Quantifying the State of Your Body -- So You Can Improve It

Invited Talk
Personalized Life Extension Conference
San Francisco, CA
October 9, 2010

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
Follow me on Twitter: lsmarr

UCSD
UCIrvine

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

UCSD
UCIrvine

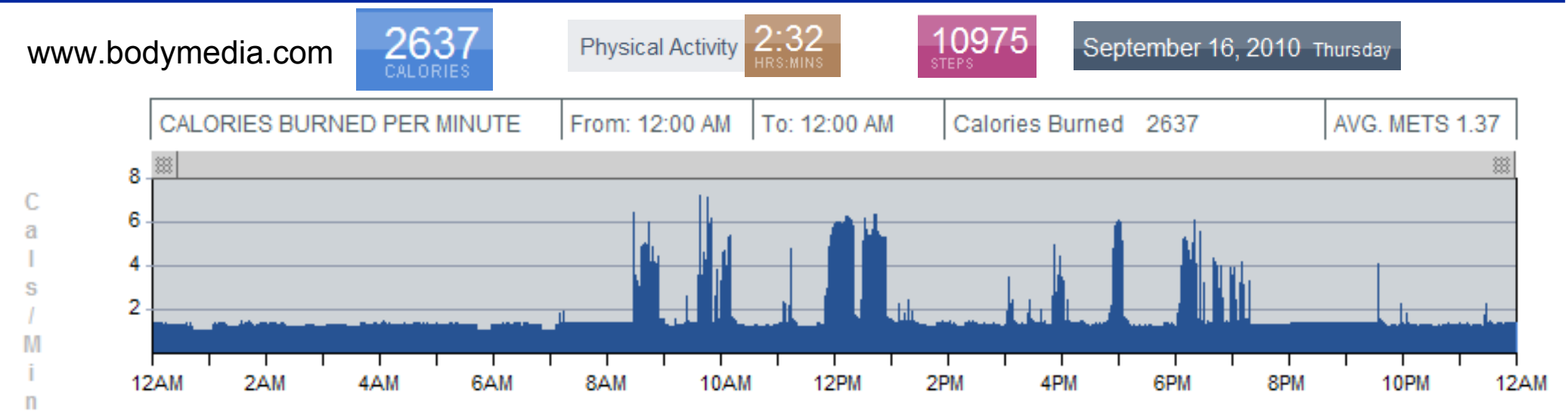
The Content of This Slide from 2001 Larry Smarr
Calit2 Talk on Digitally Enabled Genomic Medicine

it²

Nine Years Later I Am Recording My Metabolic Self

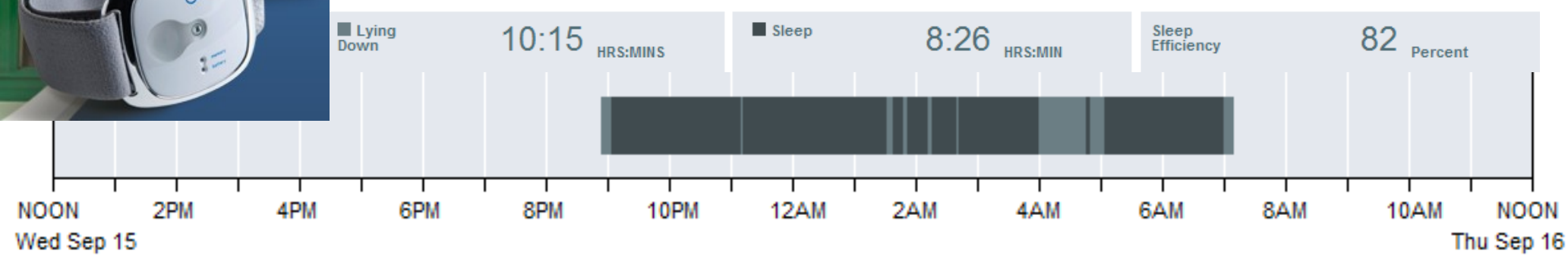
BODYMEDIA® Know your Body. Change your life

www.bodymedia.com





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



UCSD UCIrvine

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

it²

There Are a Rapidly Growing Set of Tests and Strategies for Improving Health and Living Longer

I am Actively Engaged in All These

Personalized
Life Extension Conference

October 9-10, 2010
San Francisco Airport Marriott

Strategies and Tactics for a Long Healthy Life



- ✓ Supplements
- ✓ DNA Testing
- ✓ Telomere Protection
- ✓ Blood Testing
- ✓ Finding a Life Extension Doctor
- ✓ Gadgets
- ✓ Inflammation
- ✓ Calorie Restriction & Intermittent Fasting
- ✓ Sleep
- ✓ Stress reduction
- ✓ Self-experimentation
- ✓ Exercise
- ✓ Enhancement & Brain Function
- ✓ Eating
- ✓ Standards of Information Quality
- ✓ Mood

READ MORE

UCSD
UCIrvine

it²

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

in 2000 I Arrived in San Diego After 20 Years in the Midwest and Began to Measure and Modify My Body

