My N=1 Experience

Pioneer Session: "N=1: Pioneers of Self-Tracking"

Panel at the Genomes, Environment, and Traits Conference

Harvard Medical School

Cambridge, MA

April 25, 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

Follow me at http://lsmarr.calit2.net

I am the Digitally-Enabled "Patient of the Future": Measuring the State of Your Body and "Tuning" It

Age 51





Age 61

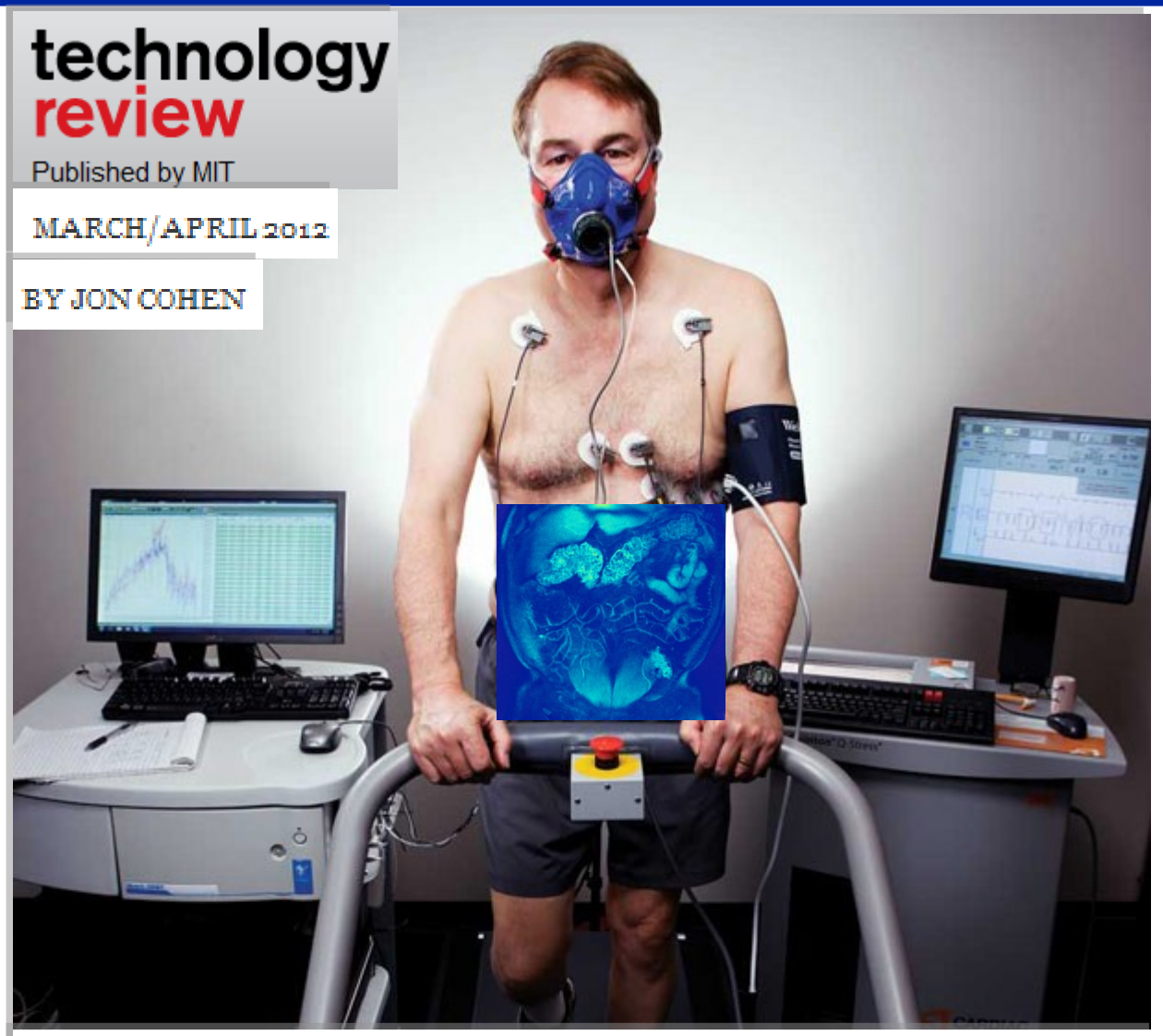
I Arrived in La Jolla in 2000 After 20 Years in the Midwest and Discovered I was Pre-Diabetic.

