"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

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

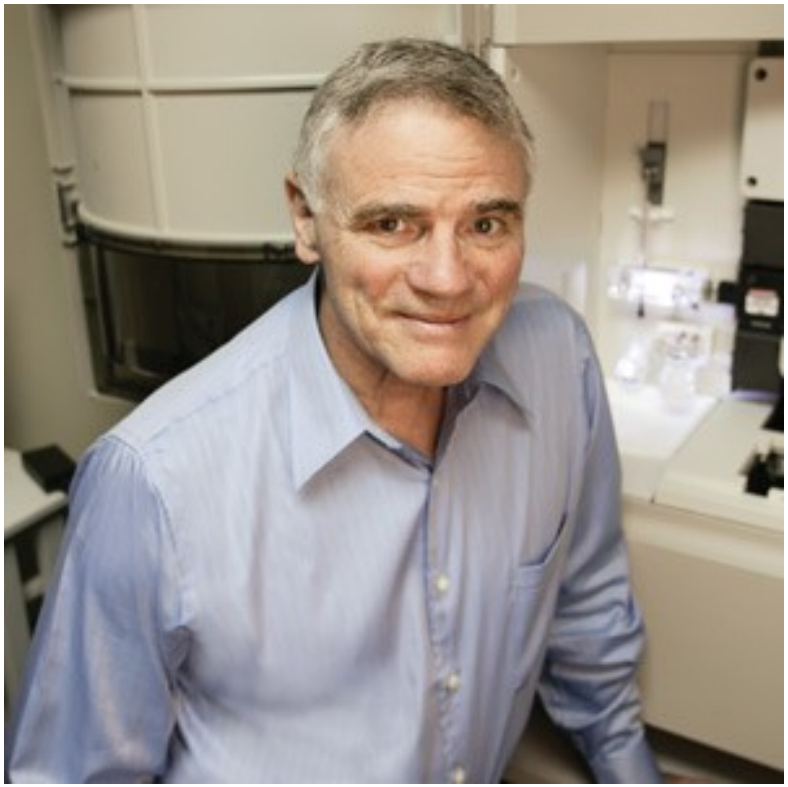
Newsweek

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



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

it²

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

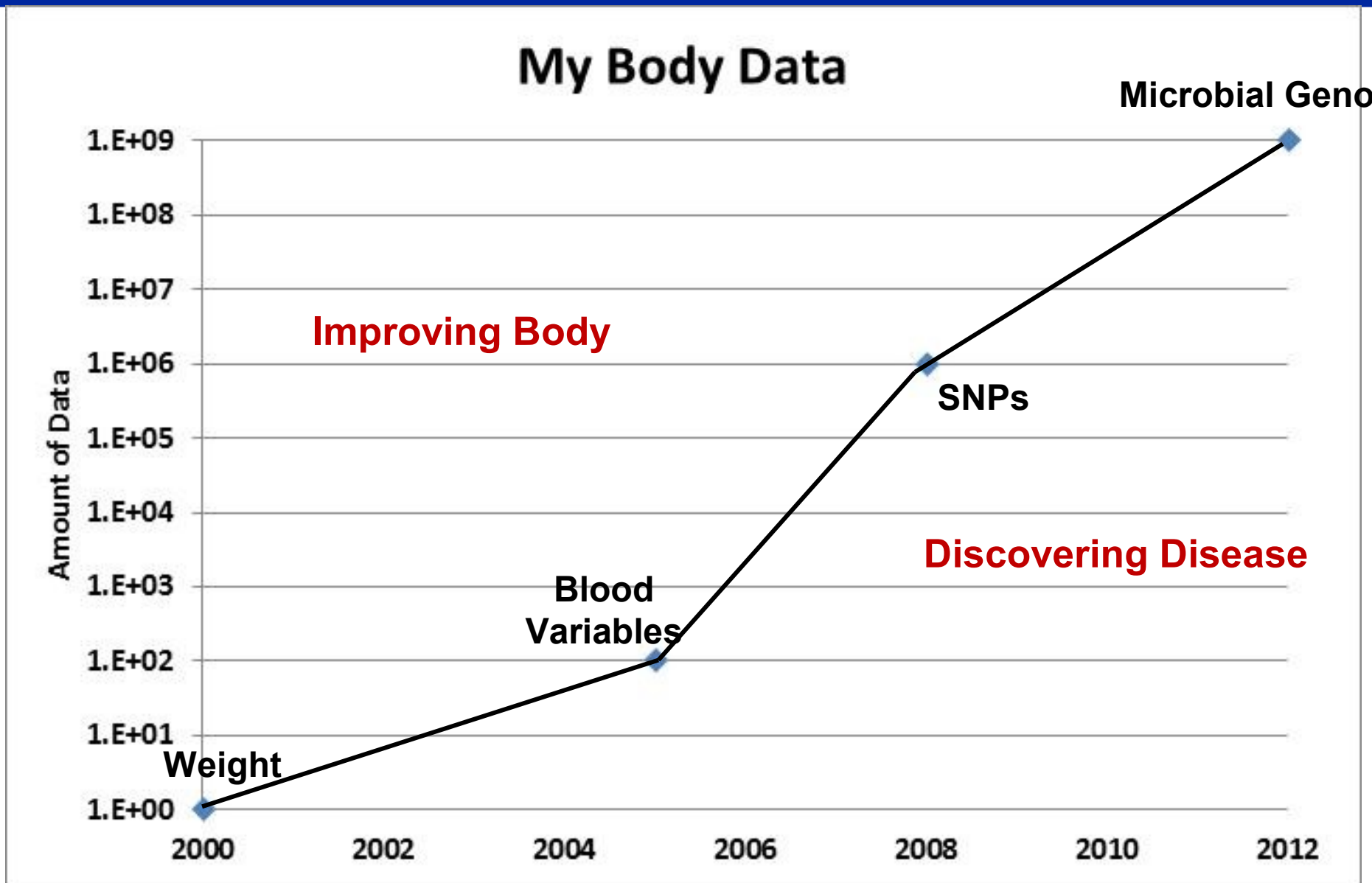
http://lsmarr.calit2.net/repository/Biotech_J._Supporting_Info_published.pdf



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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!