Age 52





Age 62

HEALTH IT, PEOPLE, WIRELESS

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

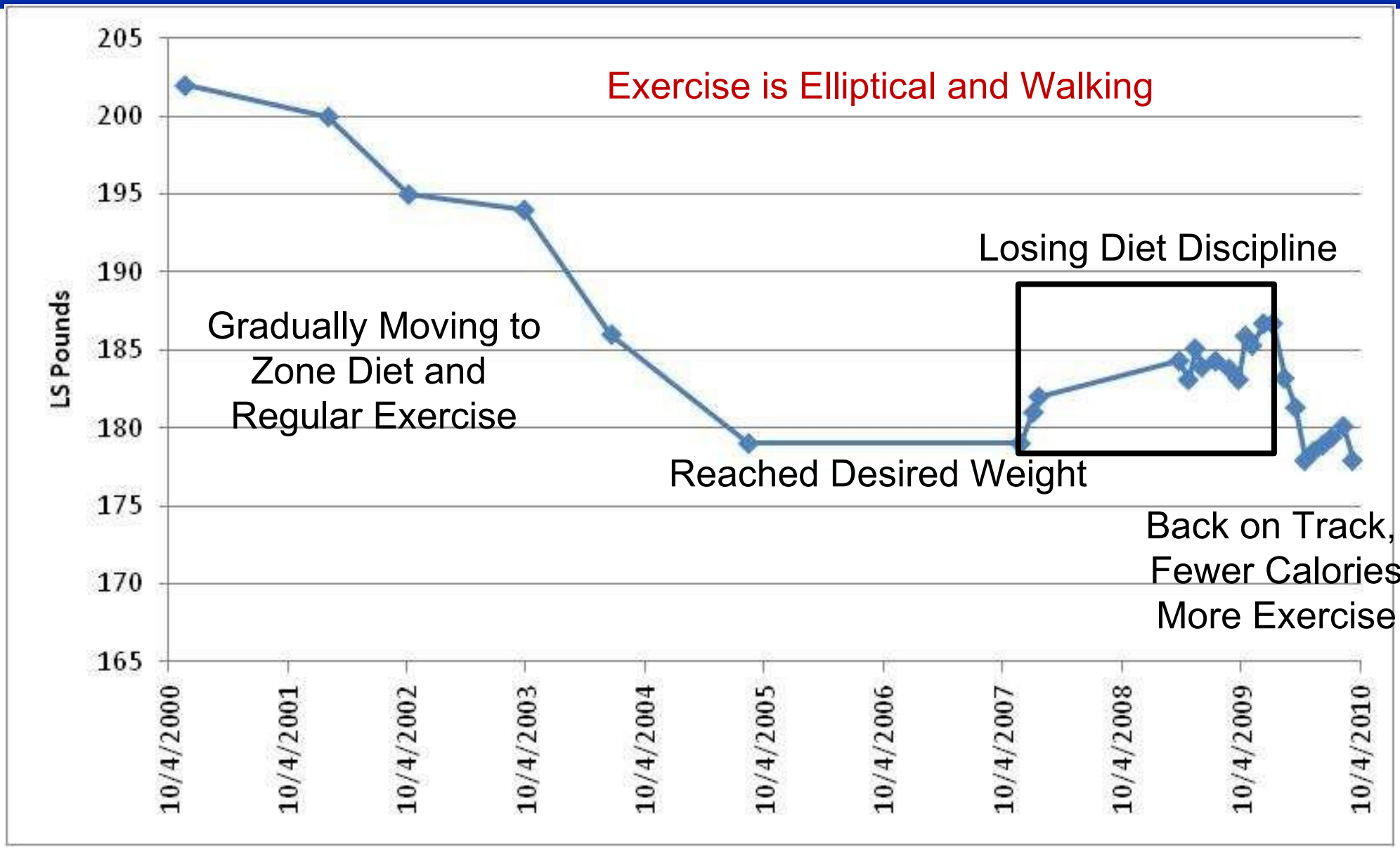
Luke Timmerman 5/12/10

UCSD
UCIrvine

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

it²

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

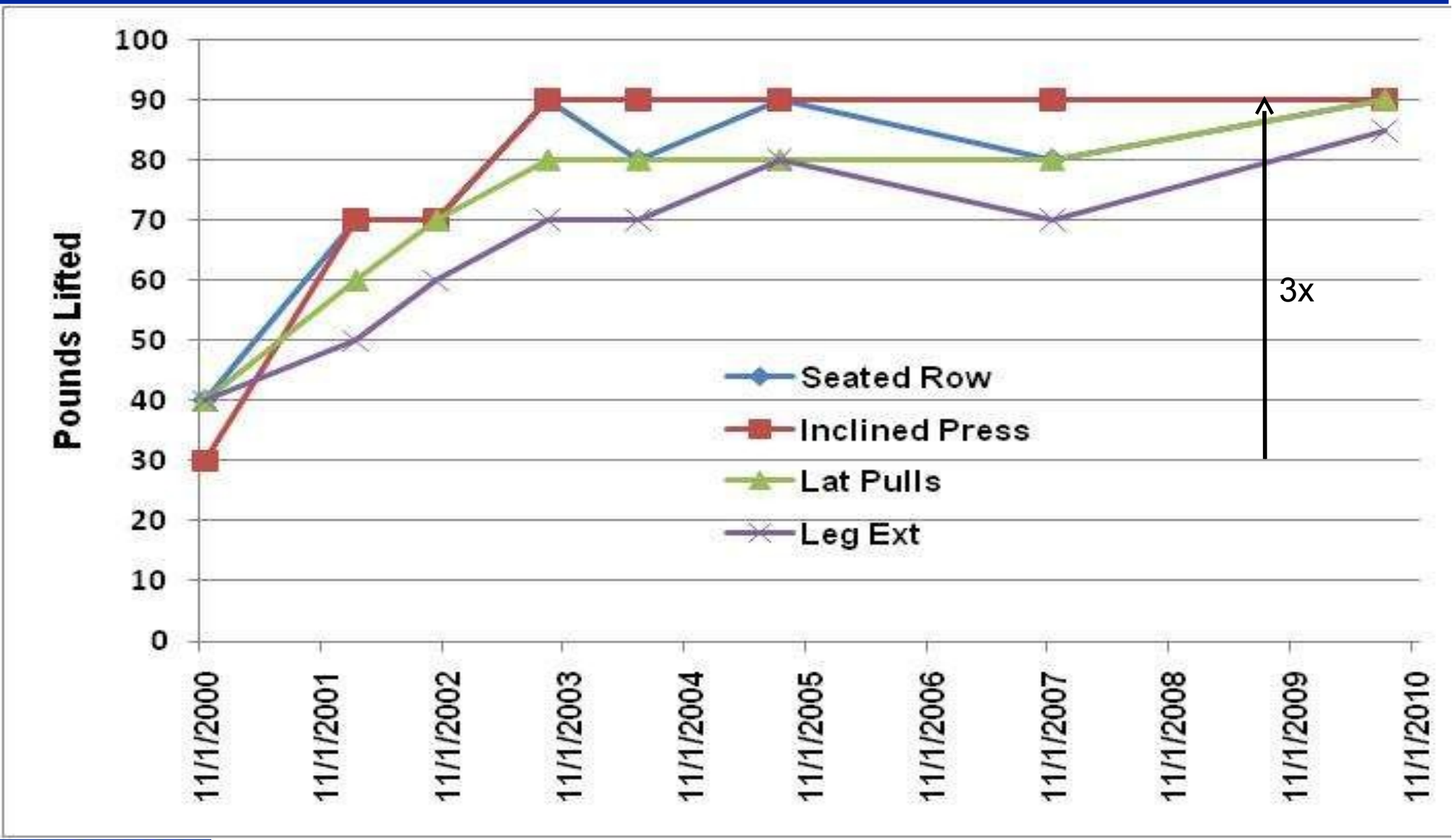


UCSD
UCIrvine

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

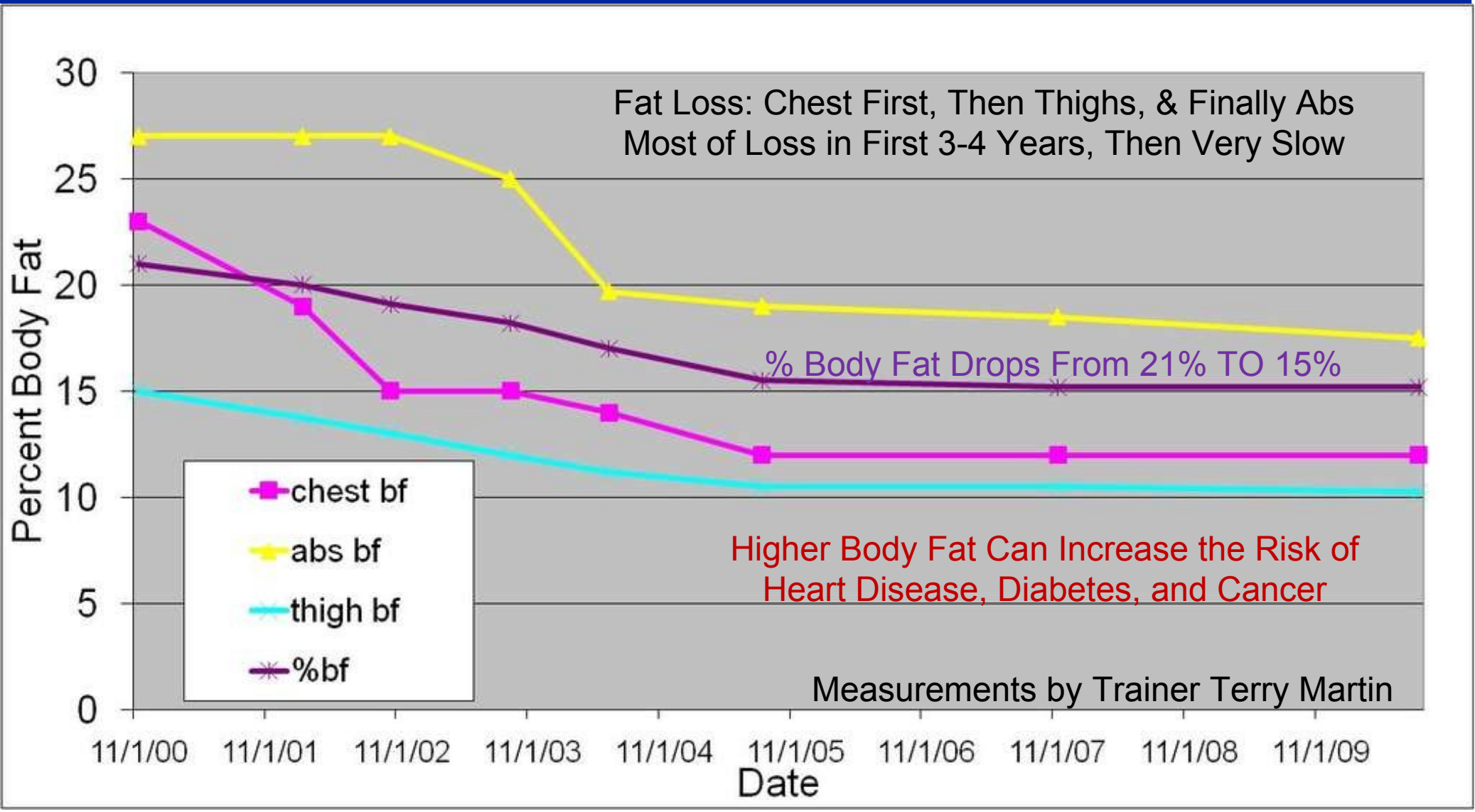
it²

Goal: Use Strength Training to Raise My Rest Metabolic Rate



Source: Terry Martin, LS Trainer

Goal: Reduce My Body Fat Through Nutrition and Exercise



UCSD
UCIrvine