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

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From Measuring Macro-Variables to Measuring Your Internal Variables



www.technologyreview.com/biomedicine/39636

My Quarterly Blood Tests In Addition to Lipids: Only One Was Far Beyond Normal Limits

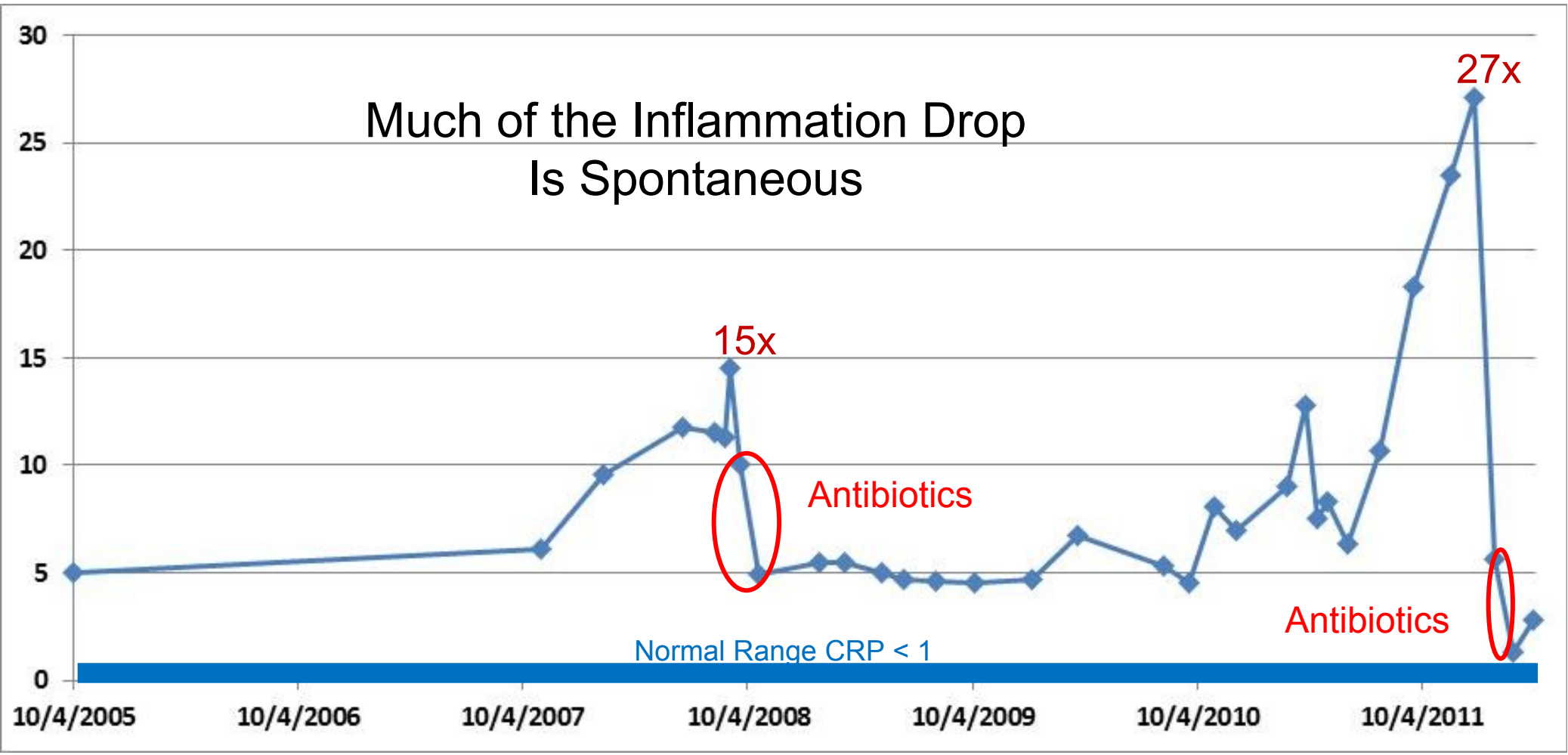
- **Electrolytes**
  - Sodium, Potassium, Calcium, Magnesium, Phosphorus, Boron, Chlorine, CO_2
- **Micronutrients**
  - Arsenic, Chromium, Cobalt, Copper, Iron, Manganese, Molybdenum, Selenium, Zinc
- **Blood Sugar Cycle**
  - Glucose, Insulin, A1C Hemoglobin
- **Cardio Risk**
  - Complex Reactive Protein
  - 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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I Track Over 100 Blood Variables Over Time

