

“Predictive & Preventive Personalized Medicine”

Invited Talk

Right Care Initiative Annual Leadership Summit

Collaborating to Prevent Heart Attacks, Strokes, and Diabetic Complications

UC Berkeley

October 1, 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

<http://lsmarr.calit2.net>

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

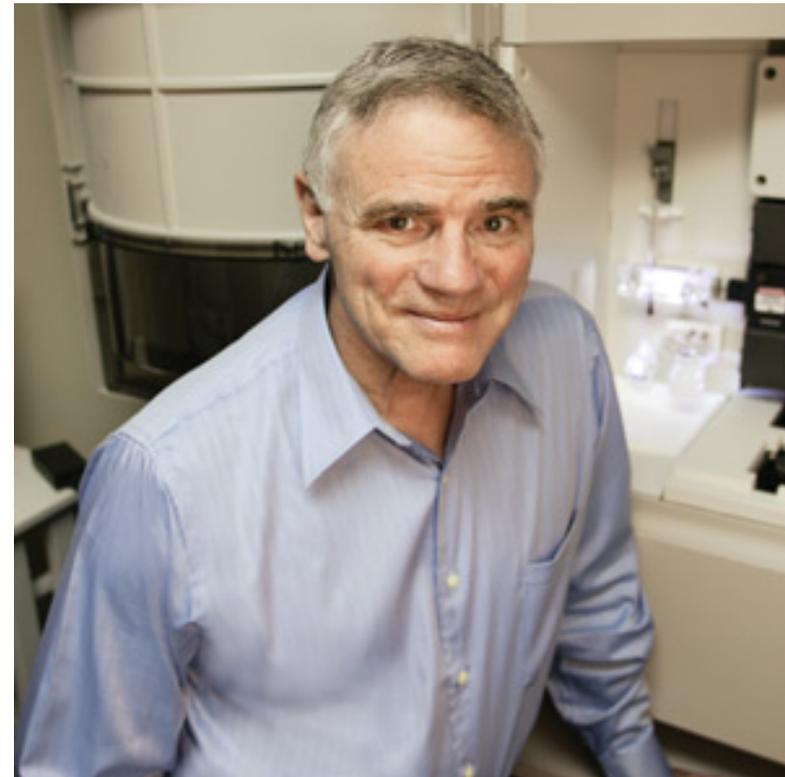
Newsweek

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



Invited Paper for Focus Issue of Biotechnology Journal, Edited by Profs. Leroy Hood and Charles Auffray.

Perspective

Quantifying your body: A how-to guide from a systems biology perspective

Larry Smarr

University of California, San Diego, CA, USA

Download Pdfs from my Portal:

http://lsmarr.calit2.net/repository/Biotech_J._LS_published_article.pdf

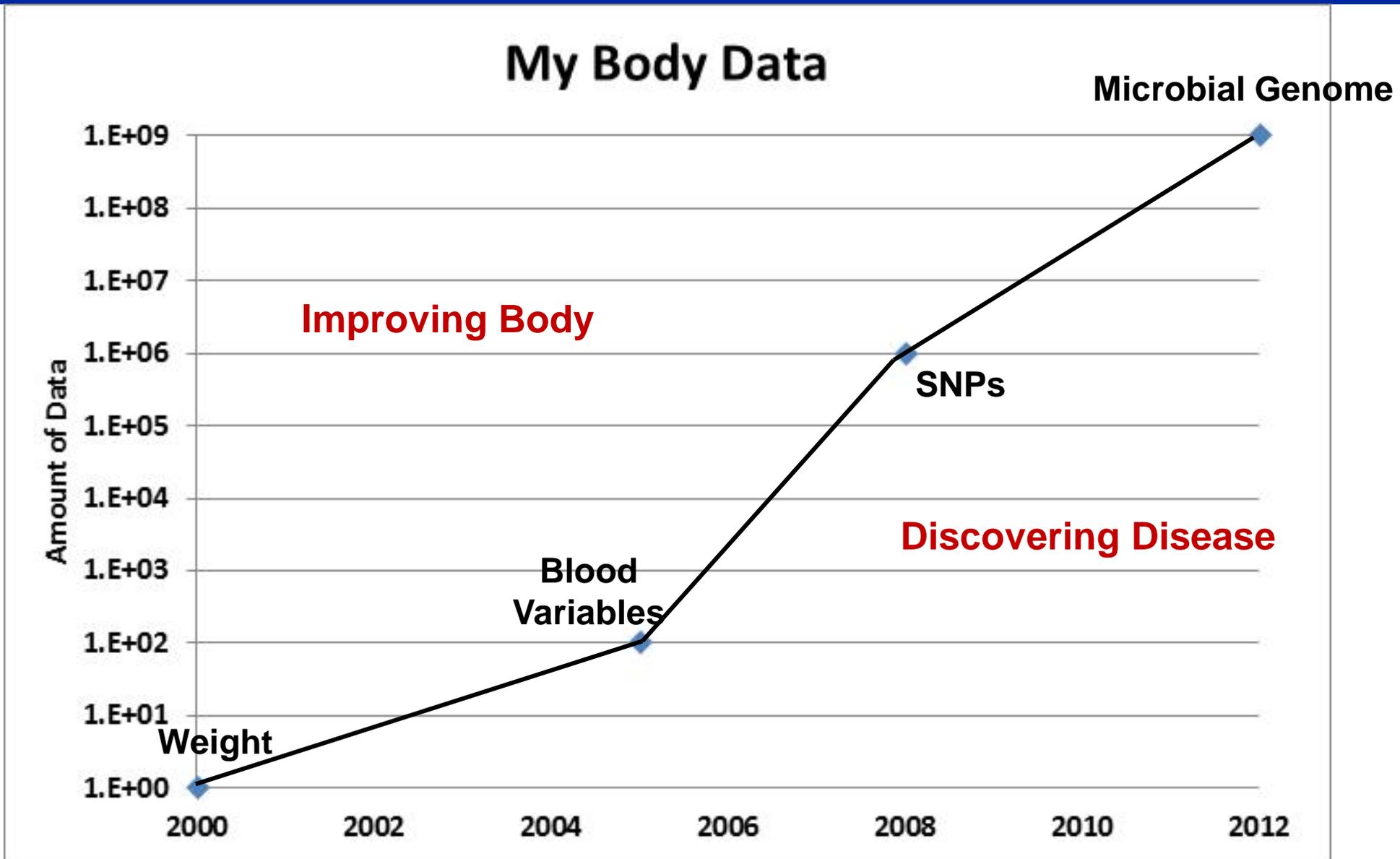
http://lsmarr.calit2.net/repository/Biotech_J._Supporting_Info_published.pdf



Biotechnol. J. 2012, 7, 980–991



From One to a Billion Data Points Defining Me: The Exponential Rise in Body Data in Just One Decade!