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

it²

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%

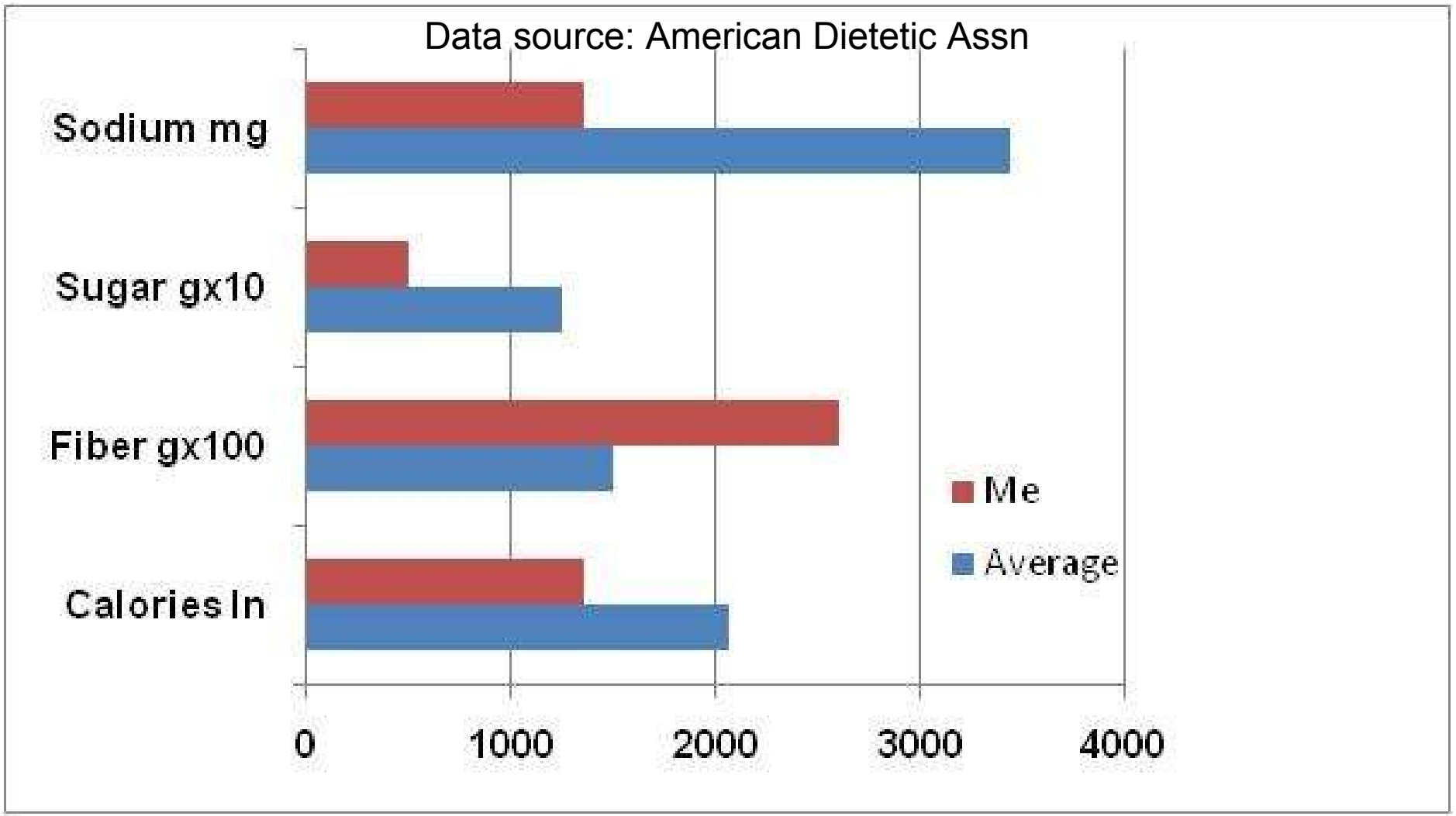
- **Quality of Food**
  - **All Organic and Mostly Locally Grown**
  - **Carbs are Low Glycemic Index**
    - **No Added Sugar or Refined Flour – Mostly Fruits and Vegetables**
  - **Proteins are Lean**
    - **Meat is Grass Fed – No Corn or Antibiotics**
    - **Fish is Wild, Often Locally Caught**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

UCSD
UCIrvine

it²

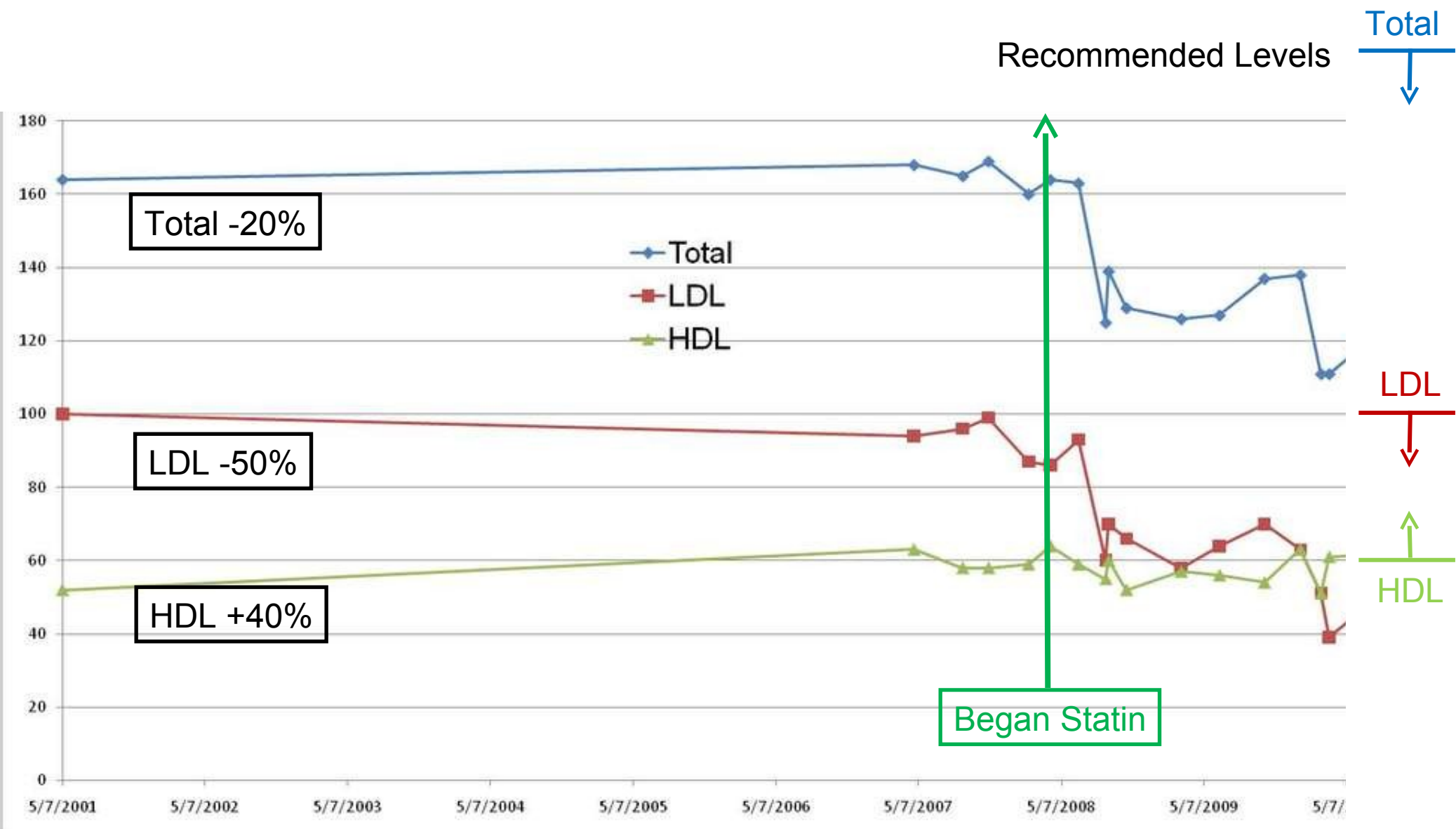
Goals: Reduce Calories, Sugar, and Sodium Intake, While Increasing Fiber

