coming/

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# Should You Keep Your Health Data Private or Share to Gain the Most Knowledge?

U.S. Department of Health & Human Services
HHS.gov *Improving the health, safety, and well-being of America*

**The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy and Security Rules**

trusera

Trusera is an online health network platform where you can find and share real-world experiences. Share your story and experience the Power of Been There™.

patientslikeme®

**Share Your Health Profile**

By openly sharing your health profile with the community, you can learn more about yourself while helping other patients like you.

Social Networks and Health NEXT

Medicine 2.0 #10 – Medicine and the Second Generation of Internet-based Services

by Walter Jessen

Quantified Self
tools for knowing your own body and mind

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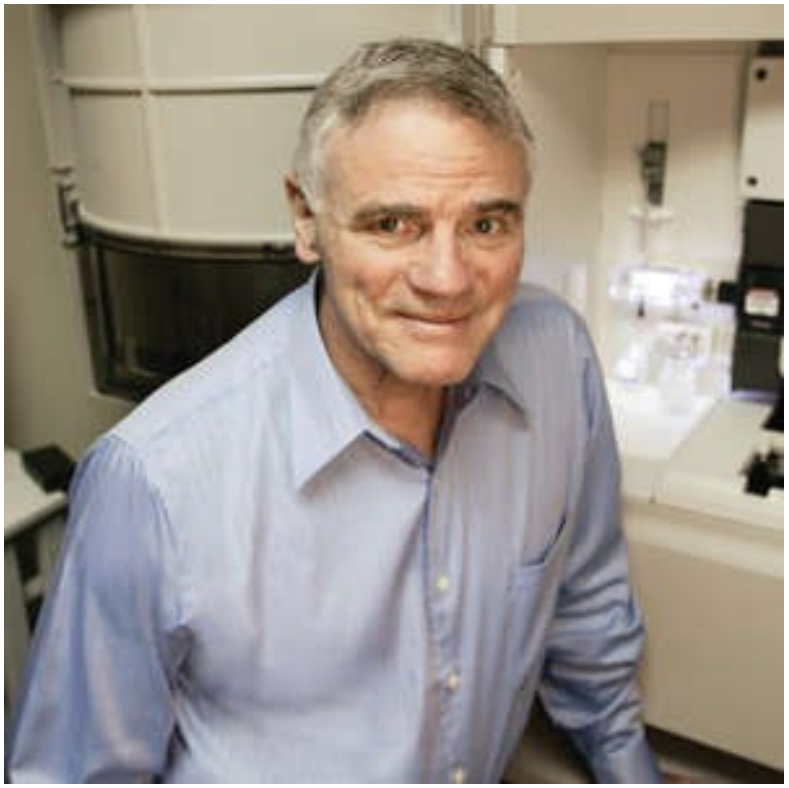
# Where I Believe We are Headed: Predictive, Personalized, Preventive, & Participatory Medicine

Newsweek

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

Leroy Hood
NEWSWEEK

From the magazine issue dated Jul 13, 2009



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

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# Organ-Specific Blood Proteins Will Make the Blood a Window into Health and Disease