I Have Improved My Health By Measuring the State of My Body and “Tuning” It

Age
51



2010



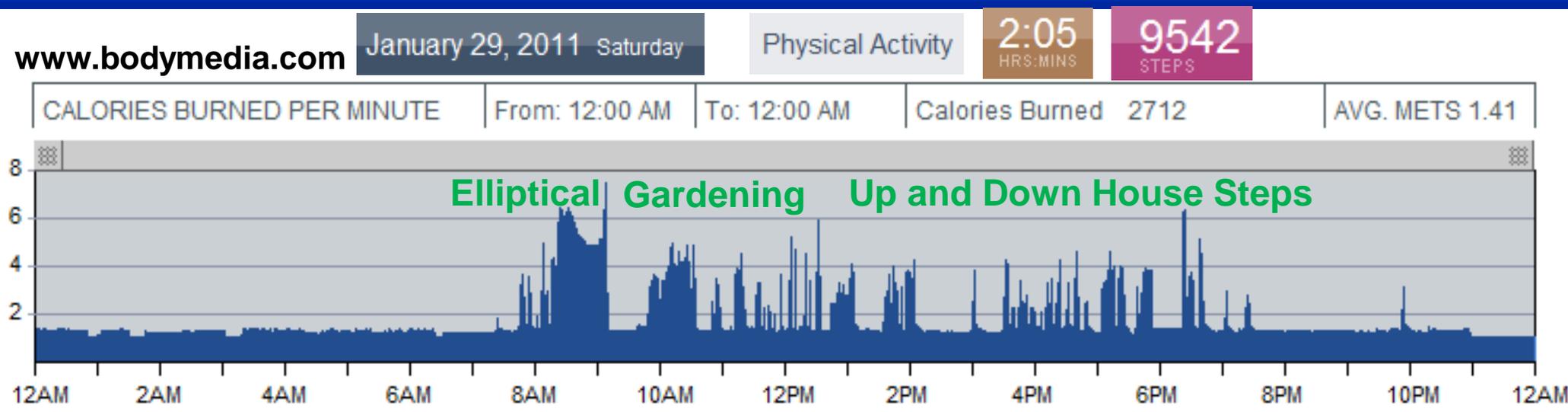
Age
61

**I Arrived in La Jolla in 2000 After 20 Years in the Midwest
and Discovered I was Pre-Diabetic.**

LS Resting Heart Rate

Year	Resting Heart Rate
2000	60
2005	50
2010	45
2012	40

The Biofeedback of Monitoring Enables Me To Increase My Daily Caloric Burn



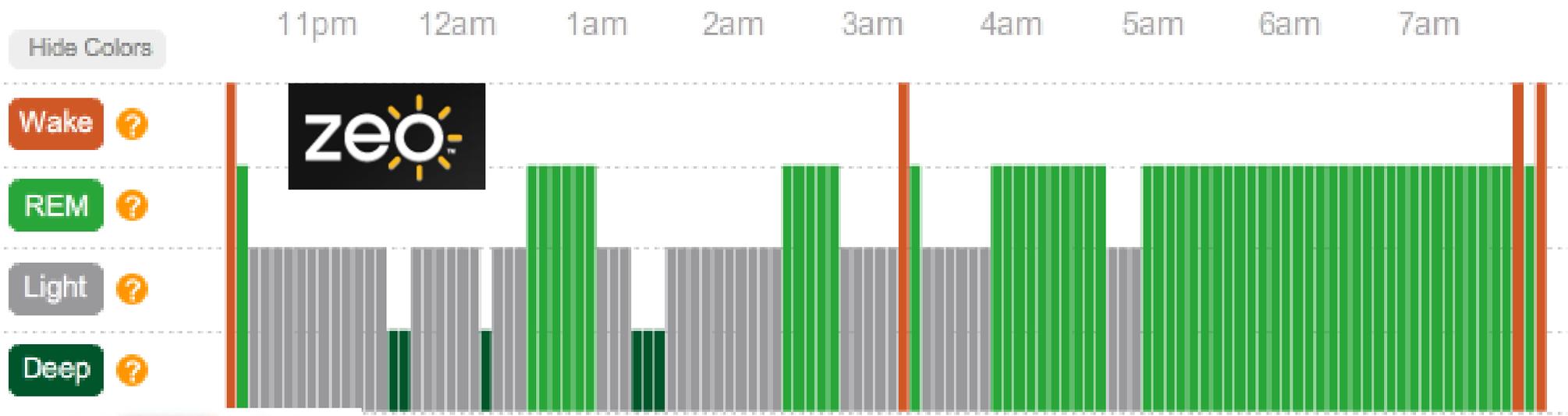
25 Week Average:
2473 Calories Burned/Day
1:19 hr Physical Activity/Day (>3 METs)
6887 Steps/Day (~3.4 Miles)