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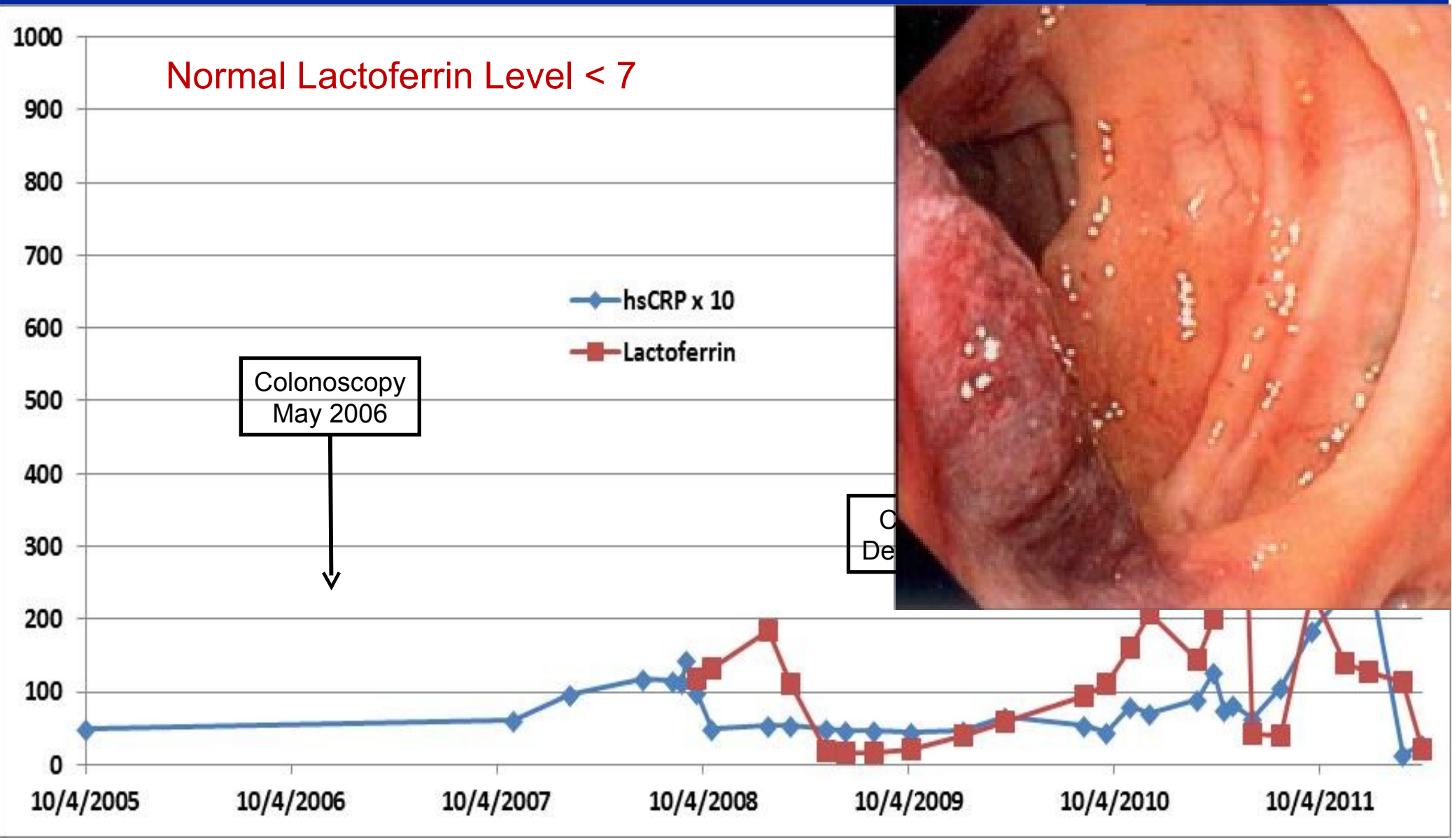
Natural Anti-Inflammation Can Be Much Larger Effect Than Antibiotic-Induced Inflammation Remission



Demonstrates Value of Fine-Grained Time Series

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Frequent Stool Analysis Reveals Lactoferrin Spike to Active Crohn's Disease (CD) Level