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

Age 51





Age 61

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

I Reversed My Body's Decline By Altering Nutrition and Exercise

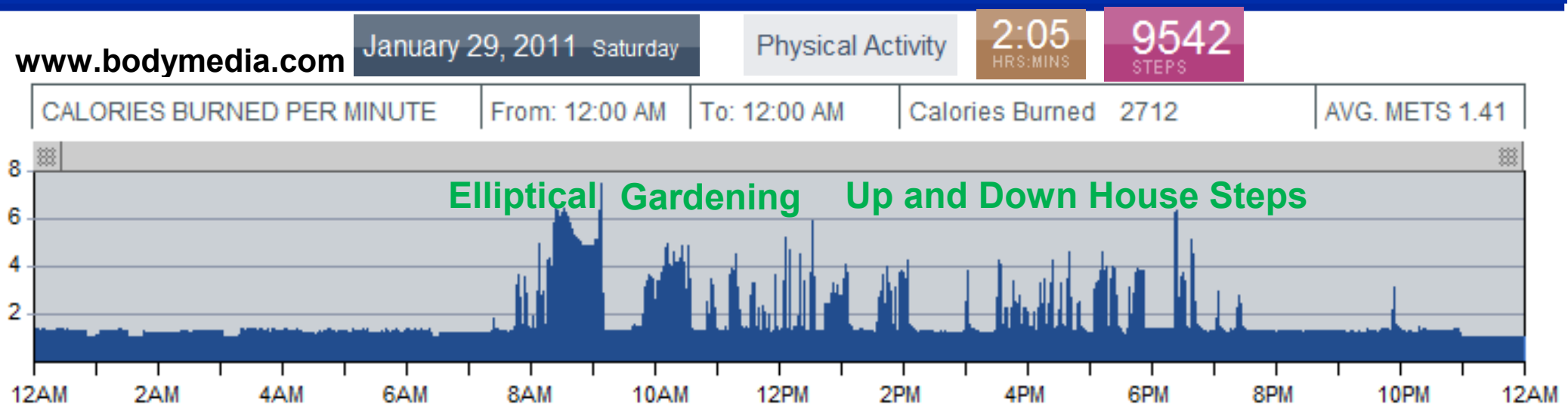
LS Resting Heart Rate

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

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

www.bodymedia.com





BODYMEDIA®
Know your Body. Change your life

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

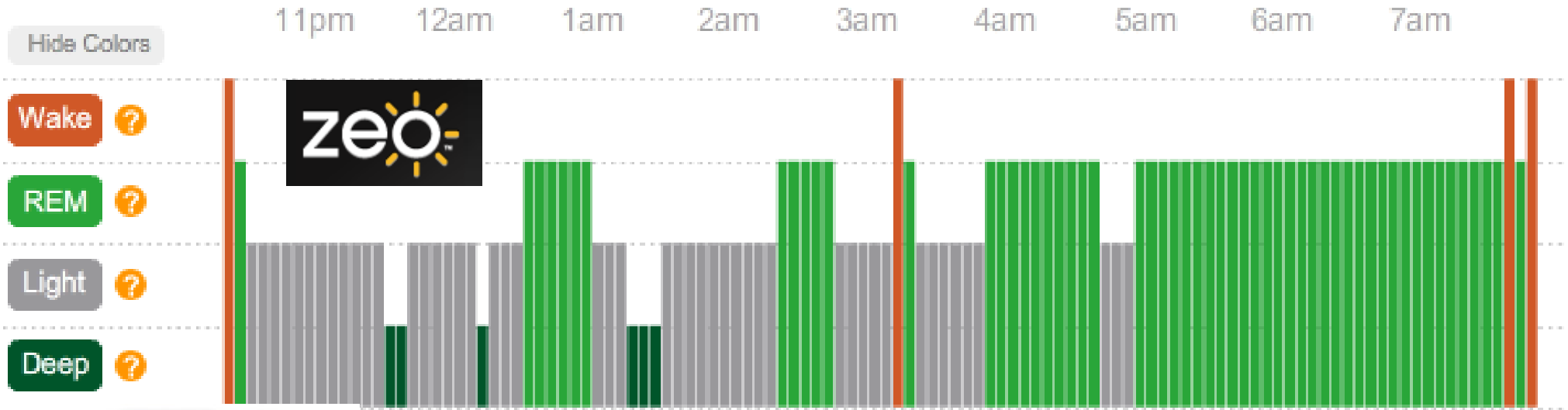
Now Using Fitbit
Average 8000 Steps/Day



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

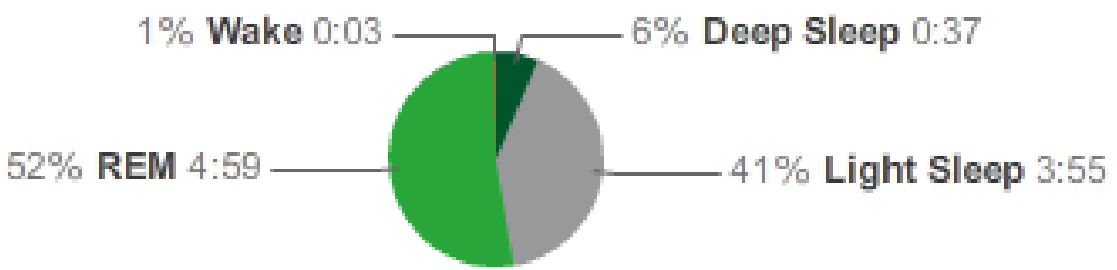




Stroke risk increased by sleeping less than six hours a night
-M. Ruiter, *Sleep* 2012

Total Z: 9 hr 31 min

Time to Z: 0 hr 2 min



Why are these numbers different from the sleep graph above?