Now Using Fitbit
Average 8000 Steps/Day

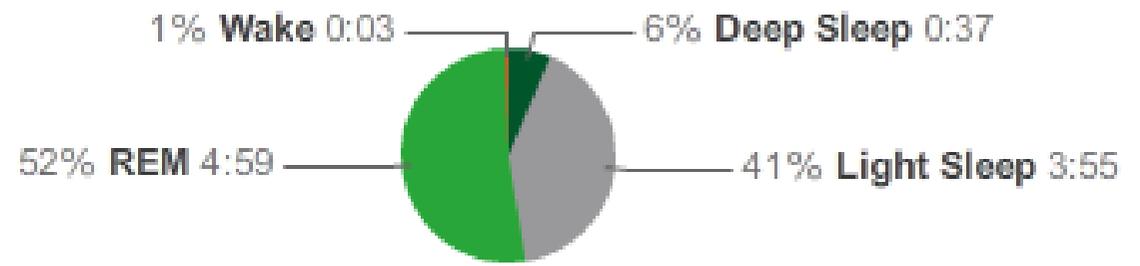


Quantifying My Sleep Pattern Using a Zeo - Increased My Average to 8 Hours/Night



Stroke risk increased by sleeping less than six hours a night
 -M. Ruiters, *Sleep* 2012

Total Z: 9 hr 31 min
 Time to Z: 0 hr 2 min



Why are these numbers different from the sleep graph above?

Lower Triglycerides by Reducing Foods High in Simple Sugars

- **TG**

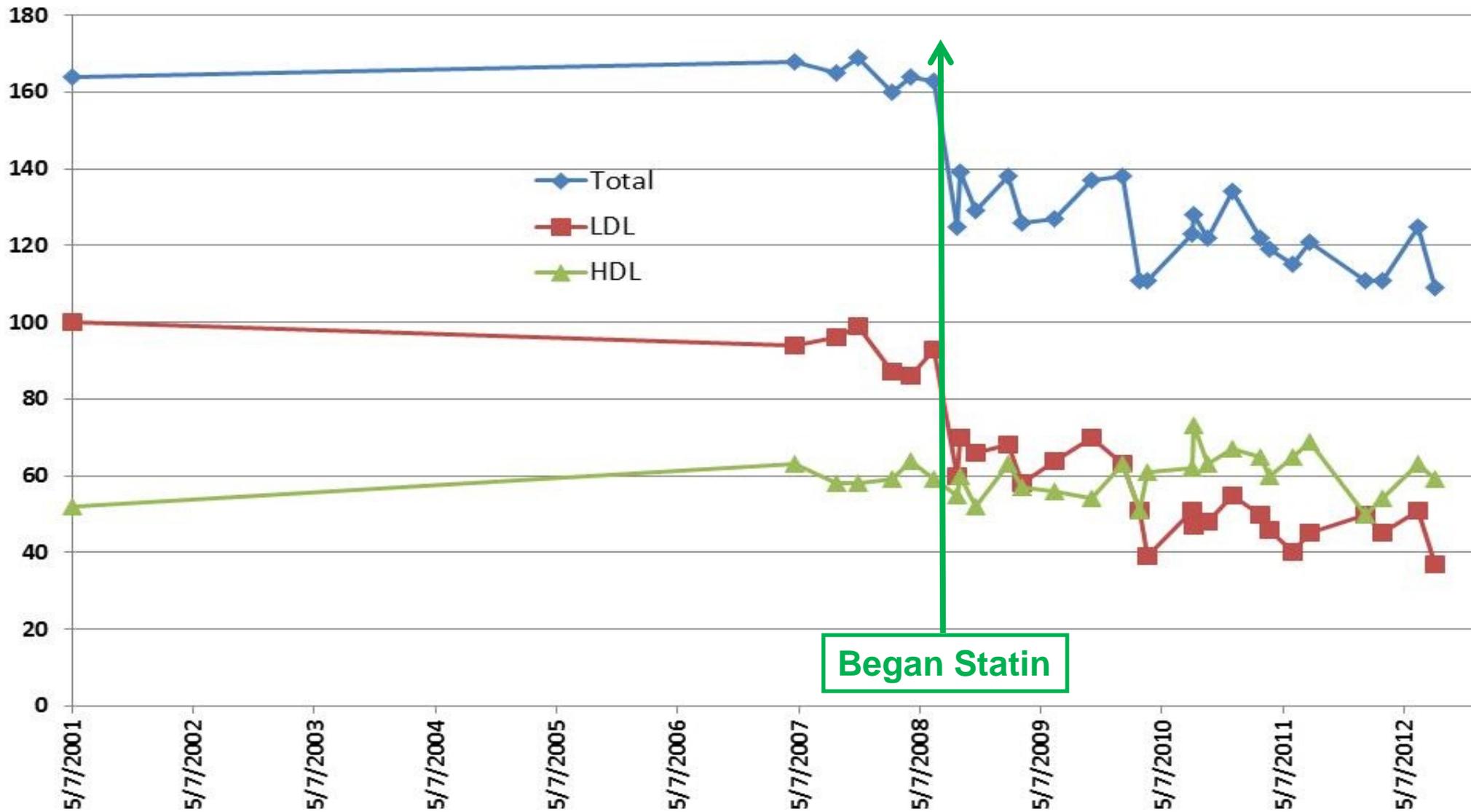
- High Risk 200-500
- Best <150
- My TG ~40

- **TG/HDL**

- Ratio >4 Are Pre-Diabetic or Have Type 2 Diabetes
- Average American Has a Ratio of ~3.3
- My Ratio 0.6

“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]