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



Me Compared to Average American Male Over 60

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

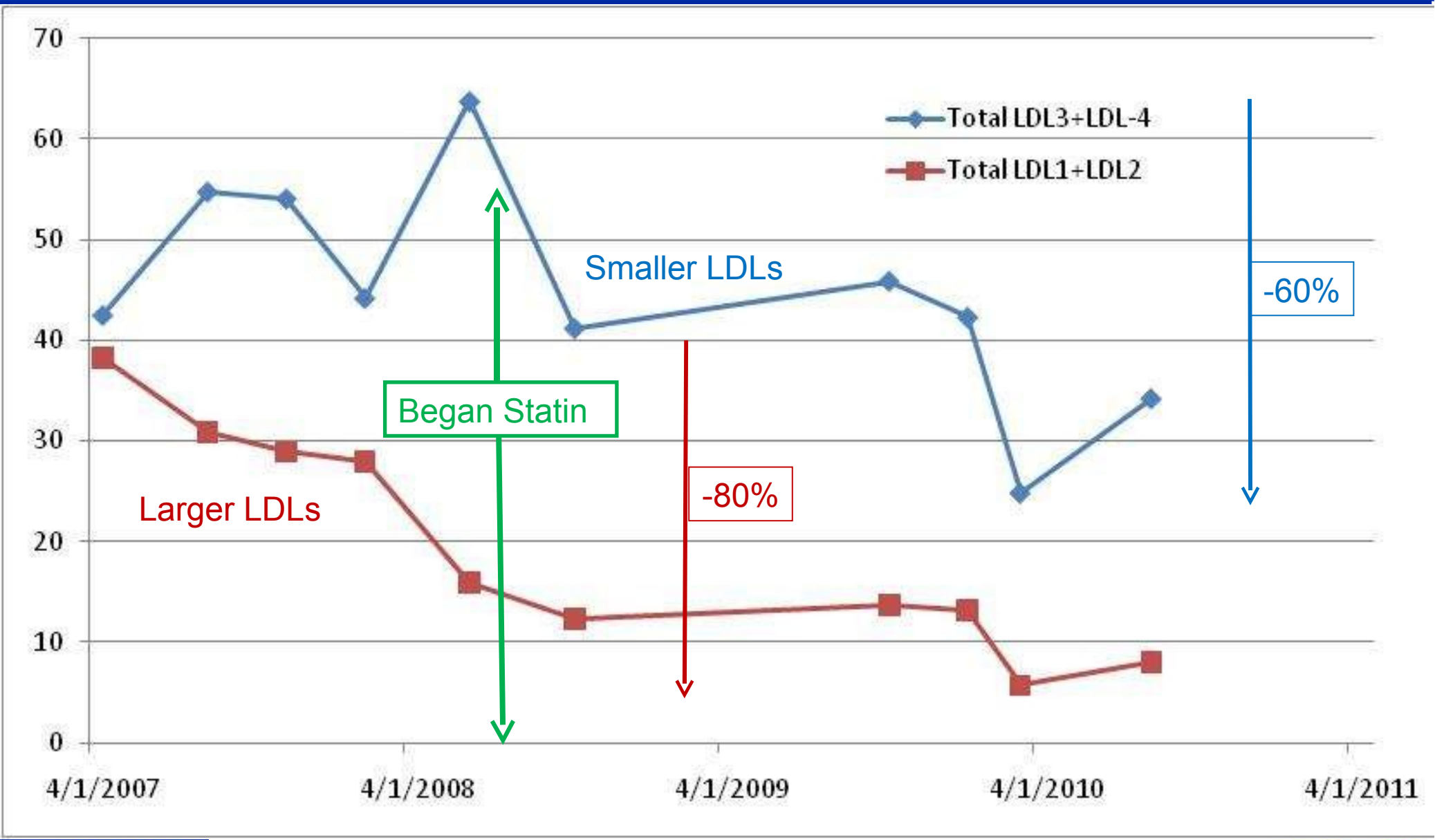


UCSD
UCIrvine

Raising “Good” HDL Seems Most Difficult

it²

Goal: Make Major Reductions in LDL Subfractions to Avoid Future Plaque Deposits



UCSD
UCIrvine

Data Source: Scripps Center for Integrative Medicine

it²

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**

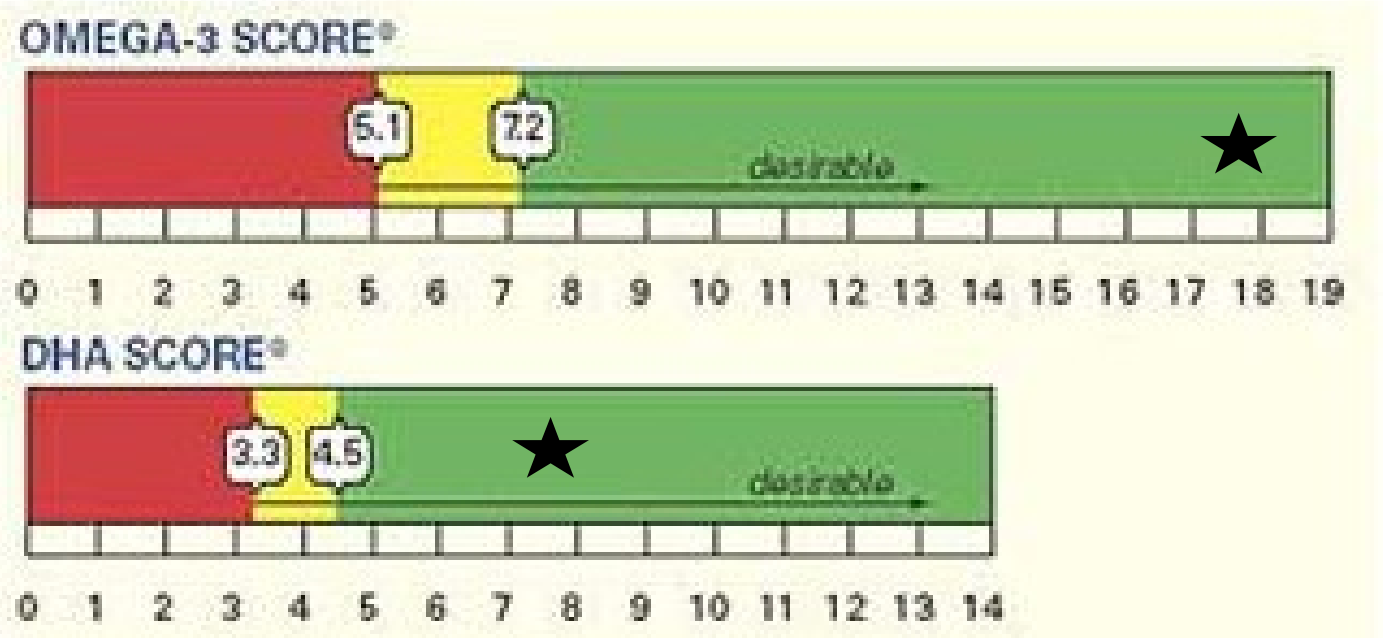
"The Ratio of Triglycerides to HDL Cholesterol (TG/HDL-C) is the Single Most Powerful Lipid Predictor of Extensive Coronary Disease."
[Clinics 2008; v.64: 427-432]