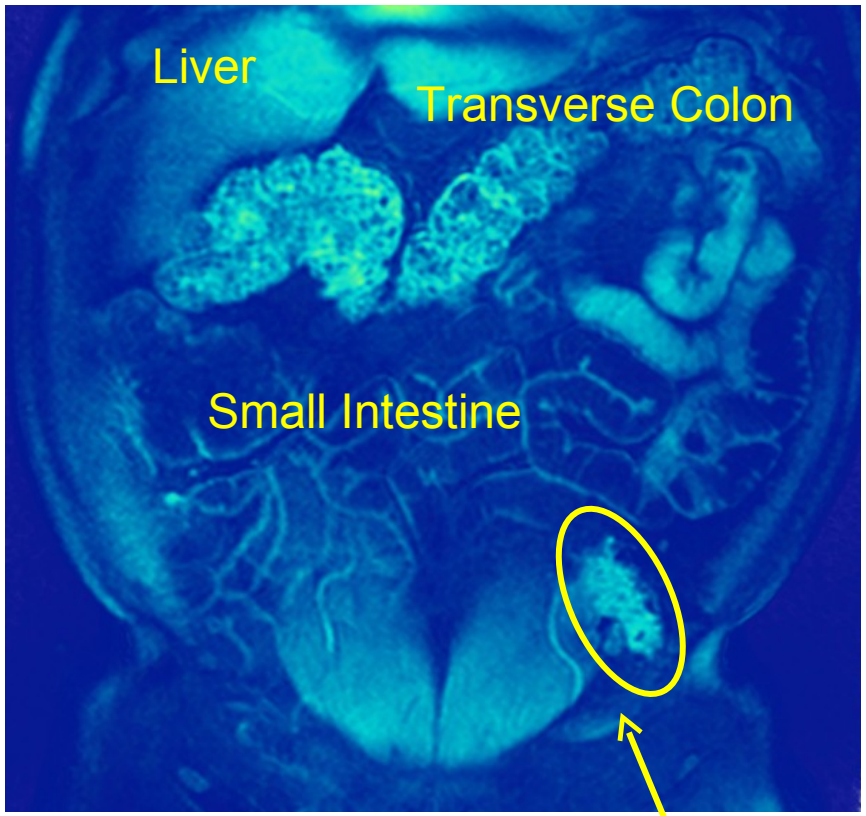


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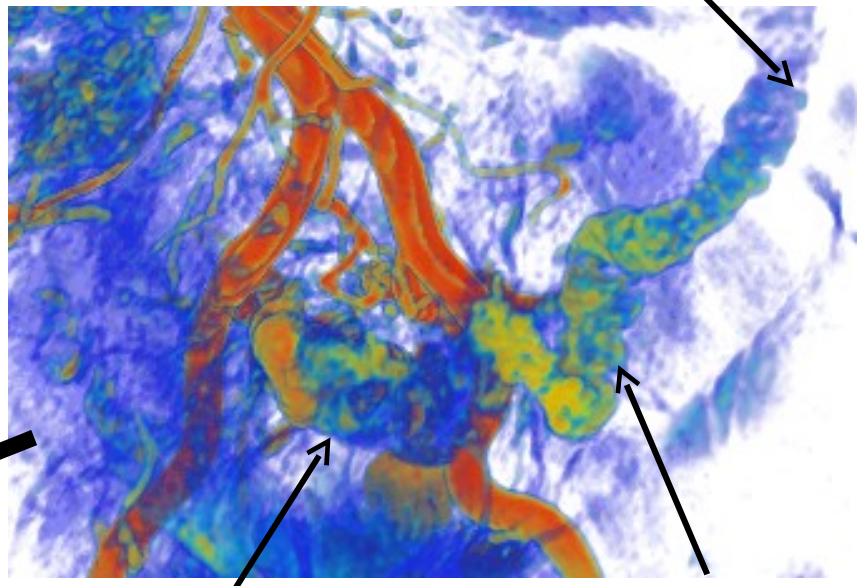
Colonoscopy and Biopsies
Support CD Diagnosis

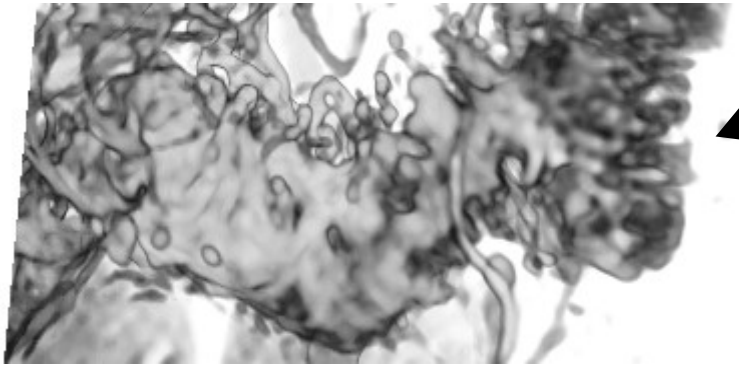
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Confirming the Crohn's Hypothesis: Finding the "Smoking Gun" with MRI Imaging