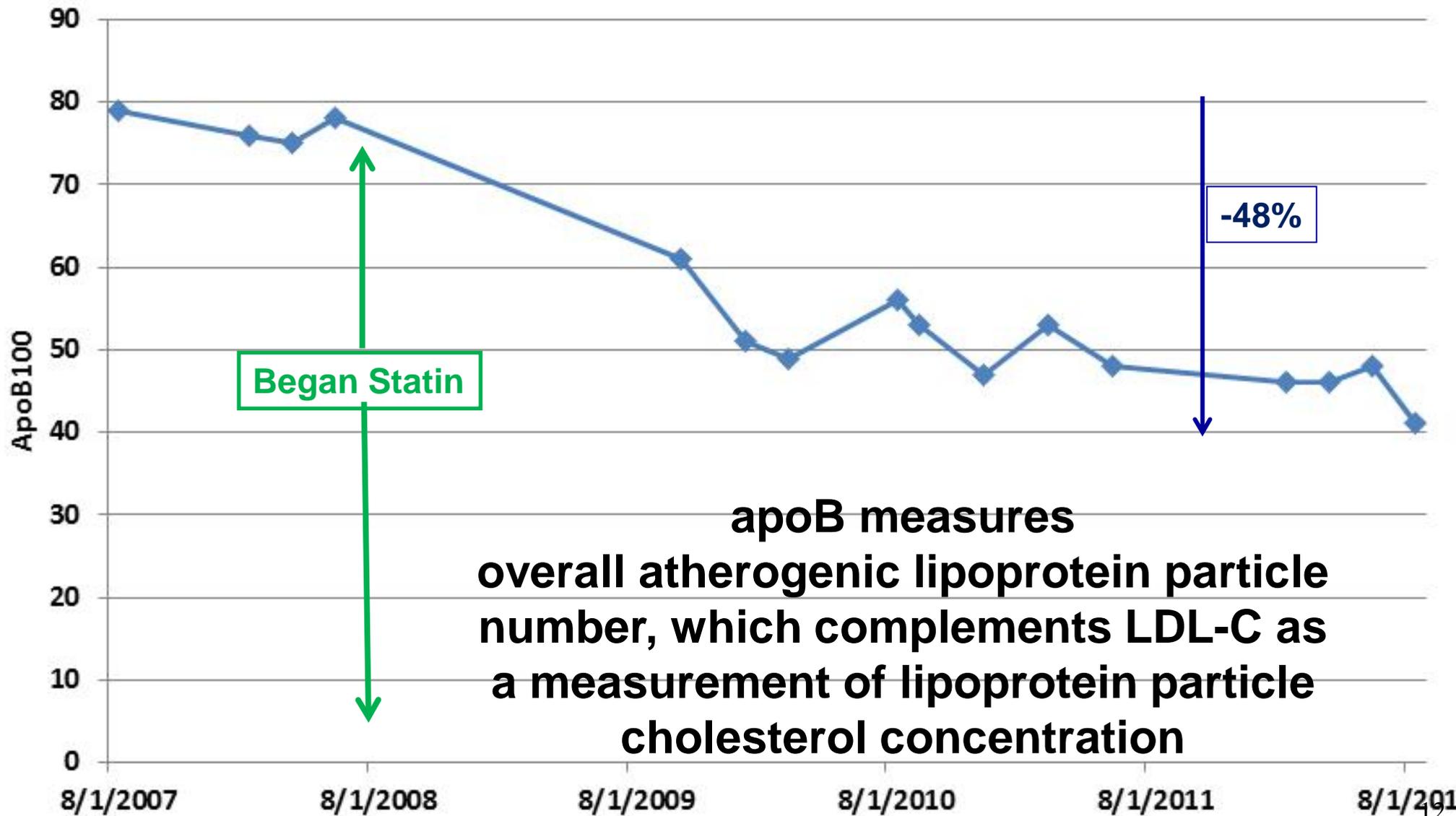
Goal: Change Your Cholesterol Levels to Lower LDL, Raise HDL, While Lowering Total



Change in LS Cholesterol Profile Before and After Statins

	Before Statin	After Statin	% Change
Total Cholesterol	165	125	-25%
LDL	94	54	-43%
HDL	59	60	No change
TG	45	38	-16%

Lowered apoB100 After Taking Statin—High Levels of apoB can Lead to Plaques that Cause Vascular Disease



apoB measures overall atherogenic lipoprotein particle number, which complements LDL-C as a measurement of lipoprotein particle cholesterol concentration

Change in LS Blood Pressure Under Different Blood Pressure Medication

Year	Blood Pressure Drug	Average Systolic	Average Diastolic
2010	Benecar 20mg	134	73
2012	Losartan 100mg	143	82
2012	Lotrel 5/10mg combo	125	70