UCSD
UCIrvine

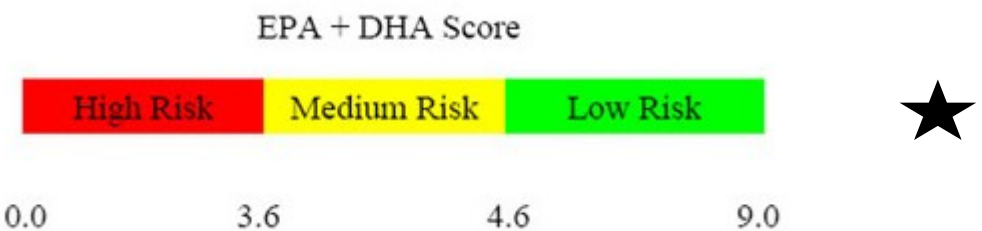
Goal: Improve My Omega-3 Scores To Protect Against Future Heart Disease

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



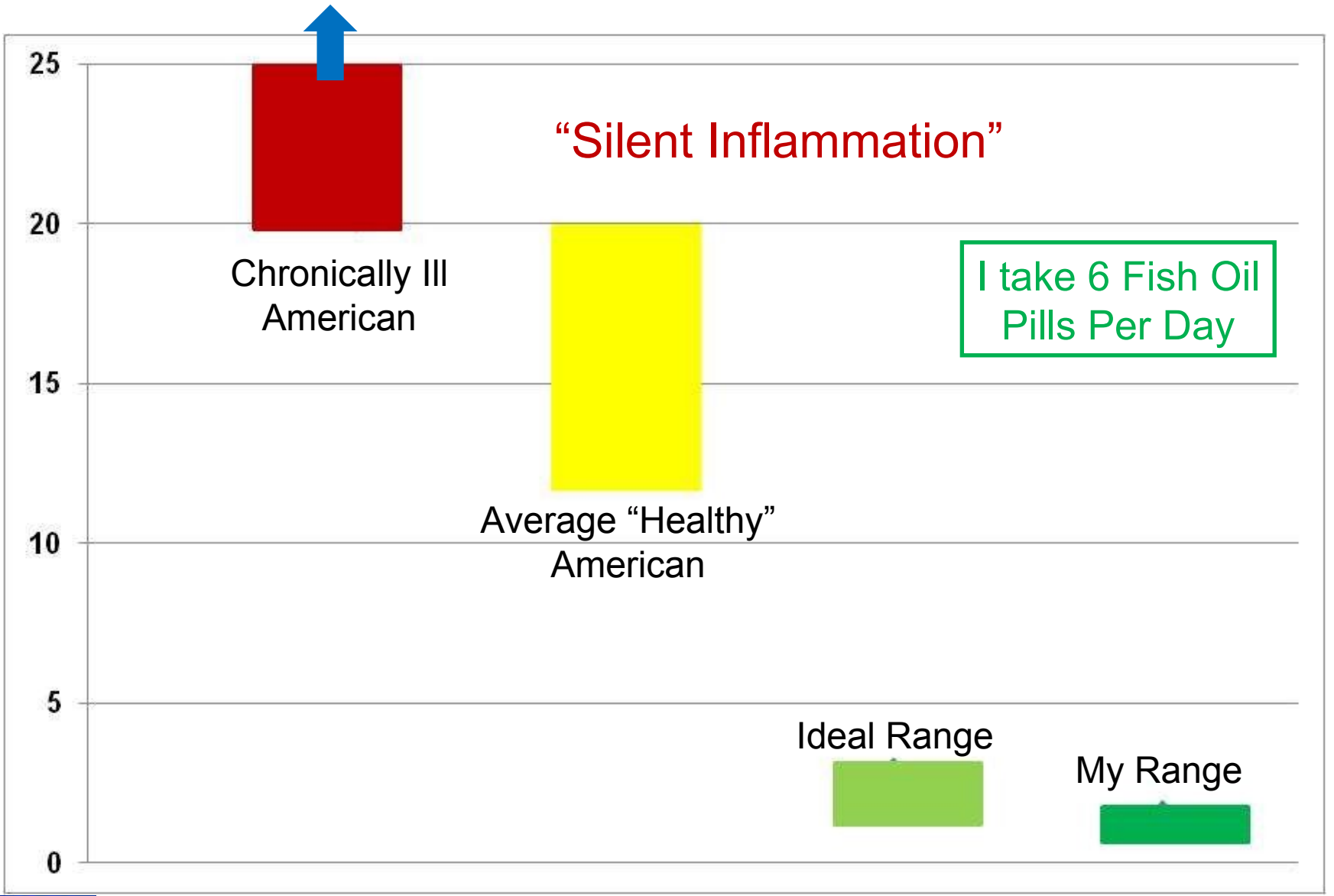
If your EPA+DHA Score is at least 4.6, you are 70% less likely of dying from a heart attack.