Source: Lee Hood, ISB

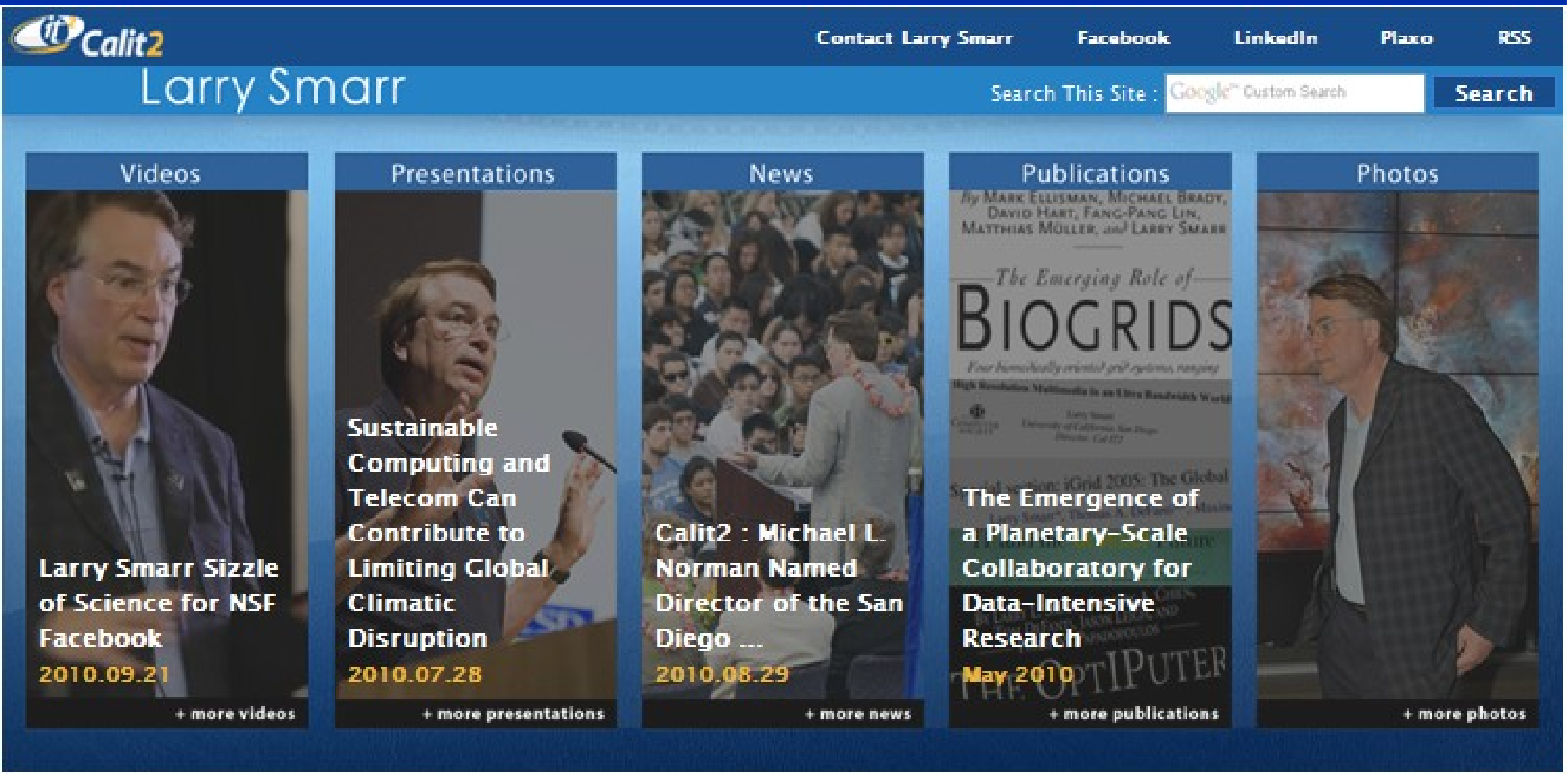
- **Perhaps 50 Major Organs or Cell Types**
  - **Each Secreting Protein Blood Molecular Fingerprint**
- **The Levels of Each Protein in a Particular Blood Fingerprint Will Report the Status of that Organ**
  - **Probably Need Perhaps 50 Organ-Specific Proteins Per Organ**
- **Will Need to Quantify 2500 Blood Proteins from a Drop of Blood**
  - **Use Microfluidic/Nanotechnology Approaches**

Key Point: Changes in The Levels Of Organ-Specific Markers Can Assess Virtually All Disease Challenges for a Particular Organ

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# You Can Download This Presentation at lsmarr.calit2.net




## ABOUT LARRY SMARR

Larry Smarr is the founding Director of the California Institute for Telecommunications and Information Technology (Calit2), a UC San Diego/UC Irvine

## WHAT I'M READING

**Complete List of Larry's Recommendations**

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