From Measuring Macro-Variables to Measuring Your Internal Variables

technology review

Published by MIT

MARCH/APRIL 2012

BY JON COHEN

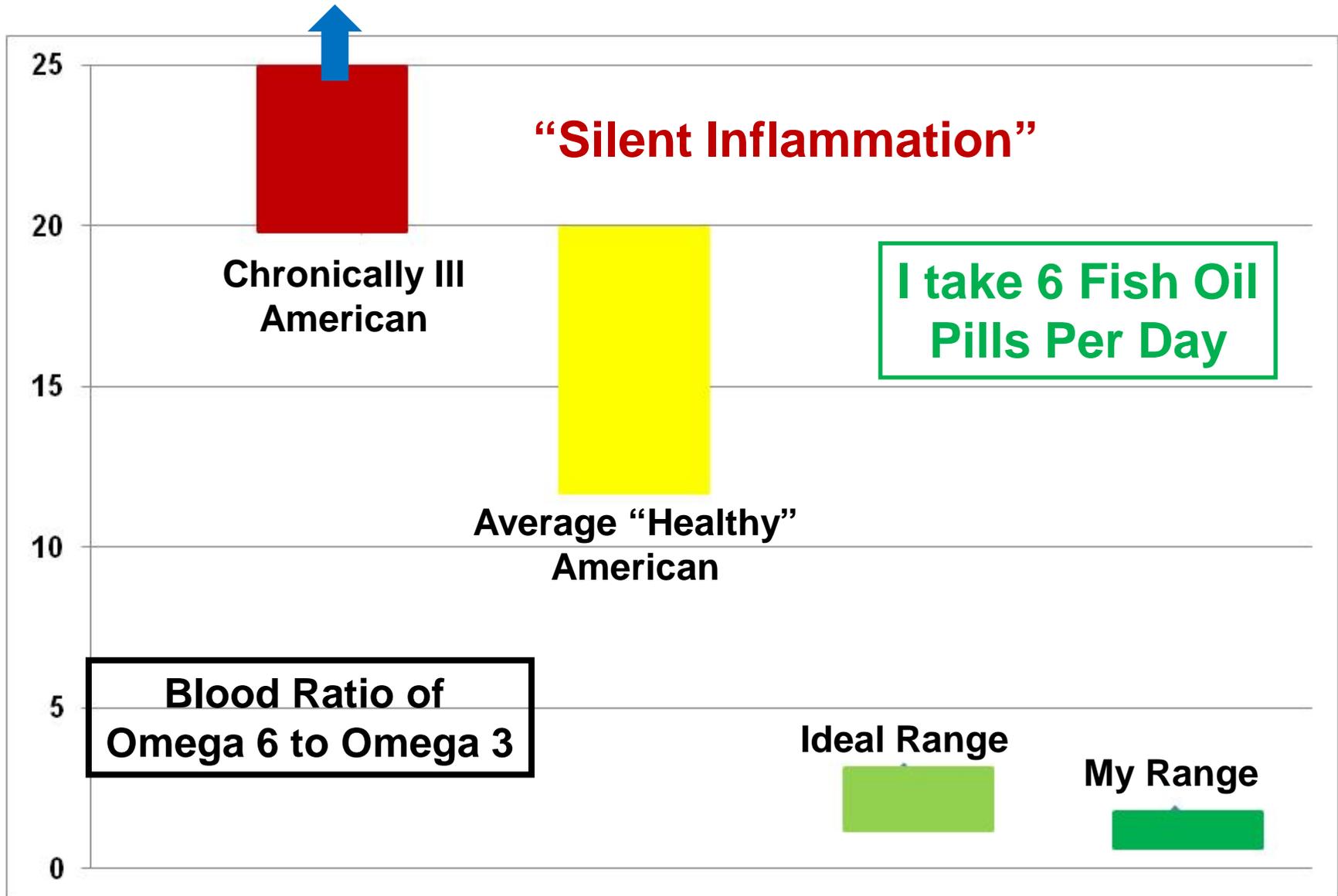


The Patient of the Future

Internet pioneer Larry Smarr's quest to quantify everything about his health led him to a startling discovery, an unusual partnership with his doctor, and more control over his life.

www.technologyreview.com/biomedicine/39636

I Lowered My Body's Inflammation From Food By Increasing Omega-3s and Reducing Omega-6s