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





Sigmoid Colon
Threading Iliac Arteries

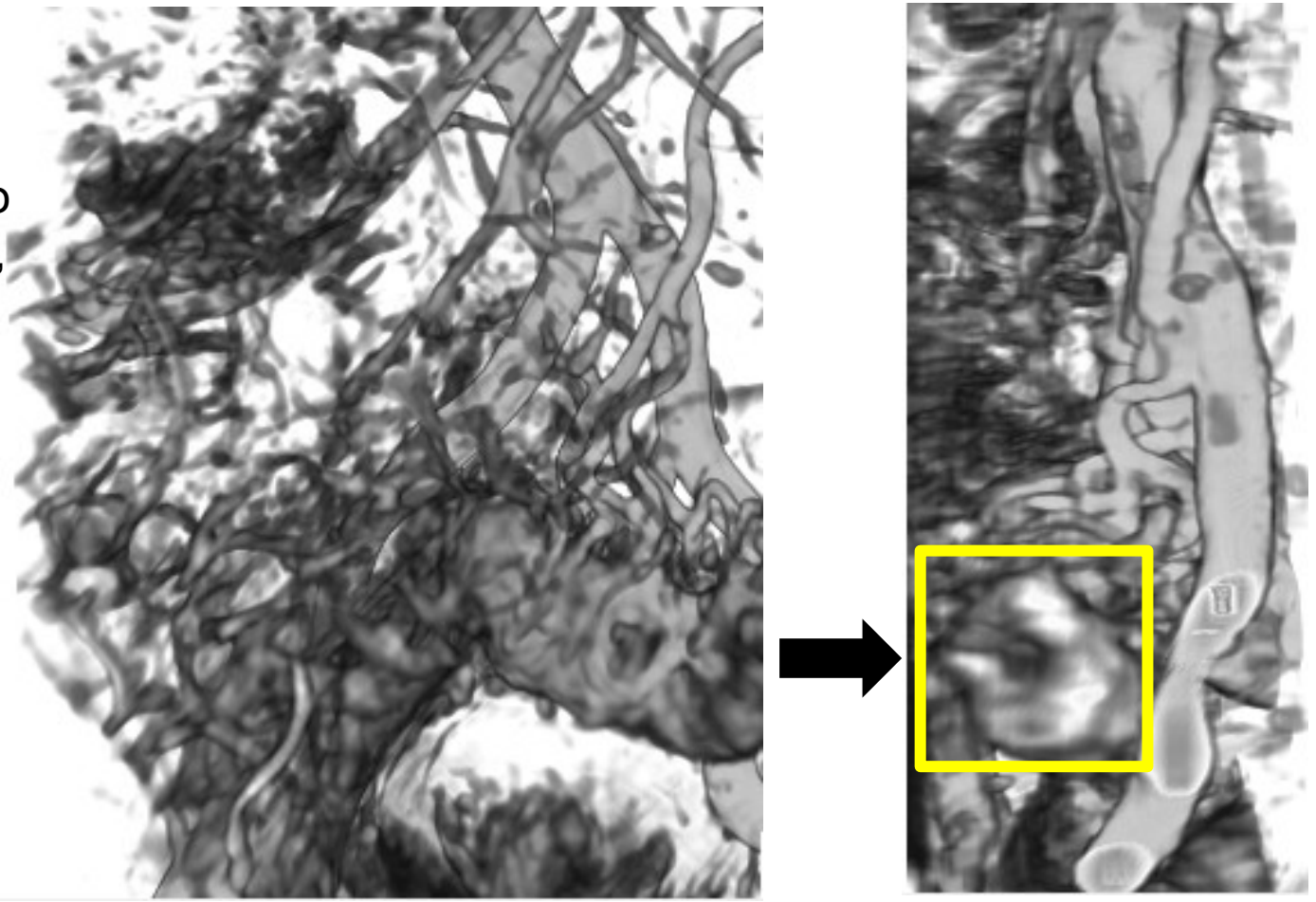
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LS Sigmoid Colon Cross Sections Showing Inflamed Wall

Jan 2012 MRI Enterography report: “long segment wall thickening in the proximal and mid portions of the sigmoid colon, extending over a segment of approximately 16 cm, with suggestion of intramural sinus tracts.

Ulcerative Colitis is Restricted to the Mucosa, while Crohn's Disease Affects the Whole Bowel Wall



Note Thickness of Wall - Normal is 3mm (like a Balloon)