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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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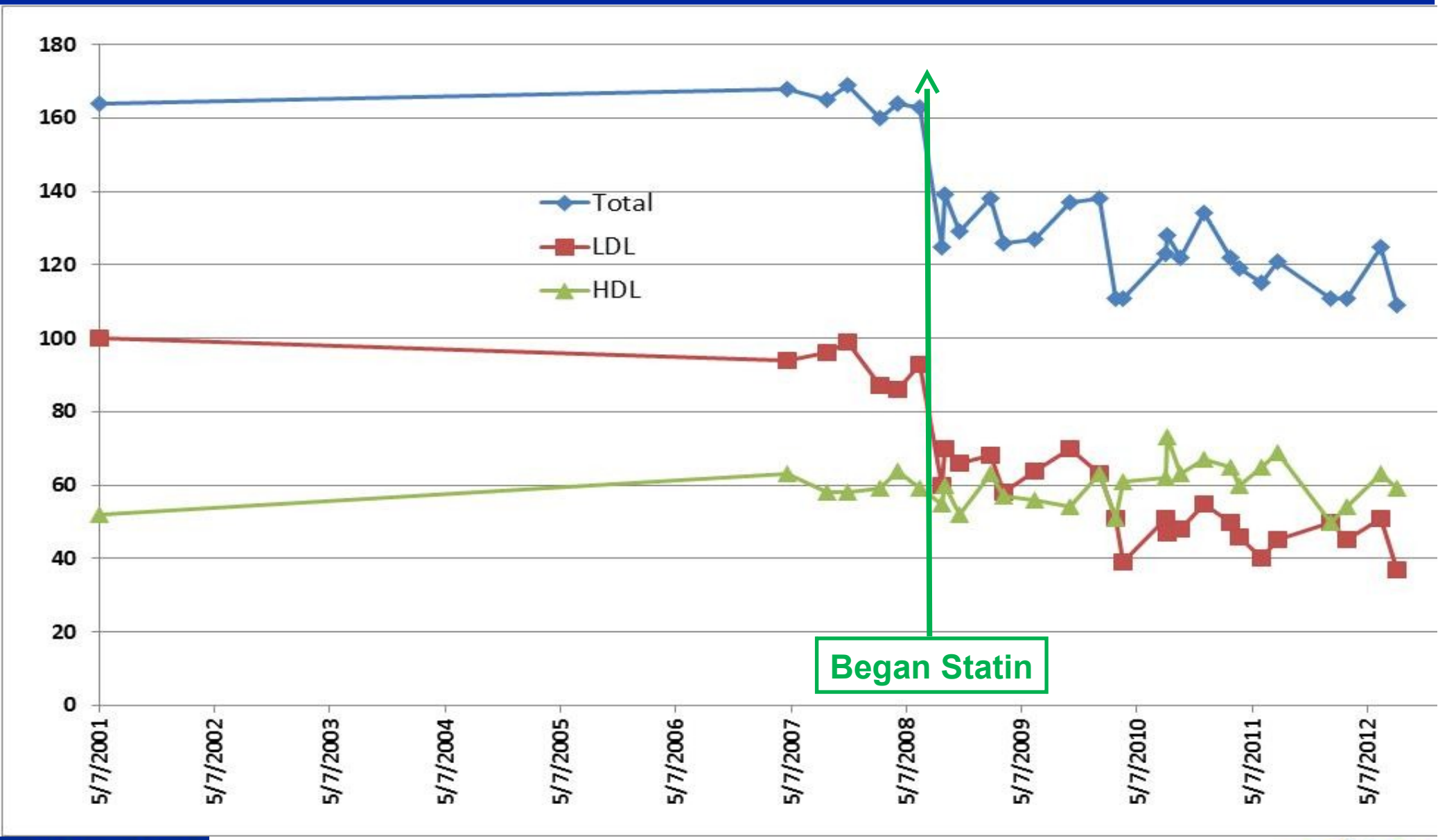
Lower Triglycerides by Reducing Foods High in Simple Sugars

- **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]

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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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Change in LS Cholesterol Profile Before and After Statins