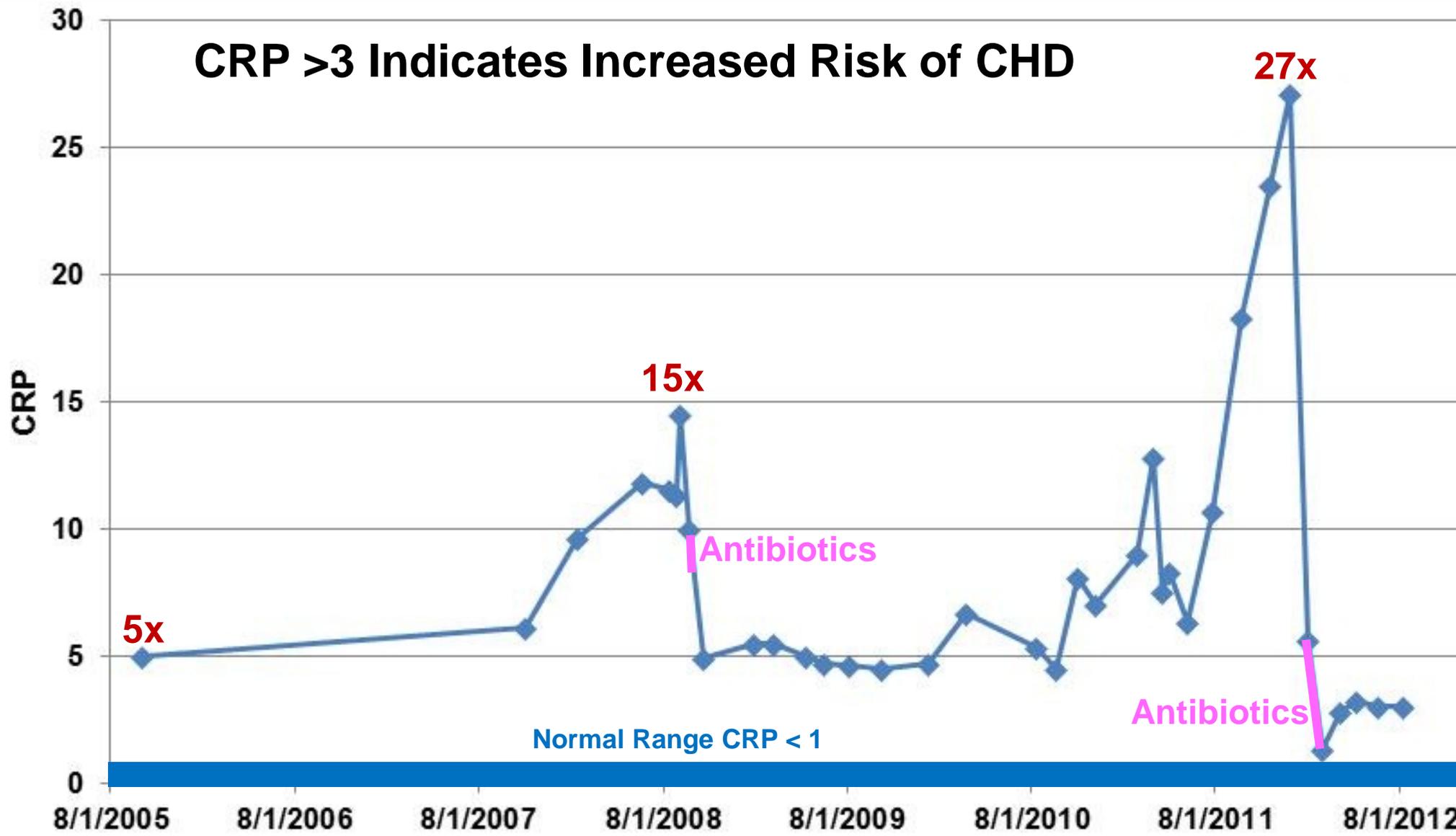


I Track 100 Variables in Blood Tests Done Quarterly to Annually

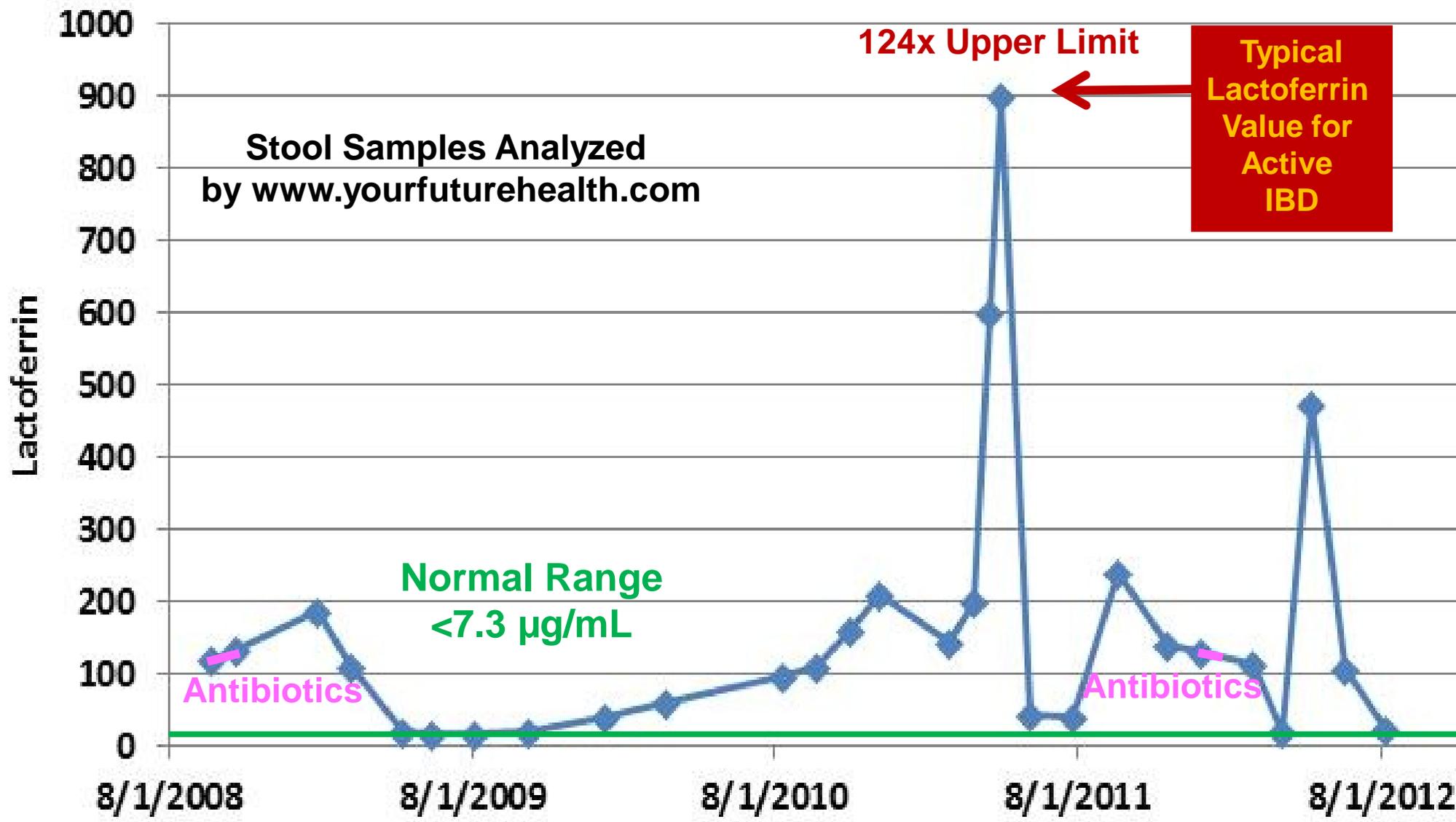
- **Electrolytes**
 - Sodium, Potassium, Calcium, Magnesium, Phosphorus, Boron, Chlorine, CO₂
- **Micronutrients**
 - Arsenic, Chromium, Cobalt, Copper, Iron, Manganese, Molybdenum, Selenium, Zinc
- **Blood Sugar Cycle**
 - Glucose, Insulin, A1C Hemoglobin
- **Cardio Risk**
 - **Complex Reactive Protein**
 - Homocysteine
- **Kidneys**
 - Bun, Creatinine, Uric Acid
- **Protein**
 - Total Protein, Albumin, Globulin
- **Liver**
 - GGTP, SGOT, SGPT, LDH, Total Direct Bilirubin, Alkaline Phosphatase
- **Thyroid**
 - T3 Uptake, T4, Free Thyroxine Index, FT4, 2nd Gen TSH
- **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.

**Only One of These Was
Far Out of Normal Range**

But, In Spite of My High Levels of Omega-3s, My Blood Measurements Revealed Chronic Inflammation