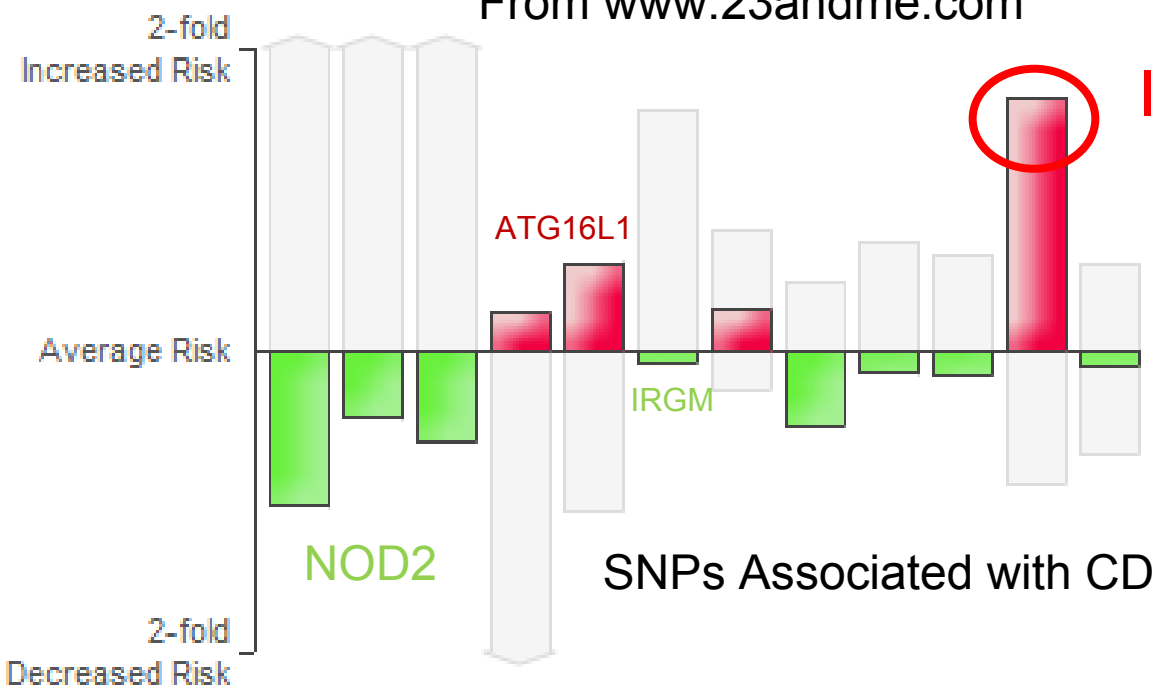
Source: L Smarr Using Calit2’s Jurgen Schultz Software

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I Wondered if Crohn's is an Autoimmune Disease, Did I Have a Personal Genomic Polymorphism?

From www.23andme.com



Polymorphism in Interleukin-23 Receptor Gene — 80% Higher Risk of Pro-inflammatory Immune Response

News and Views

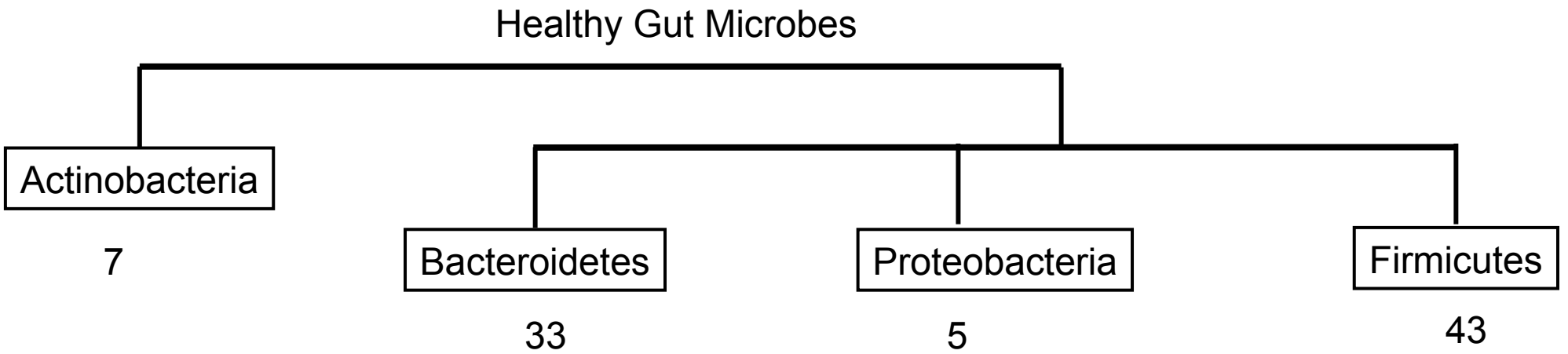
Nature Medicine **13**, 26 - 28 (2007)
doi:10.1038/nm0107-26