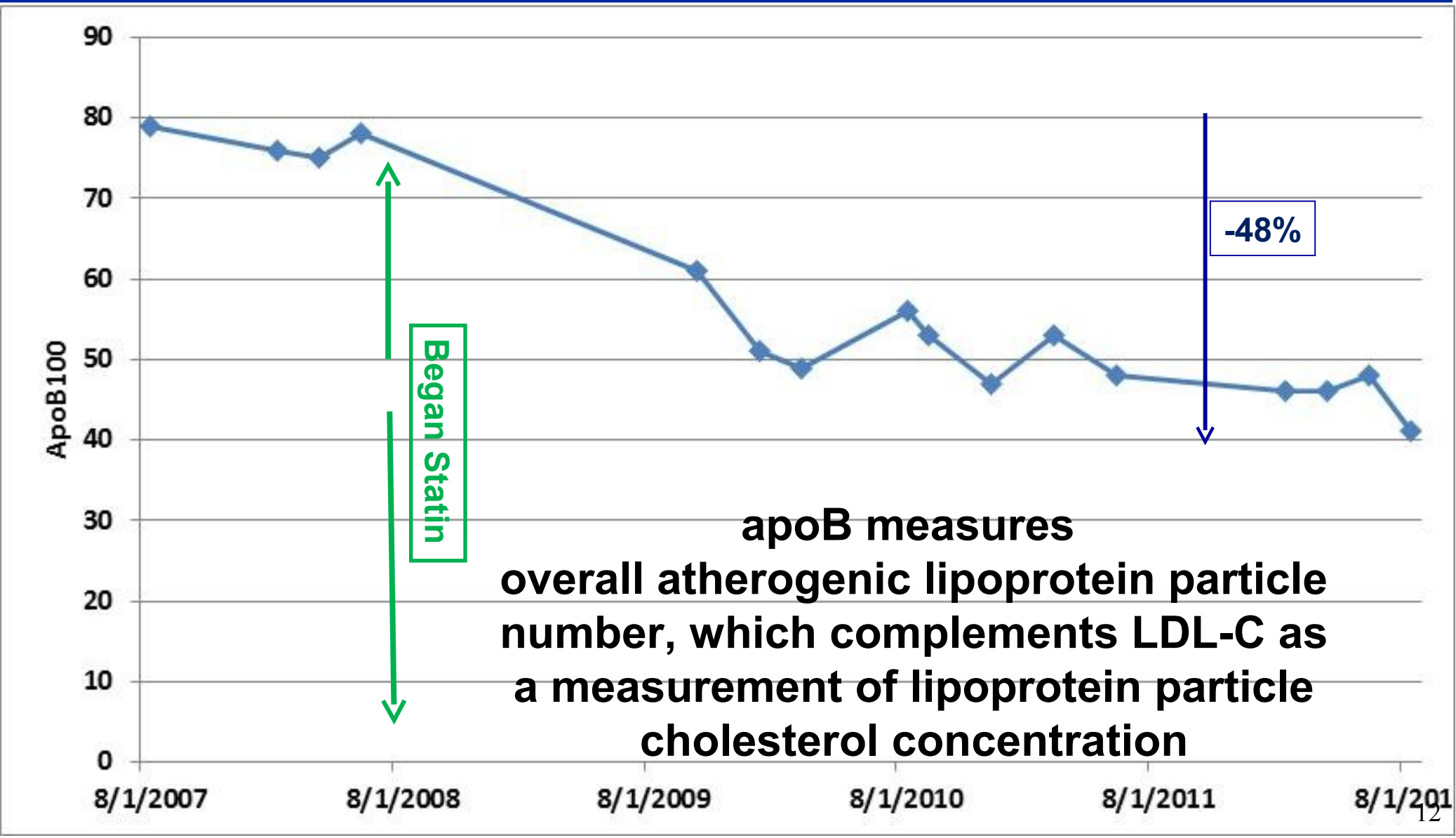
	Before Statin	After Statin	% Change
Total Cholesterol	165	125	-25%
LDL	94	54	-43%
HDL	59	60	No change
TG	45	38	-16%

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Started Crestor July 2008
Data from 2001-2012

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



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Apolipoprotein B

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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

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From Measuring Macro-Variables to Measuring Your Internal Variables