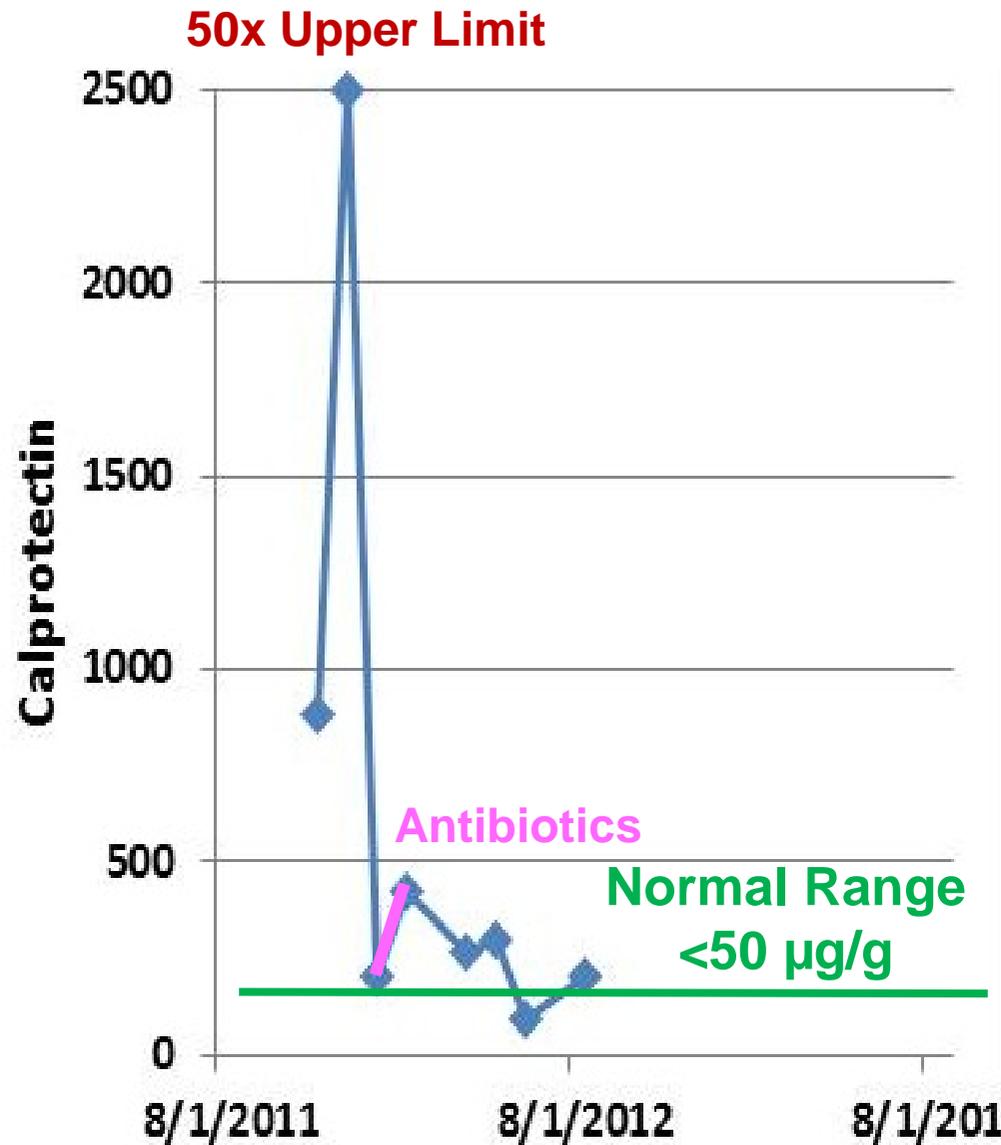


By Quantifying Stool Measurements Over Time I Discovered Source of Inflammation Was Likely in Colon



Confirmation of IBD Using Calprotectin Biomarker From Stool Sample

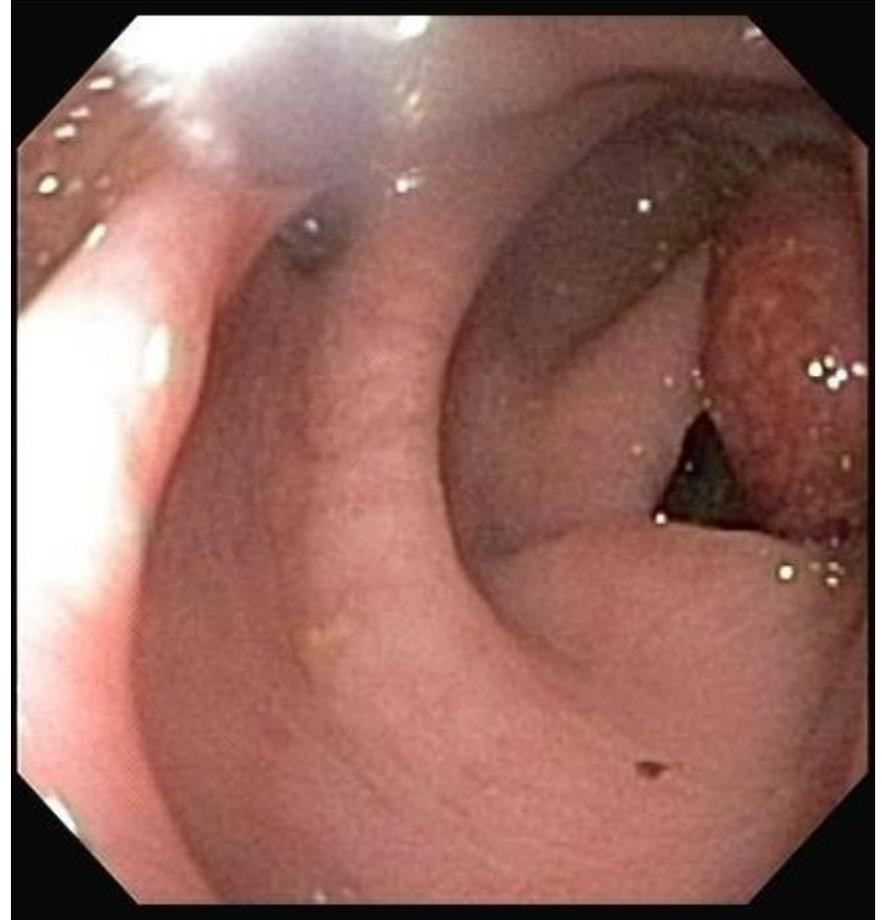
“It is worth noting that **calprotectin** concentrations **correlate more closely** with histological than macroscopic (endoscopic) findings, suggesting that this biological marker **is more sensitive than endoscopy** in evaluating IBD’s activity.”
--Fecal Calprotectin and Lactoferrin for the Prediction of Inflammatory Bowel Disease Relapse, Gisbert, et al., Inflamm. Bowel Dis. 15, 1190-1198 (2009)