★ = 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

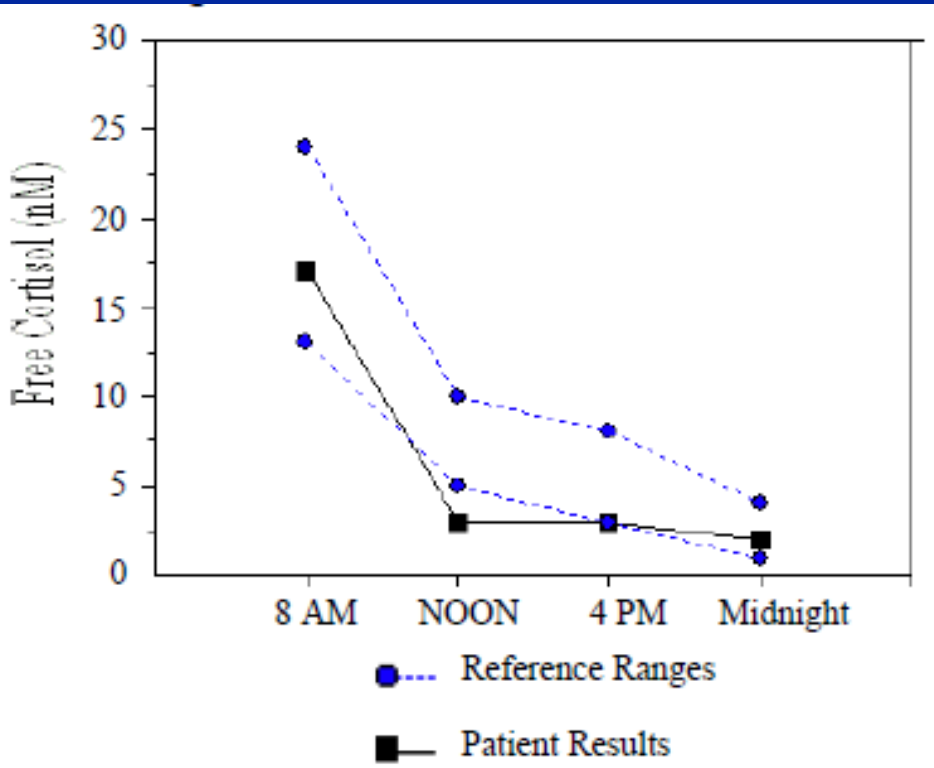


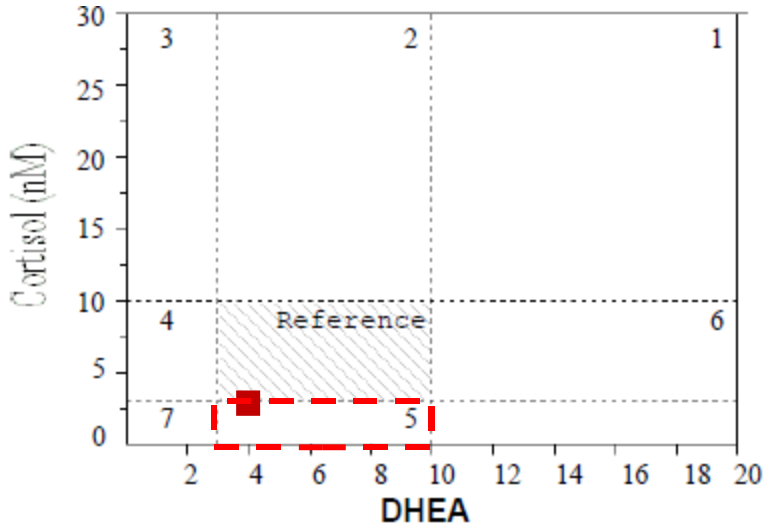
UCSD
UCIrvine

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

it²

Goal—Lower Stress and Cortisol Levels: Use Saliva Tests to Quantify





CORTISOL-DHEA CORRELATION SPECTRUM

1. Adapted to stress.
2. Adapted with DHEA slump.
3. Maladapted Phase I.
4. Maladapted Phase II.
5. **Non-adapted, Low Reserves.**
6. High DHEA.
7. Adrenal Fatigue.

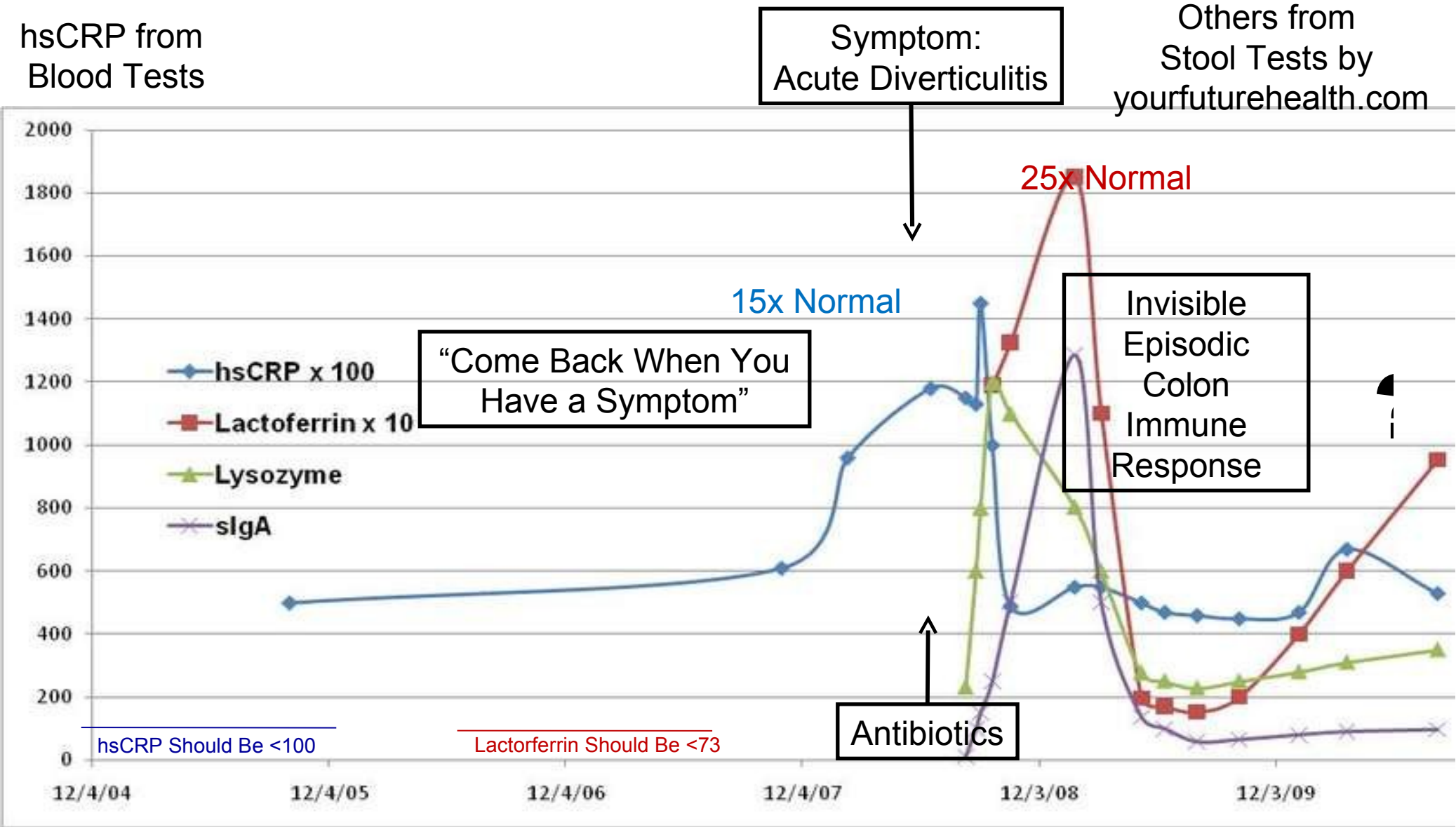
- **Surprising Result—Low Cortisol In Spite of My Stressful Life Style**
- **Hypothesis: Suboptimal Cortisol Output Reflects an Adrenal Decline or a Depleted Reserve Caused by Chronic and Protracted Exposure to Stressors**