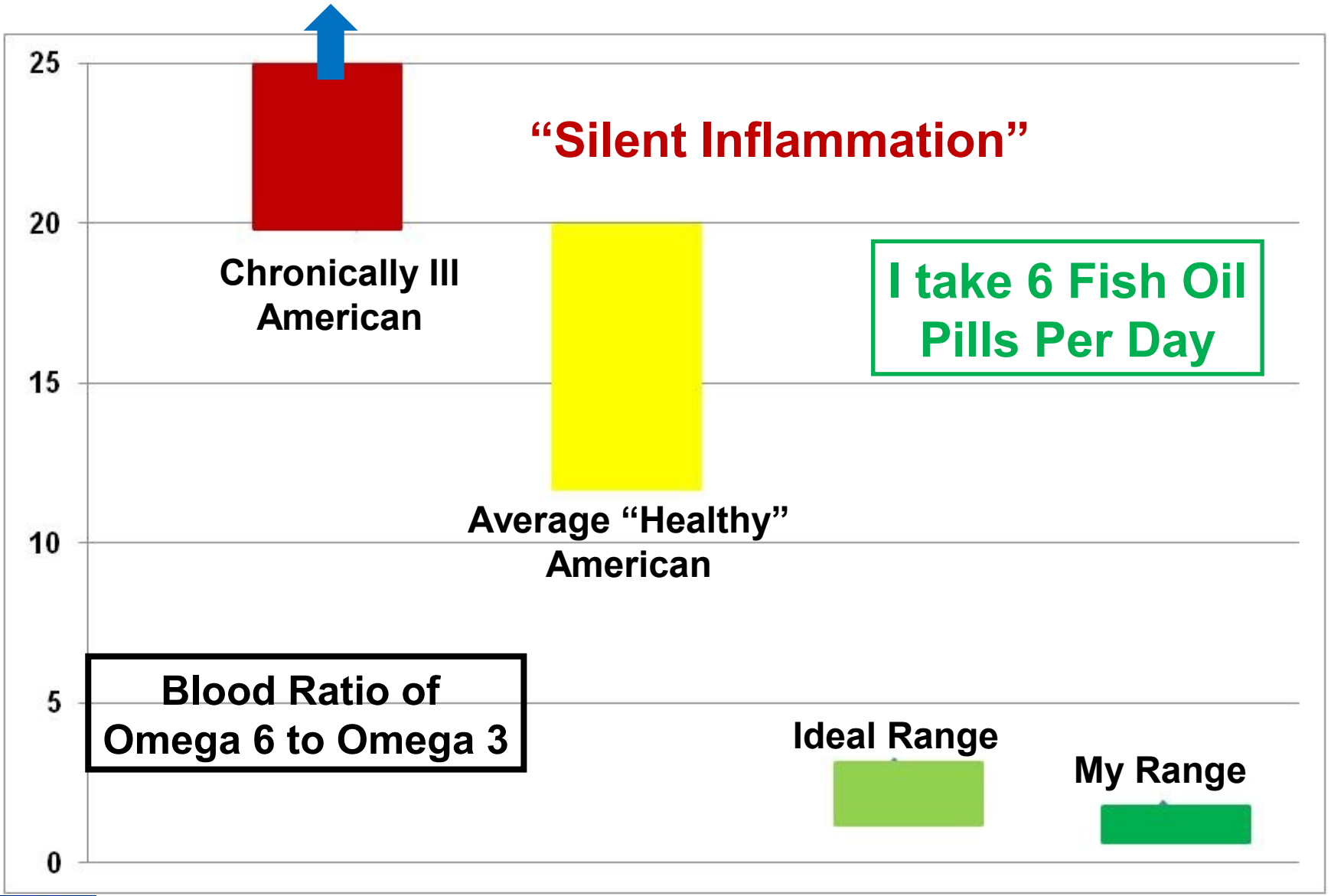


www.technologyreview.com/biomedicine/39636

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



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

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I Track 100 Variables in Blood Tests Done Quarterly to Annually

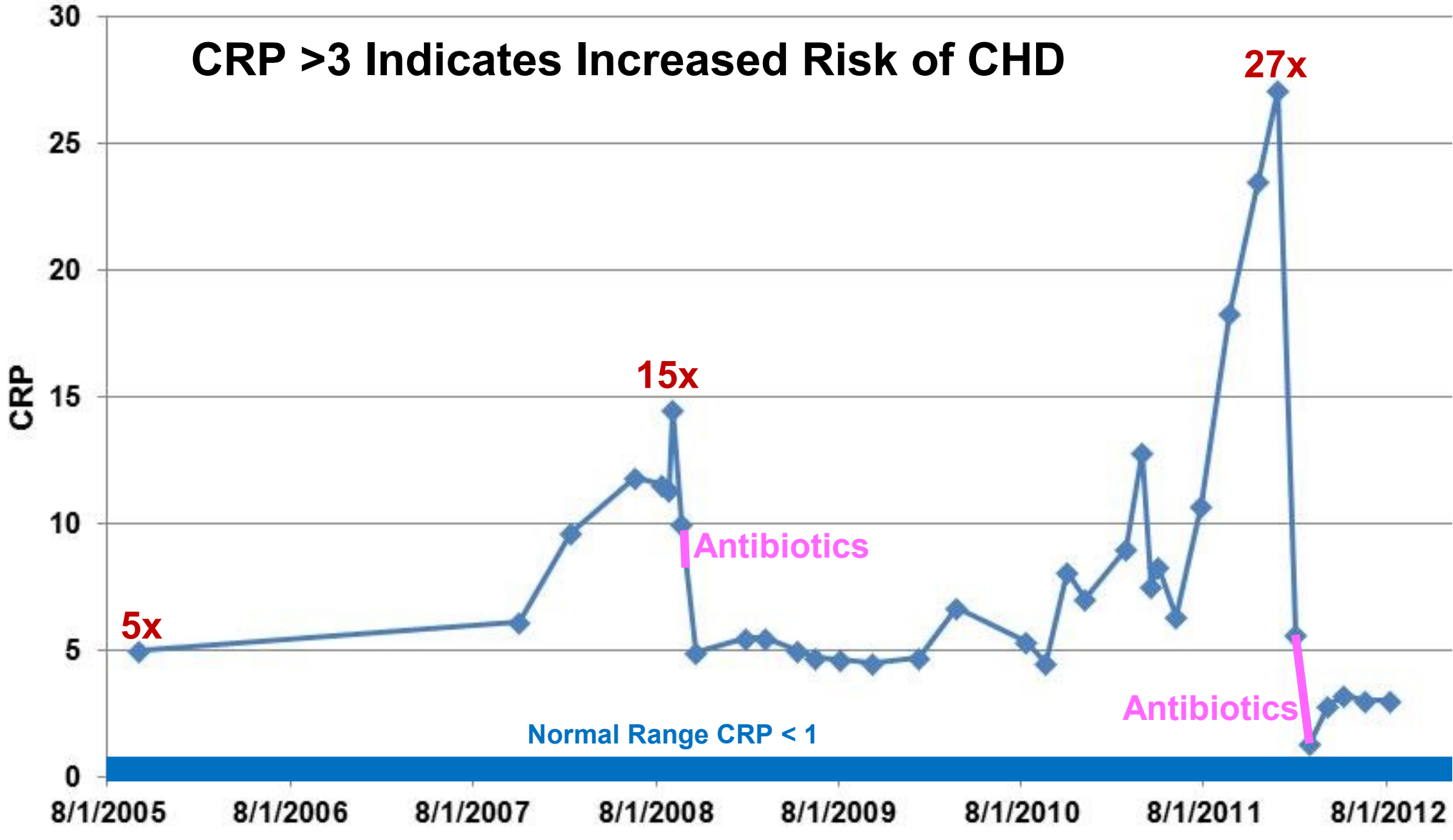
- **Electrolytes**
  - Sodium, Potassium, Calcium, Magnesium, Phosphorus, Boron, Chlorine, CO_2
- **Micronutrients**
  - Arsenic, Chromium, Cobalt, Copper, Iron, Manganese, Molybdenum, Selenium, Zinc
- **Blood Sugar Cycle**
  - Glucose, Insulin, A1C Hemoglobin
- **Cardio Risk**
  - Complex Reactive Protein
  - 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.