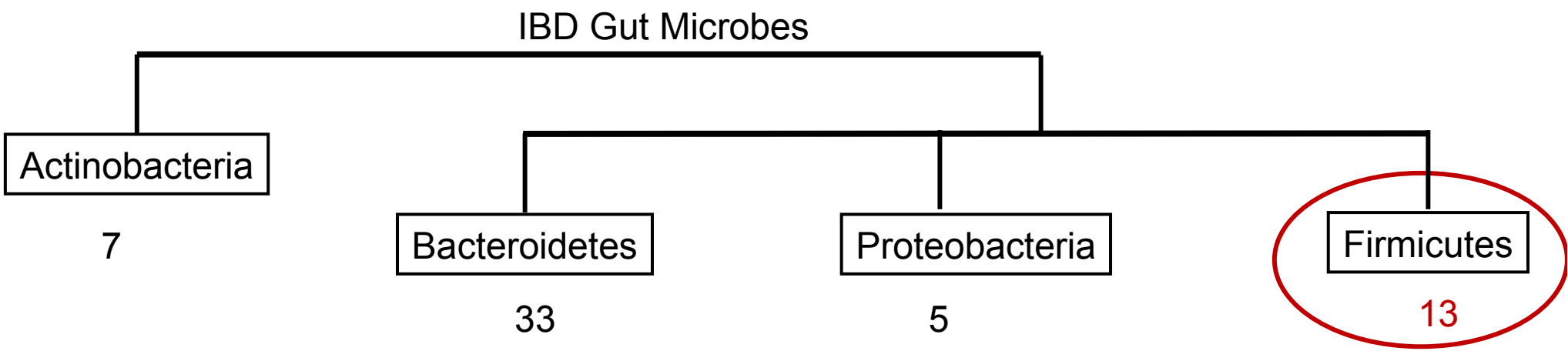
IL-23: a master regulator in Crohn disease

Markus F Neurath[1]

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Crohn's Disease Patients Have Number of Firmicute Gut Microbe Species Reduced by Over 2/3!





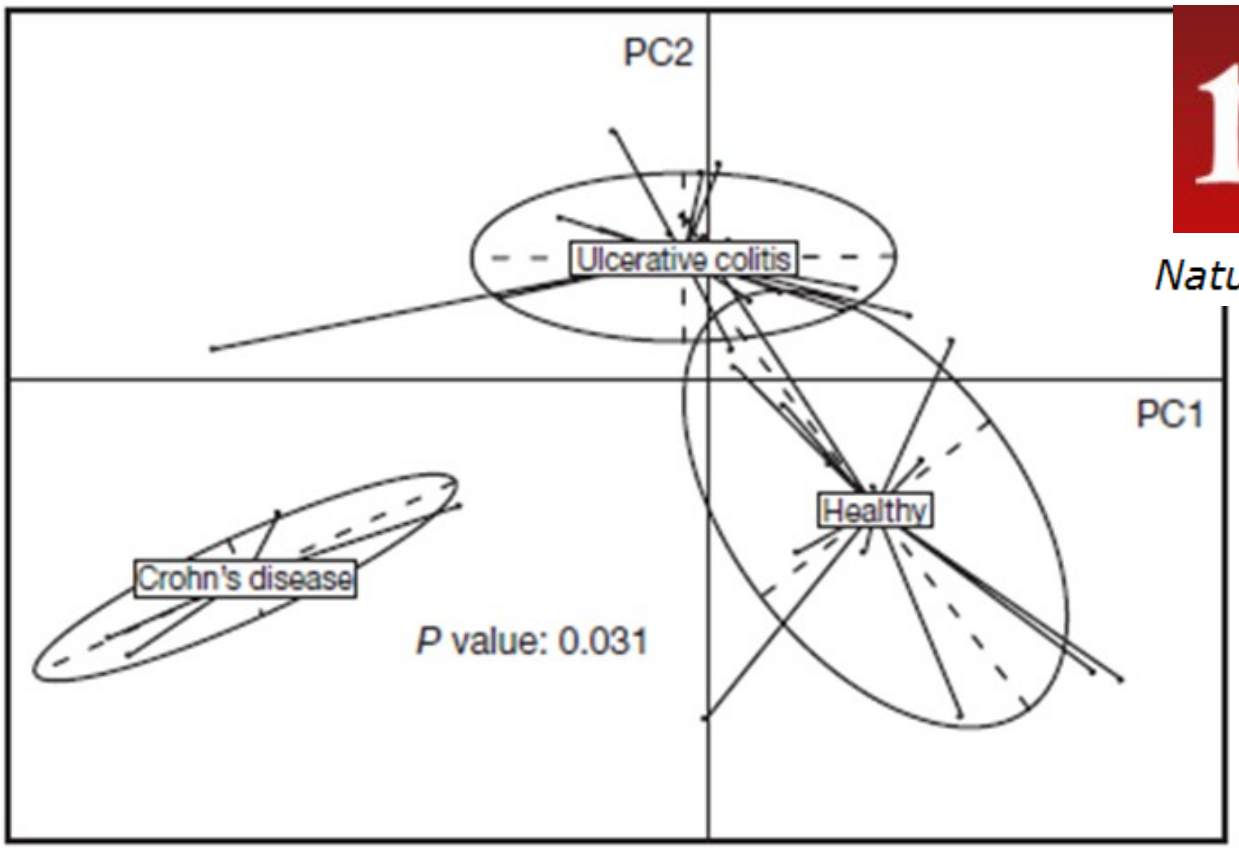
The Missing Firmicutes Inhibit Pro-Inflammation

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Manichanh, et al, *Gut* 2006;55:205–211