UCSD UCIrvine

Adrenal Glands Produce Cortisol, DHEA, and Adrenaline Coupled to Cholesterol Cycle

it²

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



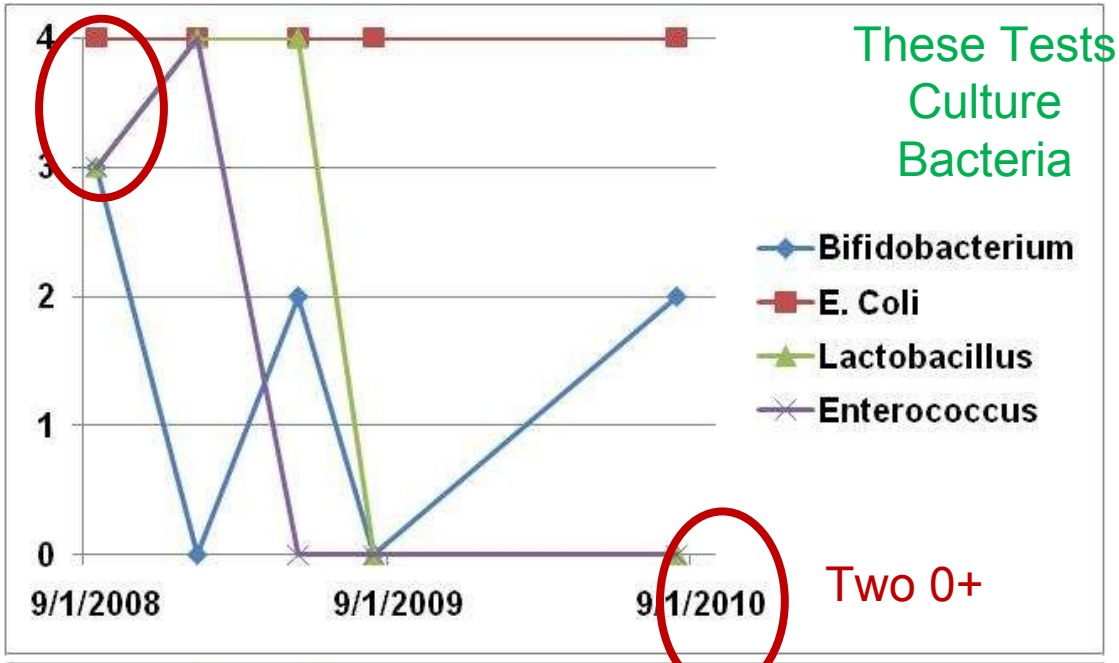
UCSD UCIrvine

Future Challenge: Danger of Persistent hsCRP Inflammation and Destabilized Microbiome

it²

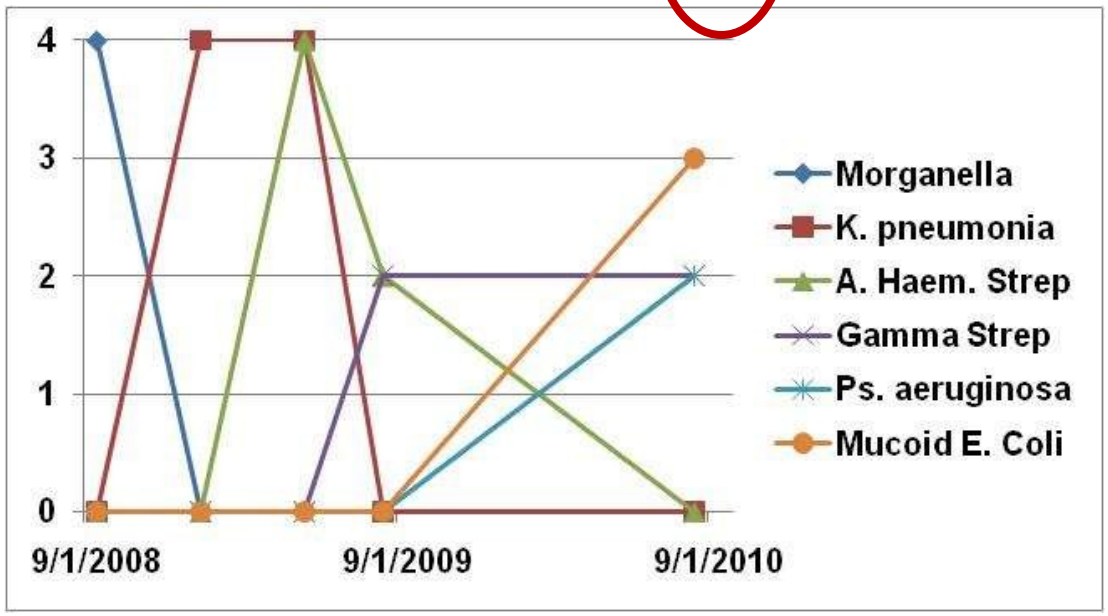
Goal: Monitor the Colon Microbiome- an Ecological Battle Between Beneficial and Harmful Bacteria

All 3+ or 4+



These Tests Culture Bacteria

Two 0+



TheTwo Years Following 10 Days of Antibiotics (Levaquin & Metronidaloze)

Bacterial Cells Are 90% of the Cells in Your Body!

Next Step Get DNA Microbe, Parasite, Yeast Test

Stool tests by www.yourfuturehealth.com

UCSD
UCIrvine

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

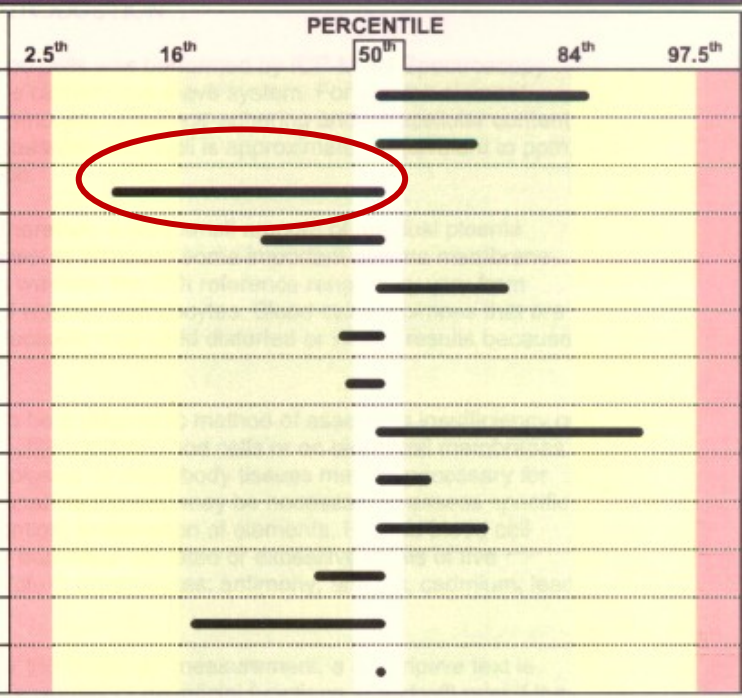
UCSD
UCIrvine

Values of Elements Inside of Blood Cells, May Not Agree with Blood Serum Levels

Elemental Abundance Inside Red Blood Cells

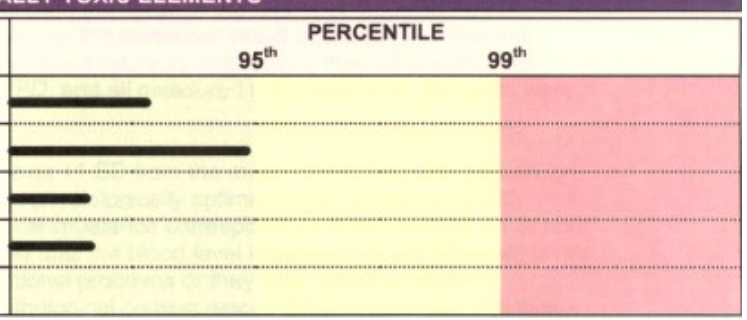
NUTRIENT ELEMENTS

ELEMENTS	RESULT µg/g	REFERENCE RANGE
Calcium	19	8- 25
Magnesium	50	39- 59
Potassium mEq/L	72	70- 90
Phosphorus	569	510- 700
Copper	0.66	0.52- 0.80
Zinc	10.8	8.6- 14.5
Iron	916	800- 1020
Manganese	0.025	0.008- 0.029
Chromium	0.0007	0.0003-0.0020
Selenium	0.30	0.19- 0.50
Boron	0.030	0.01- 0.110
Vanadium	0.0002	0.0001-0.0005
Molybdenum	0.0010	0.0006-0.0020



POTENTIALLY TOXIC ELEMENTS

TOXIC ELEMENTS	RESULT µg/g	REFERENCE RANGE
Arsenic	0.006	< 0.010
Cadmium	0.002	< 0.002
Lead	0.019	< 0.060
Mercury	0.004	< 0.010
Thallium	< 0.0001	< 0.0005



RBC Potassium is Low,
But Blood Serum
Potassium is High ??