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Only One of These Was Far Out of Normal Range

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

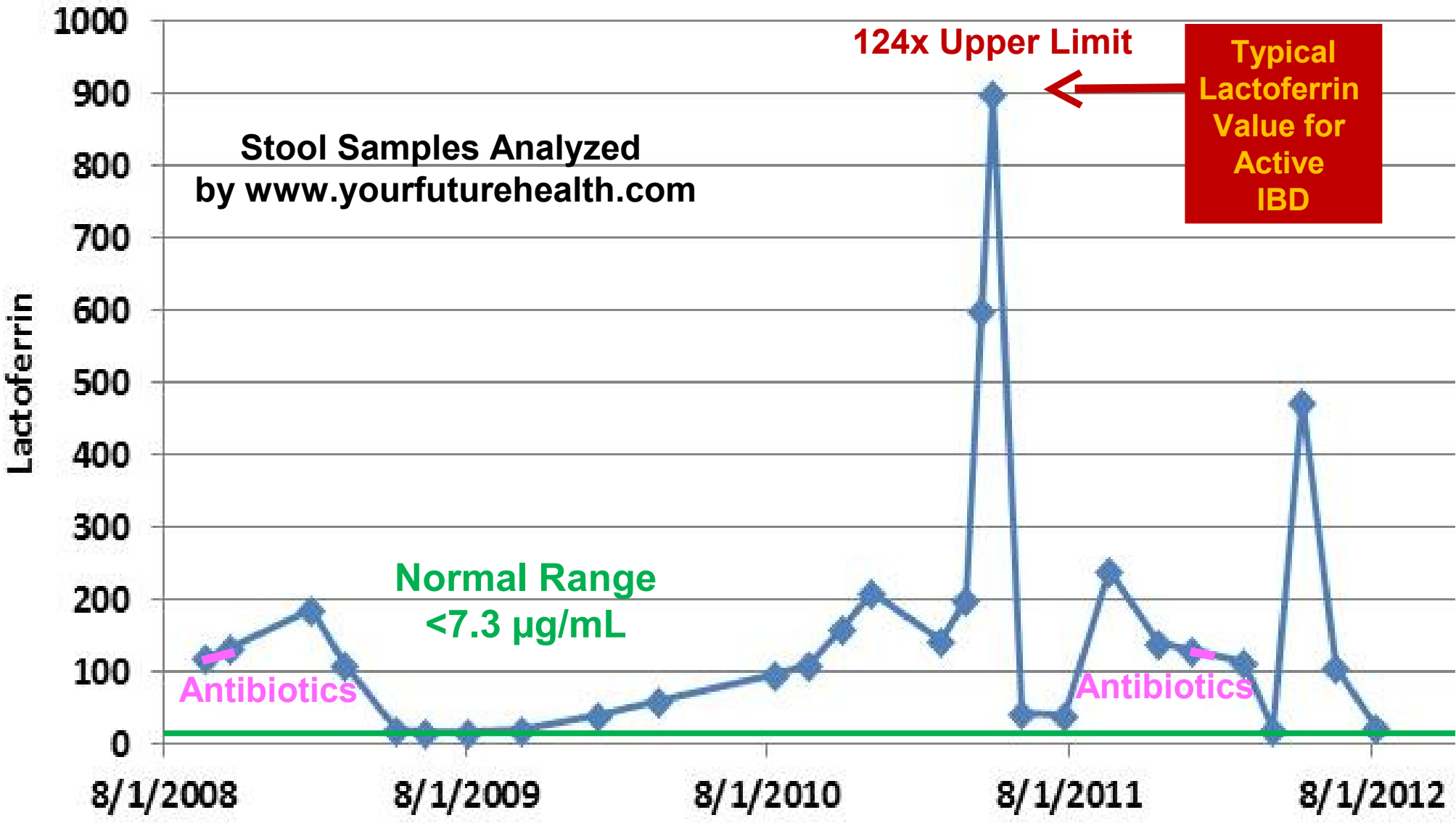


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Complex Reactive Protein (CRP) is a Blood Biomarker for Detecting Presence of Inflammation