Colonoscopy Images Show 6 Inches of Sigmoid Colon Inflammation



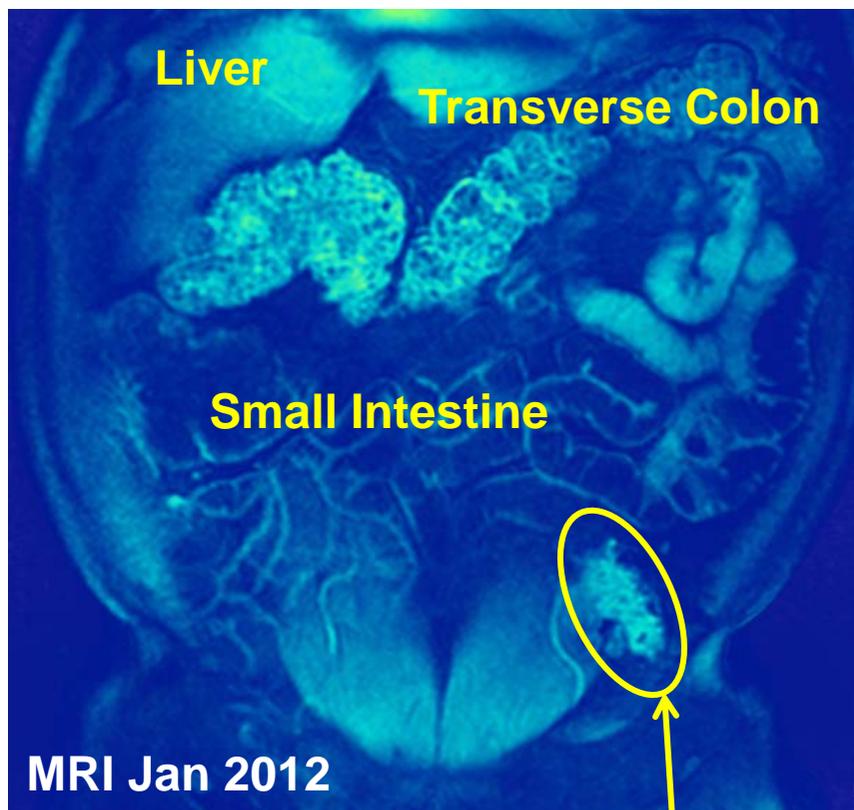
Dec 2010



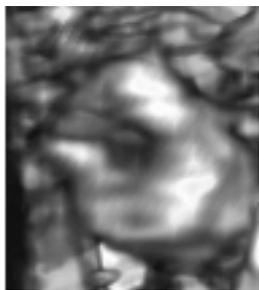
May 2011

Confirming the IBD (Crohn's) Hypothesis: Finding the "Smoking Gun" with MRI Imaging

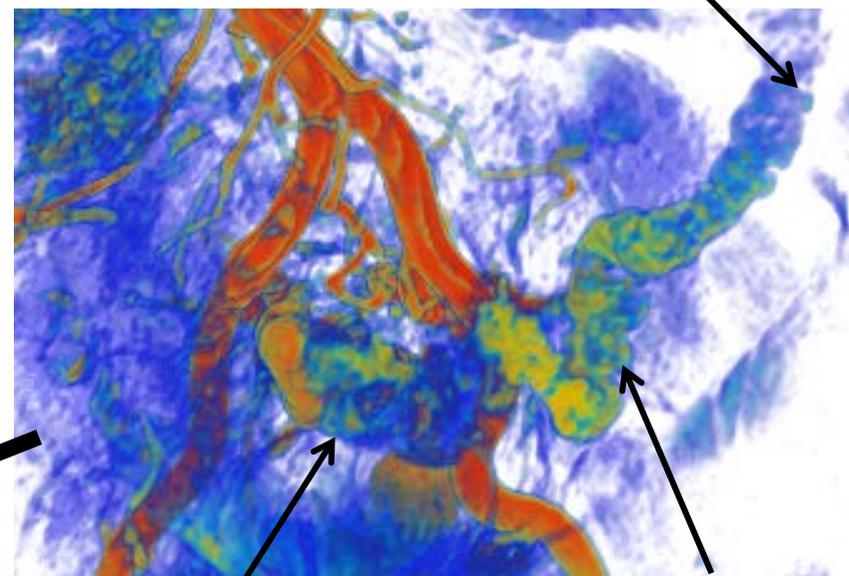
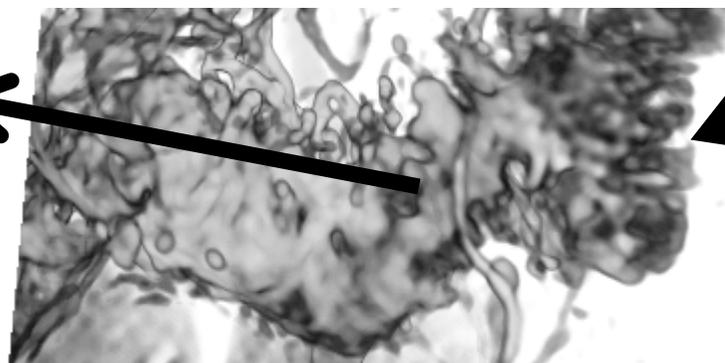
I Obtained the MRI Slices
From UCSD Medical Services
and Converted to Interactive 3D
Working With
Calit2 Staff & DeskVOX Software



Cross Section



Diseased Sigmoid Colon



Sigmoid Colon
Threading Iliac Arteries

Major Kink

Why Did I Have an Autoimmune Disease like IBD?

Despite **decades of research**,
the etiology of Crohn's disease
remains unknown.

Its pathogenesis may involve
a **complex interplay** between
host genetics,
immune dysfunction,
and **microbial** or environmental factors.
--The Role of Microbes in Crohn's Disease

So I Set Out to Quantify All Three!

From “How Do You Feel?”,
to “What Are Your Numbers?”

**Where's There's Data
There's Hope**