Possible Explanation:

My High Blood Pressure Medicine Benicar, is an Angiotensin Receptor Blocker (ARB) which is *Potassium sparing*— can cause a build up of potassium in the blood

UCSD
UCIrvine

Beyond Food: Supplements and Prescriptions

- Omega Fatty Acids
  - EPA, DHA, GLA
- Vitamin/Mineral
  - Broad Spectrum
  - Extra
    - Zinc
    - Magnesium
    - Chromium
    - Vitamin B Complex
    - Vitamin B12, C, D, E
- CoQ10
- Lycopene
- Saw Palmetto

- Only Two Prescriptions
  - Benicar (Blood Pressure)
  - Crestor (Statin)
- Bacterial Supplements
  - Probiotics
    - 5Lac, Ortho Biotic
  - Kill Bad Bacteria
    - Monolaurin
    - Serrapeptase

UCSD UCIrvine

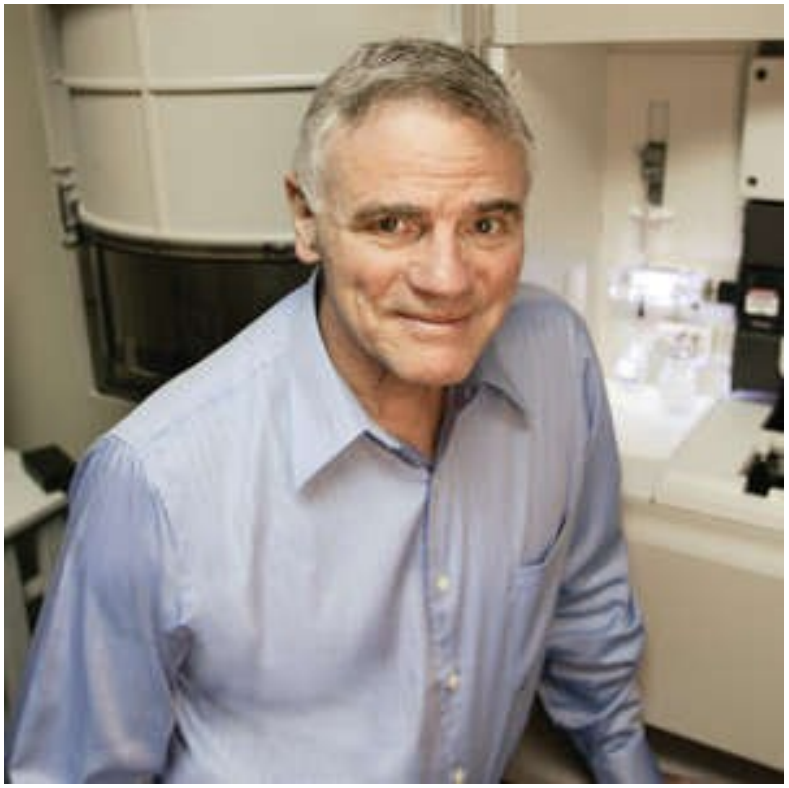
Where I Believe We are Headed: Predictive, Personalized, Preventive, & Participatory Medicine

Newsweek

A Doctor's Vision of the Future of Medicine

Leroy Hood
NEWSWEEK

From the magazine issue dated Jul 13, 2009



UCSD
UCIrvine

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

it²

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

Source: Lee Hood, ISB

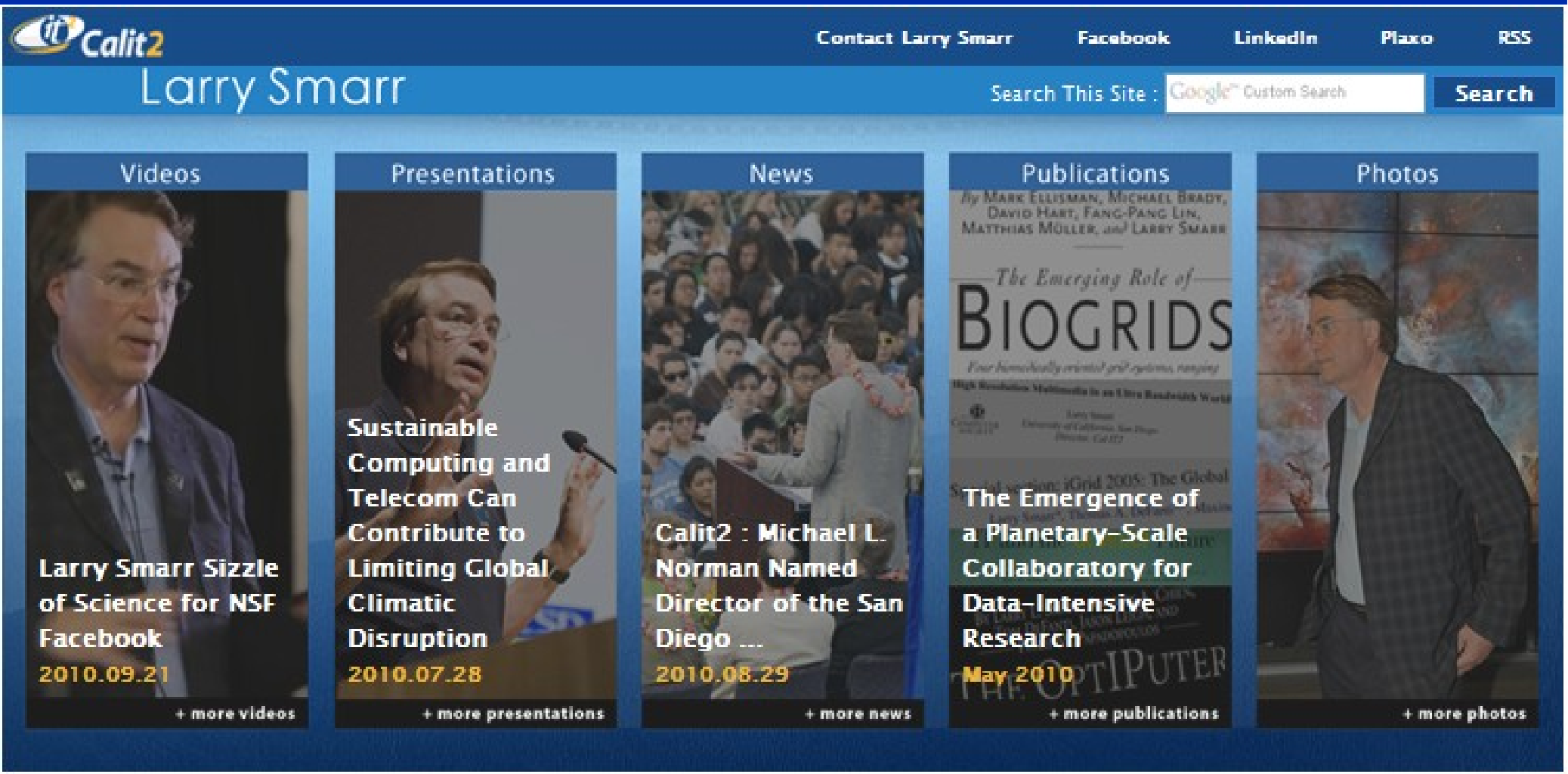
- **Perhaps 50 Major Organs or Cell Types**
  - **Each Secreting Protein Blood Molecular Fingerprint**
- **The Levels of Each Protein in a Particular Blood Fingerprint Will Report the Status of that Organ**
  - **Probably Need Perhaps 50 Organ-Specific Proteins Per Organ**
- **Will Need to Quantify 2500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

UCSD
UCIrvine

it²

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

RECENT TWITTER POSTS

Twitter?
Click To Follow Me