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



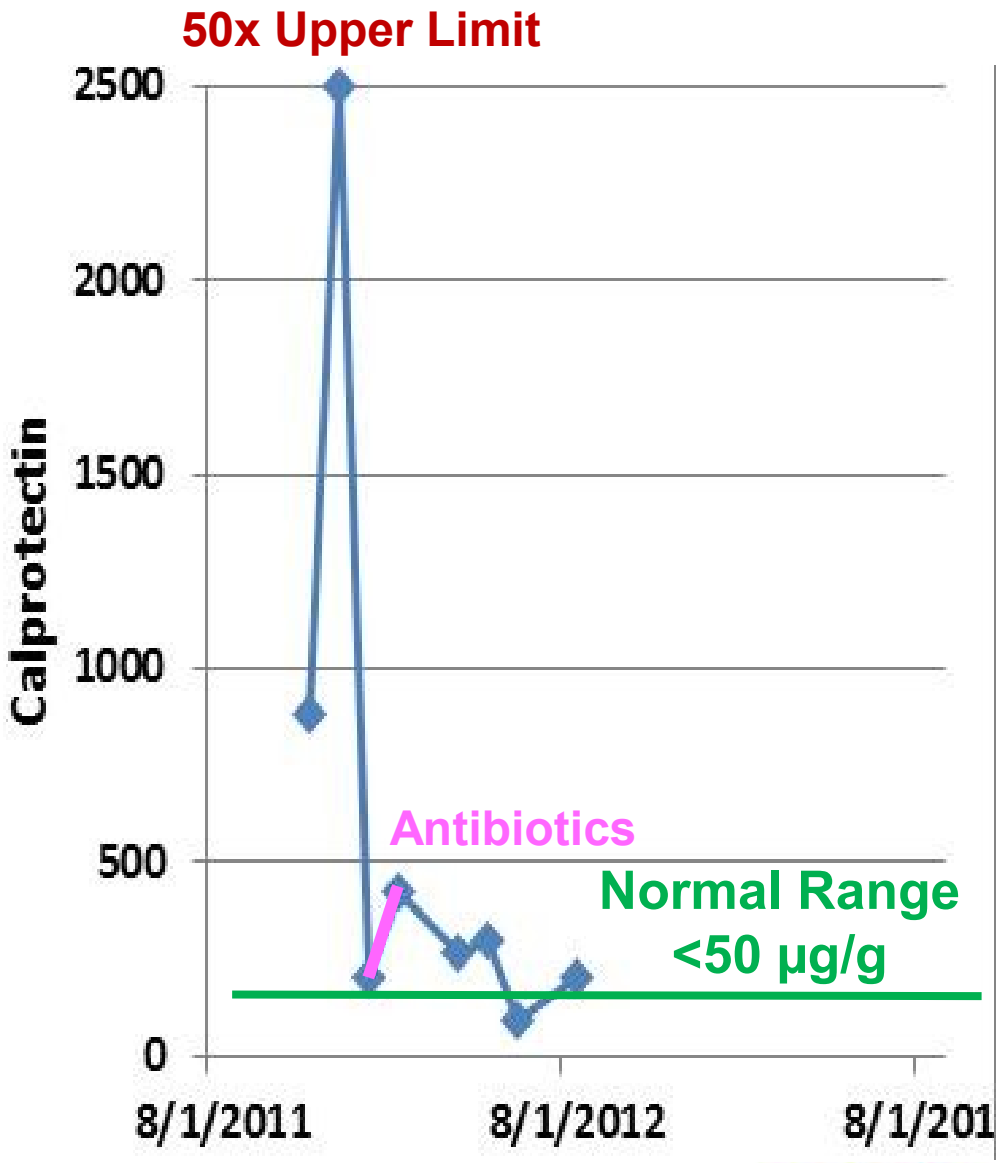
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Lactoferrin is a Sensitive and Specific Biomarker for Detecting Presence of Inflammatory Bowel Disease (IBD)

it²

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)

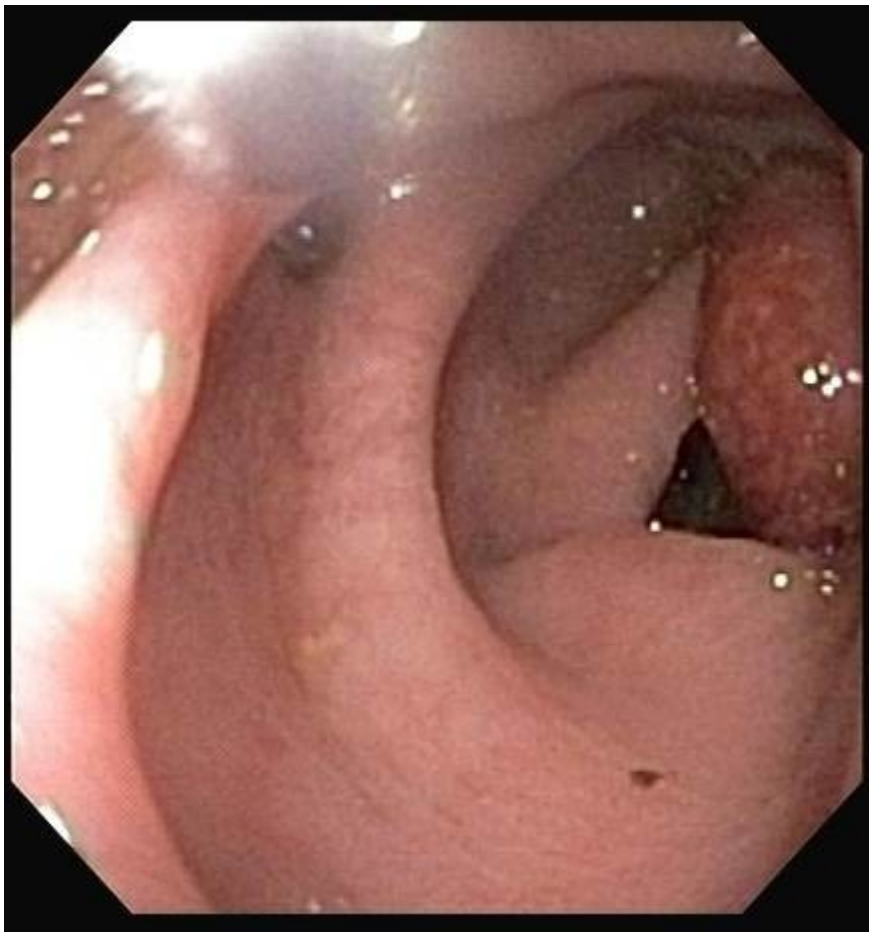


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Colonoscopy Images Show 6 Inches of Sigmoid Colon Inflammation