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Microbial Metagenomics Can Diagnose Disease States



nature

Nature **464**, 59-65 (4 March 2010)

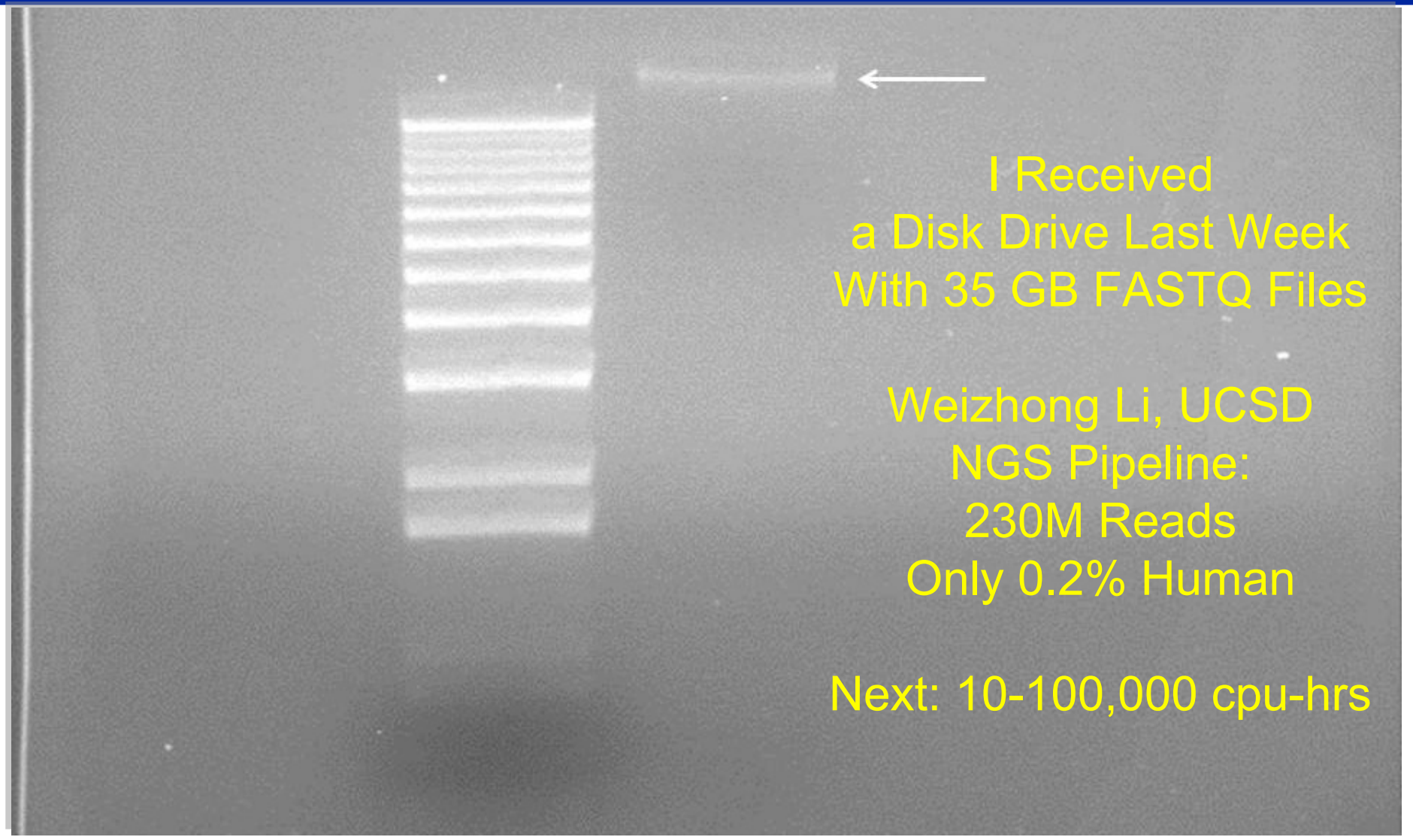
IBD Patients Harbored, on Average, *25% Fewer Microbial Genes* than the Individuals Not Suffering from IBD.

Figure 4 | Bacterial species abundance differentiates IBD patients and healthy individuals. Principal component analysis with health status as

A human gut microbial gene catalogue established by metagenomic sequencing

Junjie Qin[1]*, Ruiqiang Li[1]*, Jeroen Raes[2,3], Manimozhiyan Arumugam[2], Kristoffer Solvsten Burgdorf[4],

First Stage of Metagenomic Sequencing of My Gut Microbiome at J. Craig Venter Institute



Gel Image of Extract from Smarr Sample-Next is Library Construction

Manny Torralba, Project Lead - Human Genomic Medicine
J Craig Venter Institute

January 25, 2012

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