Dec 2010



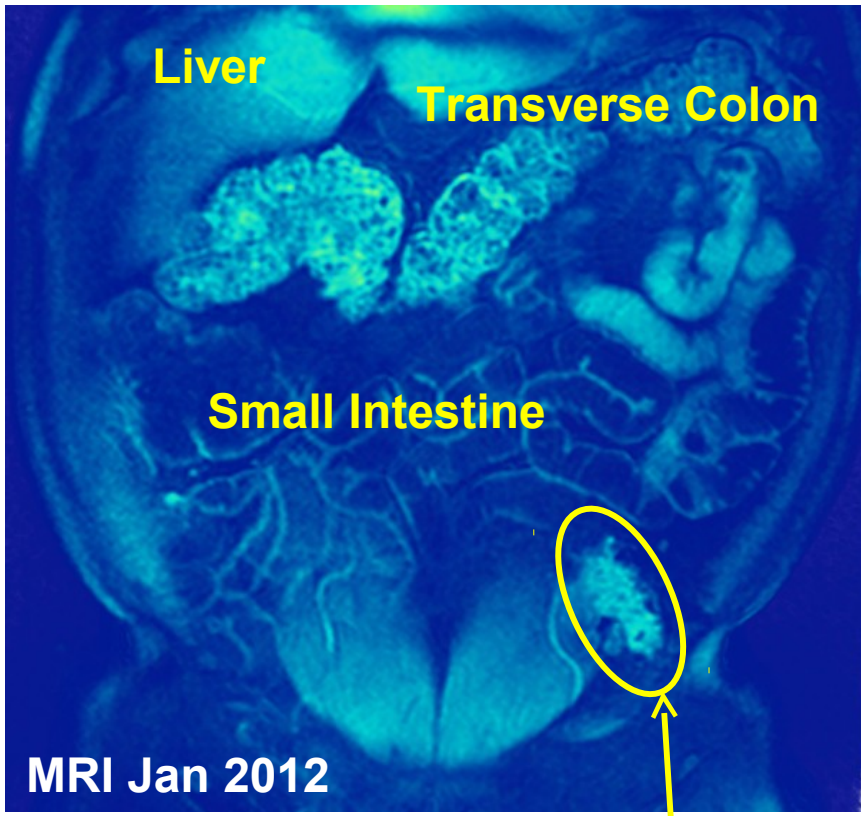
May 2011

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2010 Image from Scripps Health
2011 Image from UCSD Health Services

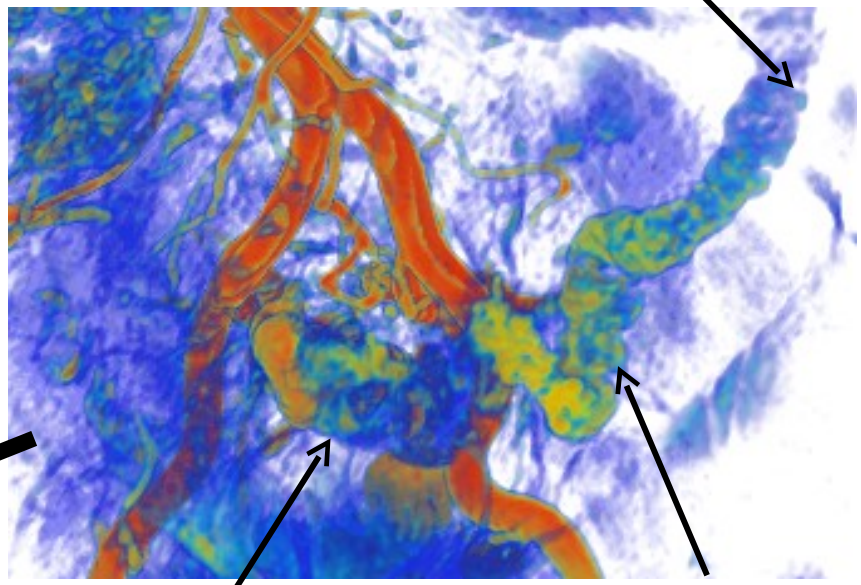
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Confirming the IBD (Crohn's) Hypothesis: Finding the "Smoking Gun" with MRI Imaging



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

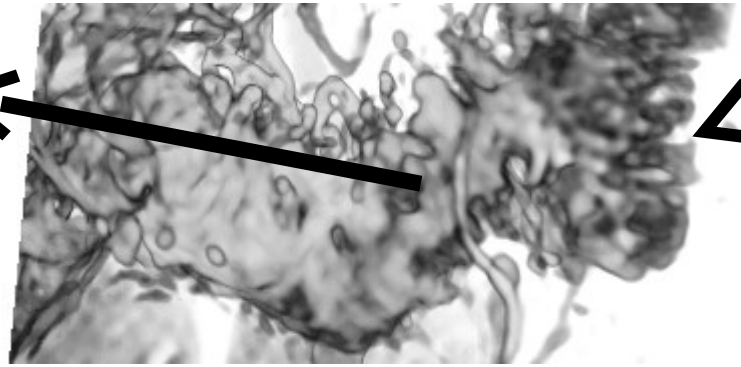
Descending Colon



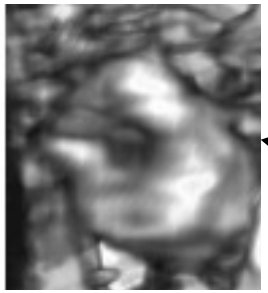
Major Kink

Sigmoid Colon Threading Iliac Arteries

Diseased Sigmoid Colon



Cross Section



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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!

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Paul B. Eckburg & David A. Relman
Clin Infect Dis. 44:256-262 (2007)

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

Where’s There’s Data There’s Hope

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